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THE CONCEPT OF MOTION IN LATE MEDIEVAL PHILOSOPHY
Edited by Daniel A. Di Liscia

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PRESENTACIÓN / INTRODUCTION

THE CONCEPT OF MOTION IN LATE MEDIEVAL PHILOSOPHY

"Motion" has been the main research subject of natural philosophy from Aristotle's *Physics* to Newton's *Principia* and beyond. Discussions and reflections on it have not only accompanied the scientific revolution of the seventeenth century, but they have also played a determining role in the outcome of the new theories of the twentieth century. Thus, "motion" seems to be inevitable if we wish to deal with whatever object of the natural world. As Albert the Great put into words a phrase that would be repeated for centuries to come: Those who ignore motion will ignore the *whole* of nature.[1]

However, it is by no means evident what motion really is or how it is to be defined. For Aristotle and the Aristotelian tradition, "motion" means something more general than "local motion" from one point in space to another within an interval of time. It includes a more general process of change, which Aristotle managed to conceptualize as the transition from potential to actual being. That this conceptualization be neither simple nor immediately understandable is something that one can appreciate by reading not only Aristotle's texts but also a whole tradition of medieval and renaissance commentators.

The following volume gathers seven papers presented at a conference organized in collaboration with the *Laboratoire SPHère* (Université de Paris; CNRS) and held at the University of Munich in November 2021 (https://www.mcmp.philosophie.uni-muenchen.de/events/workshops/container/motion/index.html).

For the conference and this volume as well, our aim was to cover a broad field of authors, questions, and texts belonging in their great majority to "late medieval" philosophy and science. Chronologically, the first author studied is the Catalan philosopher and prolific writer, Ramon Llull; the last one is the equally unusual French poet, moralist, and philosopher, Jacques Legrand. Of course, in the body of the papers, the reader will also find some references going back to ancient philosophy – mostly, of course, to Aristotle – and some others projecting the discussed points forward to the period of the "scientific revolution." For, in a volume which is centered on the concept of motion, a line of discussion – though not necessarily of continuity – between Aristotle and Newton does not seem to be unjustified.

Given the fact that two of the papers are on Nicole Oresme, one of the most outstanding thinkers of this period, another one on Robert Halifax, and still another on an anonymous text from approximately the same time – the treatise *De sex inconvenientibus* – it is

[1] "Ignorato motu, ignorabitur tota natura", Alberti Magni ... *Opera omnia, Physica*, edited by P. Hossfeld, 4.1 (Münster: Aschendorff, 1987), 146a,22-23. This short formula used by Albert goes back to Aristotle himself, *Physica* III, 1, 200b12-15.

obvious that this volume mainly deals with natural philosophy from the fourteenth century. Lull announces, in fact, many of the motives which are typical for the fourteenth century, and Legrand clearly continues this tradition of thinking.

While the volume displays a thematic unity, it does not intent to be a systematic presentation of the concept of motion in all its manifestations. This would not only be unconscionable, but also less credible. Focusing on this fundamental subject of philosophy and science of all times, however, variety rather than a uniform textbook presentation was a priority from the beginning. Thus, the reader will find diverse sources, methods, and problems in each case, always connecting with discussions around this one basic concept: motion.

The first contribution by José Higuera Rubio addresses the linguistic perspective on the motion's intermediate parts which are implicitly involved in the Aristotelian conception of *energeia* and *kinesis*. These concepts do not allow a merely intuitive understanding of motion as the flowing from potency (*dynamis*) to actualization (*entelechia*). The unlimited division of the parts of motion is of little help in solving all the problems it causes itself. Thus, the middle parts could be spotted linguistically through verb tenses (as Aristotle did) or Latin declensions (e.g. Albertus/Llull). Llull refreshed the medieval semantics of motion's middle parts to grasp an innovative vocabulary. He points out the continuity of motion and the flowing of change vindicating the Averroistic perspective: for a natural philosopher "to have the capacity of 'being white,' 'to become whiter' and 'being white' are equivocal motion's parts.

Aurora Panzica explores the scholastic debate about *antiperistasis*, a mechanism consisting of the intensification of a quality caused by the action of the contrary one. Because of its (partial) incompatibility with the categories of Aristotelian physics, the process of *antiperistasis* led medieval commentators to deepen and adapt the Aristotelian categories on motion in order to be able to include the apparent paradoxical phenomena for which Aristotle elaborated this explanation into the normal order of nature. This paper shows how – differently from Aristotle but following Galen's *Commentary on Hippocrates's Aphorisms* – scholastic masters explicitly applied the model of antiperistasis described in the first book of Aristotle's *Meteorology* to a biological context, thus establishing a link between physics and medicine substantially extraneous to Aristotle's theory.

With the paper by Edit Anna Lukács, we arrive at the *calculatores*, the group of authors who have been recently again in the focus of research because of their quantifying understanding of Aristotle. This contribution brings a new, until-now-neglected, figure into the discussion: Robert of Halifax. This Franciscan theologian active in Cambridge during the same time as the first generation of Oxford calculators, wrote – as far as we know – only one work, a *Commentary on the Sentences*, in which he approached several optical and astronomical phenomena related to motion within a theological context. The contribution focuses, above all, on Halifax's analysis of shadows, in which the optical tradition of the thirteenth century is enriched with imaginary cases involving different cases of motion. His examples and the application of proportion for the special cases of motion seem

to be very close to some of the calculators. It is to be remarked that Halifax's text was later well-known at the universities of Paris and Vienna.

The quantitative approach to motion is present, above all, in the contribution by Sabine Rommevaux-Tani. From the fourteenth century onward and following the path established by Thomas Bradwardine, William Heytesbury, and Richard Swineshead, a double point of view prevailed in the study of motion: On the one hand, (imaginary) velocities were calculated according the factors which produce it (powers and resistances, usually), i.e. according to its causes. On the other hand, the "effects" of motion in terms of covered space and elapsed time were taken into consideration. The classical history of mechanics has assumed that to be a proto-differentiation between "dynamic" and "kinematics." This paper focuses on the anonymous treatise *De sex inconvenientibus,* in which the author confronts these two ways of determining the rapidity of a motion. A close consideration of the paradoxes discussed in this text within the more general (Aristotelian) concept of change makes clear how problematic this double approach was. As a matter of fact, medieval authors seem to not have even tried to combine them, as Rommevaux-Tani argues, going in-depth into *De sex inconvenientibus*.

The two subsequent papers are devoted to Nicole Oresme, a giant of medieval theories of motion in all thinkable dimensions. Philippe Debroise deals with the problems of continuity in Oresme's theory of motion. Continuity is an essential feature in Aristotelian physics, but it is by no means obvious. As a matter of fact, Aristotle himself provided a discussion approach and anticipated many of the difficulties later developed during the late Middle Ages. For Oresme, eager to approach motion mathematically, continuity is as important as it is difficult. As Debroise shows, an analysis of Oresme's understanding of the problem needs also a presentation of his own position regarding the nature of motion. Including the discussion of particular topics in the fields of ontology, theory of knowledge, mathematics and physics, this paper highlights the tensions in Oresme's writing between the affirmation of the continuity of motion and its mathematical atomization.

Valérie Cordonier's contribution focuses on one of the more original texts of the late Middle Ages, Oresme's *De configurationibus*. In this text, Oresme not only presents a new approach to motion and qualities based on geometry, but he also tries to explain how his new doctrine could be useful to understanding some special phenomena occurring in the soul (we may not neglect the fact that the medieval concept of motion embrace also emotions and psychological alterations). In one chapter of this text, Oresme mentions the process of throwing a javelin. In fact, he is interested in explaining the behavior of people who seem to have a kind of natural ability to succeed in their actions. In analyzing a set of other texts connected to this chapter of *De configurationibus*, Cordonier shows the importance of the pseudo-Aristotelian *Liber de bona fortuna* for the history of the concepts of *impetus*, *impulsus* and *inclinatio* and *motus* in late medieval thought.

The last paper by Daniel A. Di Liscia deals with the concept of motion in a late-medieval author, who until now, has been studied little: Jacques Legrand, a member of the

Order of the Hermits of Saint Augustine, who was active in Paris at the beginning of the 15th Century. After some background information about Legrand and his main work on natural philosophy, the *Compendium utriusque philosophie*, the paper focuses on Legrand's discussion of local motion. It includes first a section on the *forma fluens* and *fluxus formae* theories previous to Legrand, as well as on Ockham's impact on the discussion about the nature of motion. In addition, the paper provides a detailed analysis of Legrand's own arguments. It shows that by rejecting the idea of motion as a *fluxus supperadditus*, even for the case of local motion, Legrand follows the main nominalist approach represented by Ockham and Gregory of Rimini. The paper suggests that this position could have been motivated by a cautious attitude regarding ontological realism, a philosophical approach identified with Wyclif and their followers and ideologically persecuted by important personalities close to Legrand, like D'Ailly and Gerson.

Finally, it is my pleasant duty to thank a series of colleagues and institutions that have been involved in the process of production of this special issue. My first thanks go to my colleague Sabine Rommevaux-Tani for her cooperative attitude as the head of SPHère. I would like also to thank Hannes Leitgeb, head of *Munich Center of Mathematical Philosophy* (LMU), my home institution, for his permanent support of my work, and to Ursula Danninger and Karsten Thiel (also MCMP) for putting at our disposal all needed resources for a successful event. I would like also to express my gratitude to the editorial committee of REMIFE for accepting these contributions for a special issue of the prestigious journal, to the fourteenth different anonymous reviewers involved in the critical assessment of the papers, and to Brian Krouzek, who as a native speaker, and with consideration of all details, made the last linguistic check on them. Above all, I am particularly grateful to the *Deutsche Forschungsgemeinschaft* for their generous funding of both the conference itself and the production of this volume.[2]

Daniel A. Di Liscia, Ludwig-Maximilians-Universität München

Munich and Copenhagen, June 2022

During the correction of this volume we have received the happy news that Aurora Panzica's contribution included in this volume has been honoured with the SIEPM Junior Scholar Award 2022. Congratulations to the author for this important achievement!

[2] The volume and the conference related to it were a part of my project "Integration und Transformation in der spätmittelalterlichen Naturphilosophie: Jacques Legrands aristotelisches *Compendium utriusque philosophie*" (DFG, Projektnummer 282682744. For further details see https://gepris.dfg.de/gepris/projekt/282682744).

ARTÍCULOS / ARTICLES

INTERMEDIATE PARTS OF MOTION ACCORDING TO RAMON LLULL: SOME REMARKS ABOUT HIS MEDIEVAL BACKGROUND*

LAS PARTES INTERMEDIAS DEL MOVIMIENTO SEGÚN RAMON LLULL: ALGUNAS OBSERVACIONES SOBRE SU CONTEXTO MEDIEVAL

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Abstract

Following Aristotle, Averroes rejects atomism and the infinite division of geometric lines. Thus, his arguments deal with the continuity and contiguity of the non-atomic parts of motion. He vindicates the perceptual aspect of physical movement that shows itself like *in-progress-path* between two edge points A and B, in which there are middle parts where qualitative, local, or quantitative changes occur. Ramon Llull takes the lines' geometrical points as "motion parts". Points are intermediate divisions that represent physical phenomena by the continuity of geometrical lines, surfaces, and figures. Also, he appeals to relational logic to spot the middle parts between A and B into the *in-progress-path* of motion. Those middle parts are signified by a dynamic vocabulary, called: *correlative language*. This contribution focuses on the conceptual environment of Llull's assumptions, in which Averroes' Latin readers explored the geometry and the vocabulary of motion intermediate parts.

Keywords

Ramon Llull; Continuous; Motion; Averroes; Aristotle

Resumen

Siguiendo a Aristóteles, Averroes rechaza el atomismo y la división ilimitada de las líneas geométricas. Sus argumentos se enfocaron en la continuidad y contigüidad de las partes del

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movimiento, y reivindicó la observación del movimiento físico que muestra como "un camino" (*via*) entre dos puntos límite A y B entre los cuales ocurren los cambios cualitativos, locales o cuantitativos de una forma instantánea. Ramon Llull asumió estas "partes del movimiento" como puntos geométricos y "unidades" físicas. Estos puntos son divisiones intermedias que representan fenómenos físicos que marcan la continuidad en las líneas, las superficies y las figuras geométricas. Además, apela a la lógica relacional para forjar las denominaciones de las partes intermedias del movimiento entre A y B, así como la ruta de movimiento en curso. Esas partes intermedias están significadas por un vocabulario llamado: lenguaje correlativo. Esta contribución se centra en el entorno conceptual de los supuestos de Llull, en el que los lectores latinos de Averroes exploraron la geometría y el vocabulario de las partes intermedias del movimiento.

Palabras clave

Ramon Llull; Continuo; Movimiento; Averroes; Aristóteles

Introduction

Usually, the image of Aristotelian motion is a continuous line C between the boundary points A and B.[1] The line represents the process of actualization – or accomplishment – of potentialities[2] which have accidental manifestations according to the categories of place, quality, and quantity. These categorizations involve the extreme points of the line, according to Aristotelian analogy, which should be accidental contraries or at least opposites. In an equivocal way, motion could be signified by the displacement from Athens to Megara, the alteration of a quality (e.g., color, being healthy) or the increase/decrease[3] in quantity. Nevertheless, other accidental predications fulfill the motion's conception as actualization of potentialities. For example, the actions of an

[1] "Utrum ergo causa sit, quia loci mutatio genus est aut quia linea genus"; "Amplius autem aliud est quod est potentia et actu; quare rectitudinis que infra sunt terminorum quodlibet signum potentia quidem est medium, actu autem non est, nisi dividat sic et instans iterum incipit moveri; sic autem medium principium et finis, principium quidem posterioris, finis autem principii", Aristotle, *Physica*, edited by F. Bossier, J. Brams and A. Mansion, Aristoteles Latinus 7 (Leiden: Brill, 1990), 271, 320.

[2] "(...) Aristotle introduces a new general doctrine about continua, which I will refer to as the Potentiality Doctrine. This is the claim that a single continuous thing, such as a motion, line, or time, has parts and middle-points only potentially or in capacity, not in actuality", Jacob Rosen, "Physics v-vi versus viii: Unity of change and disunity in the Physics", in *Aristotle's Physics: A Critical Guide*, edited by M. Leunissen (Oxford: Oxford University Press, 2015), 213; "Aristotle's favourite model of the continuum is the same as ours, namely a geometrical line, or line-segment", David Bostock, *Space, Time, Matter and Form: Essays on Aristotle's Physics* (Oxford: Oxford University Press, 2006), 158.

[3] "Non est autem motus preter res ; mutatur enim semper id quod mutatur aut secundum substantiam aut secundum qualitatem aut secundum quantitatem aut secundum locum", Aristotle, *Physica*, 97.

agent on a matter in the case of building a house; the process of learning or teaching; and natural generation.[4] Even moral choices or passion tendencies could be taken as motions. In the effort of gathering all the possible cases of motion, Aristotle displays the different senses of "being in" motion, but the medieval interpretation of how substances show their accidental manifestations include the border points between A and B. Overall, they tried to answer the question of what the nature of C is and whether it is possible to spot a specific point – or part – of C in which the motion alterations and changes effectively happen.

The well-known example of Kretzmann-Sorabji describes the motion of a train.[5] The train is in a state of rest (A) before departing to its destiny (B), but if the train suddenly stops at some point between A and B, is the displacement complete, or does stopping in some middle point accomplish a part, or a section, of the original way from A to B? The other question to address is whether the relation between an unfinished activity such as "seeing" or "knowing", and its parts, takes place as other alterations such as color alterations, building a house. The Aristotelian arguments oscillate between linguistic exposition and the geometrical line analogy. On the one hand, Aristotle established the meaning of the extreme points of motion by the terms potentiality (*dúnamis*) and actualization (*entelékheia*). In some sense, potentiality is the departing point of a motion since it means the disposition to change, to move. Meanwhile, actualization is the arriving point of any movement, or the realization of any disposition to change and to move. But those terms are not enough to explain what exactly happens in the process – the term C in between – of changing in the case of finished alterations, activities as "seeing", or displacements. Thus, Aristotle introduced a specific expression for "being in motion" (*kinêsis*) that is similar to "being in change" (*metabolé*). Aquinas and Albertus Magnus followed Averroes in the identification of motion and change, because everything that is changing is necessarily moving, therefore any alteration is motion.[6]

[4] "Quod autem hoc sit motus, abhinc manifestum est. Cum enim edificabile, in quantum huiusmodi ipsum dicimus esse, actu sit, edificatur et hoc est edificatio; similiter autem et doctrinatio et medicatio et volutio et saltatio et adolescentia et senectus", Aristotle, *Physica*, 99.

[5] "The train leaves at noon', says the announcer. But can it? If so, when is the last instant of rest, and when the first instant of motion? (...) Can the train have any first instant of motion, or last of rest, if its atoms are moving all the time, and how would these instants be defined? Yet another doubt concerns the fact that a train is not perfectly rigid. When some parts of the train, or of the engine, have started to move, other parts will be lagging behind, so that there is not a single first instant of motion or last of rest for the train as a whole", Richard Sorabji, "Aristotle on the Instant of Change", *Proceedings of the Aristotelian Society* 50 (1976): 69.

[6] "Postquam ostendit in motu locali, quod movens et motum sunt simul, ostendit idem in alteratione; quod scilicet nihil est medium alterantis et alterati. Et hoc probat primo per inductionem. In omnibus enim quae alterantur, manifestum est quod simul sunt ultimum alterans et primum alteratum. Videtur autem hoc habere instantiam in quibusdam alterationibus: sicut cum sol calefacit aerem sine hoc quod calefaciat orbes medios planetarum; et piscis quidam in reti detentus, stupefacit manus trahentis rete, absque hoc quod stupefaciat rete", Thomas Aquinas, *In octo libros physicorum Aristotelis expositio*, edited by M. Maggiòlo (Turin: Marietti, 1954), lib. 7 l. 4 n. 1, 335.

Over those terms, Aristotle added a term to mean the "capacity of being in motion" or change: *enérgeia*. This capacity is attributed to local motion, the color alterations, and even activities such as seeing, knowing, or building. The readers of the famous lines of *Metaphysica* IX, 6[7] detected the ambiguity between using two verb tenses: present perfect in the examples that describe the "capacity of being in motion" (*enérgeia*) and the present continuous regarding the motion or change (*kinêsis*), for instance someone who "is walking" (*kinêsis*) and "has walked" (*enérgeia*). Ryle[8] – who criticized Ackrill's[9] interpretation – clearly distinguishes those linguistic patterns in the Aristotelian motion and change descriptions. I will come back to those linguistic patterns about physical conception of motion when addressing Ramon Llull's language about motion and change.

Beyond the linguistic difference between the use of present perfect in the examples about the disposition of being in motion or change, and the present continuous when something is in fact moving, it is relevant to remark how Aristotle had introduced the temporal sense of physical phenomena through these verb tenses. In the example of building, bricks have the potentiality of being a house and the finished house is the actualization of this material potentiality. But the process of "building" (*kinêsis*) has some parts in which it is possible to spot the material disposition of "being built" or when exactly it "has been built".[10] To grasp this disposition, we should address the

[7] "(...) ascribing potentiality to that whose nature it is to change something else or to be changed by something else, either without qualification or in a certain manner, we also use the term in another sense, which is what we have been after in discussing these previous senses. Actuality [*energeia*] is the thing being present, but not in the way we speak of when we say it is potentially present (*Met* Θ 6, 1048a 25-30)", translated by Burnyeat in Myles F. Burnyeat, "Kinēsis vs. energeia: A much-read passage in (but not of) Aristotle's Metaphysics", *Oxford Studies in Ancient Philosophy* 34 (2008): 221; "Quoniam autem de potentia que secundum motum dicitur dictum est, de actu determinemus quid est actus et quale quid. Et enim possibile simul manifestum erit diuidentibus, quia non solum hoc dicimus possibile quod aptum natum est mouere aliud aut moueri ab alio aut simpliciter aut modo quodam, sed et aliter. Quapropter querentes et de hiis superuenimus. Est autem actus existere rem non ita sicut dicimus potentia", Aristotle, *Metaphysica*, edited by G. Vuillemin-Diem, Aristoteles Latinus 25 (Leiden: Brill, 1995), 185.

[8] "To begin with, seeing and hearing are not processes. Aristotle points out, quite correctly (Met. IX, vi. 7-10) that I can say 'I have seen it 'as soon as I can say' I see it'", Gilbert Ryle, *Dilemmas* (Cambridge: CUP, 1966), 60.

[9] "While Ryle's account of the present-perfect connection involves that an *energeia* cannot go on through time, this one implies that it must. There may be objections to thinking that seeing, for example, must occupy time, and even objections to thinking that Aristotle thought this. But the passages so far considered do not provide any evidence against the belief that Aristotle did think this", John Lloyd Ackrill, "Aristotle's Distinction between Energeia and Kinesis", in *New Essays on Plato and Aristotle*, edited by R. Bambrough (London and New York: Routledge, 1965), 121.

[10] "Propter quod et nomen dicitur actus secundum opus et tendit uersus endelichiam. Quoniam uero est horum quidem ultimum usus, ut uisus uisio, et preter hanc nullum fit alterum a uisu opus, A quibusdam uero fit aliquid, ut ab edificatoria domus preter edificationem: tamen non minus hic quidem finis, hic autem magis finis potentie est", Aristotle, *Metaphysica*, 189.

"builder" who is the agent of the building process and its different parts or stages. This process explains how the line analogy is useful to represent physical motion since every motion is divisible in the same way as the substantial parts involved. Nonetheless, this division is not infinite because any motion cannot be permanently in "disposition of being in motion" and "being in motion" during an unlimited time or magnitude. The linguistic description of motion matches the rejection of motion as an unlimited process. Thus, the linguistic patterns – of *Met.* IX.6 – seem to have a counterpart in the Aristotelian discussion about the Zeno paradoxes in the *Physica* VI.[11]

Save the problem of infinite motion and change, medieval readers accepted the line analogy simultaneously with the linguistic patterns to spot the middle parts of motion and its divisions. Besides, there are rectilinear natural motions and changes that depart from rest and arrive to resting like natural and artificial activities linked with an agent: the fire heats the wood or the artist who extracts Hermes from the stone or the wood.[12] In all those processes, natural and artificial, there are intermediate points, segments, or parts spotted by linguistic means. Aristotle used the verb tenses, either medieval masters, as Ramon Llull and Albertus Magnus, both prefer Latin declensions to describe, on the line analogy, the process of motion or change.[13] During the 13th century, lines, points, and segments suffered a "semantic enhancement" that also covered other geometrical objects. Overall, in relation to Aristotelian body's definition, it gathers three dimensions: longitude, latitude, and depth.[14] Thus, the medieval explanation of motion parts acquires a broader scope and eventually become multidimensional. However, before arriving at this point, let me introduce the way the medieval masters grasped the intermediate parts of motion.

[11] "Unde et Zenonis ratio falsum opinatur quod est non passe infinita transire aut tangere infinita secundum unamquamque in finito tempore", Aristotle, *Physica*, 224.

[12] "(...) et quod potestate est dicibile terminorum et quod est actu; et scire similiter : et potens uti scientia et utens; et quiescens : et cui iam inest quies et potens quiescere. Similiter autem et in substantiis; et enim Mercurium in lapide dicimus esse, et medietatem linee, et frumentum nondum perfectum. Quando uero potens et quando nondum, in aliis determinamdum", Aristotle, *Metaphysica*, 103.

[13] "(...) in eo quod est aedificabile, quia actus aedificabilis, inquantum aedificabile est, aedificatio est; aut enim aedificatio est actus aedificabilis nondum adhuc aedificati et perfecti secundum formam aedificii aut eius aedificatum iam et perfectum secundum formam aedificii, sicut si esset actu domus", Albertus Magnus, *Physica* 4/1, edited by T. Marschler, Editio Coloniensis (Münster: Aschendorff , 2015), 160.

[14] "Distantias quidem habet tres, longitudinis et profunditatis et latitudinis, quibus determinatur corpus omne", Aristotle, *Physica*, 138.

Intermediate sections and motion parts

Averroes vindicated motion as *via ad perfectionem* or *via ad forman*, but also as *via de potentia ad actum*.[15] Those expressions could be, according to him, the most known conceptions of motion. However, if we get back on the motion's vocabulary mentioned above, Averroes had possibly tried to signify the difference between *enérgeia* (the capacity of being in motion), *dúnamis* (the capacity of moving or changing), and *entelékheia* (the actualization of motion/change). Cecilia Trifogli has shown how Wylton's criticism of Averroes turns around on motion as a way (*via*) of actualization of form or perfection because motion is not exactly the way to perfection.[16] Otherwise, during this intermediate lapse (*via*), accidental alterations take place, for instance, the variation of quantity could have different degrees, the same as qualitative alterations. The instability of the intermediate parts of motion in between potency and actualization suddenly acquired a certain relevance. The question about what happens in the middle term between the point of departure and arriving point of motion become a controversial issue.

Medieval interpreters of Aristotle had faced Averroes' statement – *motus sit in mediis*[17] and his insistence on how the motion's intermediate parts effectively show up as a process (*via*). Averroes' critics emphasized the conception of motion as an actualizing way in which the end of motion or change is the realization of form. However, the Aristotelian vocabulary of motion addresses many senses of natural motion, thus the process, the end, or the starting point, are just different ways of dealing with a continuous process and its different parts. This processing perspective comes from Avicenna, who vindicated *medietas* as motion's form or described it as *transitus*.[18] In some sense, the medieval conceptions of motion depended on the side chosen by the interpreter to

[15] "Motus secundum quod non differt a perfectione ad quam vadit nisi secundum magis et minus, necesse est ut sit de genere illus perfectionis ... secundum autem quod est via ad perfectionem, quae est alia ab ipsa perfectione, necesse est ut sit genus perse. Via enim ad rem est aliud ab ipsa re", Averroes, *Commentarium magnum in Aristotelis De physico auditu libri octo*, in *Aristotelis Omnia quae extant Opera... Averrois Cordubensis in ea Omnes... Commentarii* v. 4 (Venice: Giunta, 1552; repr. Frankfurt Minerva, 1962), 87r.

[16] Cecilia Trifogli, *Oxford Physics in the Thirteenth Century (ca. 1250-1270): Motion, Infinity, Place, and Time* (Leiden and Boston: Brill, 2000) 75-80; and Cecilia Trifogli, "The Reception of Averroes' View on Motion in the Latin West", in *Averroes' Natural Philosophy and its Reception in the Latin West*, edited by P. Bakker (Leuven: LUP, 2015), 129-132.

[17] "Deinde cum dicit: *ex medio autem mutatur* etc., manifestat quoddam quod dixerat, scilicet quod motus sit in mediis. Et dicit quod contingit mutari ex medio ad utrumque extremorum et e converso, inquantum scilicet possumus uti medio ut contrario respectu utriusque extremi", Thomas Aquinas, *In octo libros physicorum Aristotelis expositio,* lib. 5 l. 1 n. 11, 648.

[18] "(...) inter principium propositum et finem, scilicet ut, in quo puncto posueris, non sit in eo amplius sicut nec antea nec post, non sicut duo termini extremitatum, Medietas est forma motus, et est proprietas una quae comitatur mobile et non discedit ab eo quamdiu est mobile; Motus enim per partes suas numerat prius et posterior: motus ergo non numerat ex hoc ipsa habet in transit prius et posterior; motus etiam habet mensuram transitus. Tempus autem est hic numerus et haec mensura", Avicenna, *Liber primus naturalium*, edited by S. Riet, J. Janssens and A. Allard, Avicenna Latinus 10 (Leuven: Peeters, 2006), 155; 325.

point out which is the crucial point of the motion processes. Averroes' conception gathered the linguistic denominations of the extreme points and the intermediate parts of motion according to the Aristotelian line analogy and his vocabulary (*Met.* IX.6). He did not dismiss the intermediate parts of motion as unstable phases, he otherwise endorsed that changes and motions take place "part-by-part" beyond the quality's alterations, quantity's degree variations, and the stops made by a walker.[19] Regarding line analogy, the motion as a process keeping its continuity and its parts is contiguous. There is no discontinuity in between motion processes since this conception opens the door to infinite times or magnitudes.

The conception of motion as "intermediateness"[20] is undoubtedly a heritage of Avicenna and Averroes' interpretation of the motion's equivocal nature. Aristotle was conscious about the incomplete vision of motion if someone could not address the relation between the potential form and its actualization. The linguistic constraints introduced in *Met.* IX.6 tried to resolve this issue. Averroes in the *Commentarium Magnum* VI.4, actually explains how motion-change takes places part-by-part through the variations of heat, displacement from one point to another, and color alteration. On the one hand, heat increases part-by-part because, potentially, it warms cold parts. The same as how white color acquires pale parts to become whiter. On the other hand, between two places, there are intermediate points in which one could assess the advancement of displacement. The diversity of states between the motion's two-edge points can be identified because all motion and substances are divisible; however, the divisions represent the motion parts or the phases of changing.[21] The introduction of how to assess

[19] "Every part of the form that acquires perfection reaches also a part of the [natural] place, unless impeded by some impediment, just as the parts of all other accidents that are consequent upon the form are achieved. For example, when the oil is turned into fire, each part of it that achieves 'fireness' also achieves a part of the [natural] place", Averroes quoted by Ruth Glasner, *Averroes' Physics: A Turning Point in Medieval Natural Philosophy* (Oxford: Oxford University Press, 2009), 91; also, Glasner states: "The original motion-interval is replaced by several intervals, but the interval model is maintained. The structure of the whole and that of the parts is the same. This is no longer so in the long commentary", Glasner, *Averroes' Physics*, 122.

[20] "This is the form of motion found in the mobile, namely, an intermediateness (...) Thus this intermediateness is the form of the motion and is a single description that necessarily accompanies the mobile and is not subject to change in any way as long as it is a mobile", Avicenna quoted by Jon McGinnis, "A Medieval Arabic Analysis of Motion at an Instant: the Avicennian Sources to the Forma fluens/fluxus formae debate", *The British Journal for the History of Science* 39, 2 (2006): 13.

[21] "Similiter autem demonstrabitur et longitudo divisibilis, et omnino omne in quo est mutatio (preter quedam que secundum accidens sunt, quoniam quod mutat divisibile est); uno enim diviso omnia dividentur", Aristotle, *Physica*, 232; "Although anything that is moved can be divided into parts, this does not imply that a thing's movement is causally dependent on the movement of its parts. In fact, its parts may only move in virtue of being parts of the whole", Ursula Coope, "Self-motion as other-motion in Aristotle's Physics", in *Aristotle's Physics: A Critical Guide*, edited by M. Leunissen (Oxford: Oxford University Press, 2015), 262.

the variations of quantity, the alterations of quality, and the magnitude of displacement is a big contribution of the Arabic interpretation of motion.

Continuity and Contiguity

The motion process represented by the Lullian interpretation of Aristotelean vocabulary: A is *potentia/dúnamis*, B is *perfectio/entelékheia* and C a rivalry between the *kinêsis/agere* and *enérgeia/actus*. All those terms lie on the line's longitude from point A, through line C, to point B. Regularly, everything goes well until Book VI of Physics, in which the revival of the Parmenidean foreign doctrines concerning the discrete composition of a line's quantity appears. That means that if a line is composed of points, every motion/change should pass each point from A through line C to reach B. Thus, motion does not exist in the same manner as in the vocabulary of Physics or the categories that represent it: quality, quantity, and place.

That is the reason behind the medieval concern about the intermediate path between the two extreme limits of Aristotelian motion. In the classic text of *De sufficientia*, quoted by A. Maier,[22] Avicenna introduces a clash between the categorization of motion and its relationship with quantity's species. At first glance, the intermediate path between the motion limits – named by the participle of the verbs *transire* and *fluere* – explains the categorizations of motion: quantitative, qualitative, and local displacement.[23] However, only in quantitative motions does the elapsing contain one species, according to Avicenna: continuity. Continuity answers the objections against the use of *transire* and *fluere* as denominations for the consolidated and unique path between the limits of Aristotelian motion. There is a resolution in this quantity species for the issue of the conception of a continuous motion/change path in which the questions about its discrete, or minimal parts, are not relevant. Avicenna states that differences between qualitative alterations, like *nigredo* and *nigrescere*, do not exist, since those qualitative attributions are the same as adding a line segment to a line.[24] There are no categorical differences between them.

[22] "Et dixerunt quod hac quantitas defluens una est ex speciebus quanti continui (...) Et discordaverunt auctores in hoc nomine pertruasiendi, quia quidam ex eis diversicaverunt inter nigredinem et nigrescere diversitate differentiae specificae. Quidam autem ex eis diversificaverunt non diversitate differentiae specificae, sed quia est sicut additio, quae additur lineae quae sit maior, et tamen propter hoc non exit a sua specie", Avicenna, *Sufficientia* (Venice, 1508) 23; Maier quoted it from Urb. Lat. 186 31r in Anneliese Maier, "Forma Fluens oder Fluxus Formae?", in *Zwischen Philosophie und Mechanik* (Rome: Edizioni di Storia et Letteratura, 1958), 12.

[23] "Et sequitur etiam aliud cuius extrema contingunt se sic ut videatur esse continuum in comitantia motus unius ad aliud, cuius unitas est quasi sequens unitionem motus; hic enim est cohaerentia, et hoc est sicut membra quae sunt composita ex aliis membris, et principaliter id cuius cohaerentia est naturalis, non artificialis", Avicenna, *Liber primus naturalium*, 109.

[24] See n. 22; "Sententiae igitur quae magis attenduntur in hac inquisitione, hae tres sunt, sed media non mihi placet. Nam abhorreo quod dicunt in ea, scilicet quod nigrescere sit qualitas et

Rivers of ink have been flowing around Maier's interpretation of Avicenna's statement to better understand the conception of continuous flowing/elapsing between the limits of Aristotelian motion, whether this path is the way to form realization or the form itself that displays its realization. However, the question of the continuous quantity as the only, and just unique, species that explains the flowing/elapsing of motion categorization was a big question in the Averroes commentaries about Aristotelian natural works.[25] In fact, Jean de Jandun – inspired by Averroes' authority – launched his own interpretation around the continuity as the justification of the unity of motion/change path. He embraced the Euclidian definition of point as the extreme limit and divisive conception of the line's parts. According to him, points are parts of a line in two senses: *ex partibus essentialibus* and *ex partibus quantitatiuis*.[26] In the first sense, points are essential to understand the line limits and their divisions that represent the limits of motion, its categorizations, and the different sections of the motion's path. On the other hand, points are lines' minimal parts but their conditions, such as contiguity, unlimited division, or their non-perceptible nature, do not modify the motion as a physical phenomenon or its natural realization. He seems to paraphrase Avicenna when stating that a line's extremes and white human beings do not change essentially if the line gets an additional segment, or the white human being becomes whiter. They are *dispositiones coniunctae* that happen between the two extremes of motion. Jandun endorsed Avicenna's interpretation, but it looks like he did not know the source of his own position since he thought that he was following the Comentator's authority.[27]

Perhaps the medieval debate around the unity of form's path and path's form dismissed the question of unique species of motion quantity: continuity. Although one can spot a point's divisions and extreme points in any motion/change path, they are not

augeri quantitas, et praecipue hoc quod nigrescere sit nigredo quae intenditur, quia intensio nigredinis est"; "Et dixerunt quod nigrescere et nigredo unum genus sunt (...)", Avicenna, *Liber primus naturalium*, 176, 179.

[25] Trifogli, *Oxford physics*, 49; "This position, which Albert attributes to Averroes, means that any motion can itself be essentially categorized in one of the four categories in which motion is found (...) To use Albert's example, taken from Averroes, the process of blackening and blackness are essentially identical: *nigrescere est nigredo*", Steven Baldner, "Albertus Magnus and the Categorization of Motion", *The Thomist* 70, 2 (2006): 212.

[26] "Ad euidentia questionis considerandum est quod duplex est compositio quantum ad propositum spectat. Una est ex partibus essentialis. Alia est ex partibus quantitatiuis. et hec dicitur compositio quantitatiua: et istas duas Averroem (...) in primo phisicorum ubi dixit ad cognitionem perfecta compositi oportet cognoscere ex quibus quantitatis sit compositum (...) quod una pars essentialis est potentia uel ens in potenti aliquo modo et alia est actus ut manifestum est de materai et forma que sunt proproe partes essentiales (...) partes uero quantitatiue sunt eiusdem rationis sunt aletrum in aliquibus compositis (...) partes quantitatiue non sunt in eodem loco; sed diuersos locis aliquo motum", Jean of Jandun, *Quaestiones super octo libros physicorum Aristotelis* (Venice, 1551; reimpr. Minerva, 1964), 379.

[27] "Sed cum essentias scire quam essentia linee est alia ab essentia superficiei seu latitudinis linea uero terminata est quoddam agreggatum essentia linee et terminis. sicut homo albus quoddam aggregatum ex essentia linee hominis et albedine", Jean of Jandun, *Quaestiones*, 380.

geometrical assumptions. Otherwise, they would be sections, or intermediate parts, of the elapsing/flowing of physical motion/change. Avicenna and later Jean Jandun, through the Commentator's authority, faced the question on how physical knowledge is built. Averroes' preface to his *Commentarium magnum* on Physics states how important the perceptual access is to physical phenomena. Undoubtedly, physical motion/change usually happens as perceptible phenomena, so Averroes states that there are principles and natural causes which are the background of our knowledge. However, the universal roots of physics science are based on induction, which means a permanent comparison between definitions and general assumptions with the observable facts that one would explain.[28]

Ramon Llull's linguistic postulate

In the Latin version of Averroes' preface to *Commentarium magnum*, Iacobus Mantinus translates the subject of physics as *proportio* (Harvey translates *Relation*).[29] Physics focuses on the proportion-relation between *elementa* from one thing to another, this means a comparative analysis of parts of phenomena. In Book VI of *Commentarium magnum*, Averroes displays this exercise of analytical proportion between the "parts" of physical phenomena on different instances. The revival of Zeno's paradoxes, in Book VI, appeals to the attention of Averroes as the proportional analysis between the intermediate parts of motion/change, its dimensions, and body parts. The paradoxical formulation of the unlimited motion in a limited magnitude or the unlimited time for a limited displacement and how the bodies' parts behave on these paradoxical formulations of change is the perfect plot for Averroes' conception of natural science.[30]

Albertus Magnus followed Averroes' illustrative method, the analytical and comparative exercise, in his commentary on Physics. Among the many examples of phenomena parts analysis and its proportional relations in Book VI, I'll select a remarkable example: Albert compares the parts between a slow motion in a certain time lapse with

[28] "(...) tres modi demonstrationum scilicet signi et demonstratio causae et demonstratio simpliciter, quamvis signum et causa sit plus usitata in hac scientia, et aliquando est usitata demonstratio simpliciter et maneries disciplinae divisionis et diffinitionis et enthymematis et inductionis", Averroes, *Commentarium magnum ... De physico*, 4.

[29] "Proportio [relation/Harvey] autem istius libri ad scientiam naturalem est sicut proportio elementorum rei ad rem [elements of a thing to thing/Harvey], quia iste liber comprehendit res, quae sunt sicut principia et radices universales illorum, in quibus vult alloqui naturalis", Averroes, *Commentarium magnum... De physico*, 4; Steven Harvey, "The Hebrew Translation of Averroes' *Prooemium* to His 'Long Commentary on Aristotle's Physics'", *Proceedings of the American Academy for Jewish Research* 52 (1985): 55-84.

[30] "We say that the aim of natural science [physics] in general, of which the aim of this book is a part, is to know the causes of the sensible species and the causes of the accidents that exist in them. lb The subject, then, of this art into which we are inquiring is things that are recognizable to the senses and that change by themselves, i.e. they have within themselves the principle of motion and rest", Harvey, *Prooemium*, 73.

the speed motion. If we carefully observe Albert's exposition through the linear figures divided in proportional parts called *atoma*, it is clear that he spots physical properties of motion (speed differences) in relation to a specific magnitude of time lapse and, in parallel, he introduces an arithmetic proportion of the number's series. All of this to conclude that *atoma* are continuous.[31] This continuity is demonstrated by the proportional relation between the intermediate parts of motion apart from its properties, but this relation is inherent to both proportional sections inscribed along the magnitudes: speed and time. In this sense, Albert embraces Avicenna's conception of continuous as the unique species of quantitative motion. An idea that departs from the arithmetic relation, represented by linear figures, showing the variations of physical phenomena.

Albertus Magnus vindicates continuity through the arithmetic proportions inscribed on the line longitude comparison, but what about the other substantial dimensions according to Aristotle: latitude (*latitudo*) and depth (*profunditas*)? Do those dimensions accomplish some role in physical phenomena? The irruption of multi-dimensional physical analysis is a big issue regarding the research about the intermediate parts of motion. Though, it was a self-educated layman – Ramon Llull – who wrote his principal works in vernacular, that addressed a linguistic hypothesis on this approach.

As we have seen, those intermediate parts have just one quantity species: continuity. Jandun dealt with this aspect of motion as quantitative perspective that does not modify the actualization of forms and the causal principles: potentiality and act. He followed Averroes' awareness on the ambiguity of geometrical representations regarding physical phenomena.[32] Lines resemble motion but their properties are completely different from physical phenomena, and we should check them perceptually to achieve the certainty about our knowledge. On the other hand, Albert uses arithmetical proportion to demonstrate the continuity of motion parts according to some physical properties. This tendency to resemble motion with lines obviously comes from Aristotle, but also from medieval masters – from Arabic to Latin – who contributed to superposing more conceptualization sources on lines, such as arithmetic proportions, science methodology, and linguistic features.

Categorization of motion introduced some linguistic issues in motion predication, among others, the species of quantity whose continuity Avicenna knew very well. If we see a schematic display of Lullian motion (Img. 1), it has a philosophical vocabulary in

[31] "Et quia nos supra posuimus, quod tempus necesse est dividi secundum divisionem magnitudinis et converso, tunc tempus, in quo velocius transit lineam trium atomorum, necesse , est dividi in tres atomos componentes totum tempus motus", Albertus Magnus, *Physica*, 458.

[32] "Manifestum est quod Naturalis et Geometra communicant in consideratione de tribus magnitudinibus, sed diversis modis; et cum ita sit, communicantes sunt in propositionibus et conclusionibus, ergo impossibilia que accidunt a positione falsa de istis magnitudinibus geometricis accidunt etiam naturalibus nisi sint aliqua accidentia existentia in eis inquantum sunt abstracte a materia et non existentia in eis inquantum sunt in materia aut econverso", Averroes, *Commentum magnum super libro De celo et mundo Aristotelis*, vol. 2, edited by R. Arnzen (Leuven: Peeters, 2003), 493.

which Aristotle shows the relation of extreme points that bordered the elapsing/flowing of motion. This set of "motion" denominations that gathers the potentiality-action realizations through the kinesis/energeia activity suffered a fascinating reform by Ramon Llull's vocabulary of elemental composition and the influence of divine virtues on natural behavior:

> Thus, what has been said on the intellect is true, seems to be provable by means of the definition of Goodness, Greatness, etc., by the second species of the rule CD. Goodness, being of a simple essence and form, has a continuous quantity which is disseminated through other essences by its genus and nature. However, regarding the reason which produces the good, it has a discrete nature through *bonificantem* (the capacity of bonifying), *bonificabile* (the capacity of being bonified), and *bonificare* (the action of bonifying). And indeed, from those [Goodness correlatives] flow discrete, and wandering, quantities through the composition of individual subjects in which Goodness has continuous and discrete quantities.[33]

In parallel, Llull adopted – but we still ignore the precise source[34]– some assumptions from Albertus Magnus' description of flowing points that build the lines, and their extreme points:

> Besides, if we imagine that flowing point makes a line, and this flowing ends at some point, it is manifest that the line's limit is the point in which point flowing stops, and it is intrinsic and essential regarding the line; and we could not say that the flowing end point has a different essence than the point flowing.[35]

[33] "Quod autem sit uerum, quod dictum est de intellectu, satis uidetur esse probabile per definitionem bonitatis, magnitudinis, etc., et per secundam speciem regulae CD, quoniam bonitas, in quantum est essentia et forma simplex, habet quantitatem continuam et disparatam ab aliis essentiis ratione suae generis et naturae. Sed in quantum est ratio, ut producat bonum, habet naturam discretam per bonificantem, bonificabile et bonificare. Et ab ista quidem influuntur quantitates peregrinae et discretae per compositionem, quam habent in subiecto indiuiduato; in quo bonitas habet continuam et discretam quantitatem", Ramon Llull, *Ars generalis ultima*, edited by A. Madre, ROL XIV (Turnhout: Brepols, 1986), 34; "Et haec quantitas est sustentata in illa creatura, quae creata est, ut ipsa sit. Sicut bonitas, quae creata est, ut ipsa sit, et magnitudo similiter. Haec quantitas continua exit de parte substantiali continue et discrete. Continue, sicut quantitas bonitatis, quae continua est in sua essentia et in concretis suis, quae sunt bonificatiuum, bonificabile et bonificare; et est continua, quoniam unumquodque illorum est in alio, et sunt ex una et eadem essentia, quae est bonitas", Ramon Llull, *Arbor scientiae* I, edited by P. Villalba, ROL XXIV (Turnhout: Brepols, 2000), 46.

[34] Charles Lohr, "Ramon Lull's Theory of the Quantification of Qualities", in *Constantes y fragmentos del pensamiento luliano*, edited by F. Domínguez and J. de Salas (Tübingen: Max Niemeyer, 1996), 9-17; and "Ramon Llull's Theory of the Continuous and Discrete", in *Late Medieval and Early Modern Corpuscular Matter Theories*, edited by Ch. Lüthy *et al.* (Leiden: Brill, 2001), 75-89.

[35] "Adhuc autem, si nos imaginemur puncti fluxum facere lineam et terminari fluxum puncti in aliquo puncto, ubi terminatur fluxus eius, constat, quod terminus lineae, in quo stat fluxus puncti, intrinsecus est et essentialis lineae; et non possemus dicere, quod punctus terminans fluxum esset alterius essentiae quam punctus fluens, sed esse est aliud fluentis et stantis per modum termini", Alberto Magno, *Physica*, 153; Avicenna, *De sufficientia*, 35r.

Ramon Llull took the *fluxum puncti* as a means to explain the reciprocal influence of the elements' minimal parts. That reciprocal influence accomplishes the Aristotelian definition of motion/change that can only happen between opposites or contradictory qualities or quantities. But this contradictory condition of motion is not fulfilled by divine virtues since they are "attributes" that resemble the divine unity.[36] However, Llull states that this unity behaves as motion/change, because it usually happens in natural creation where virtues flow and elapse just as the substances in which they have influence. He gave special privilege to intermediate parts of the flowing/elapsing. Medium – flowing/elapsing – is the path in which elemental qualities flow through substances, for example, medium's ignis is *calefacere* (to heat) and its flowing departs from the potentiality of heating, called *calefactibile* (potentially heating) and the activity of heating, *calefactiuum* (the actualization of heating). Medium has three species: the union of extreme points, the 'measure' of flow between extreme points, and the extremes by themselves that limited the flowing of heating activity. This vocabulary tries to 'replace' the Aristotelian terminology: every denomination with the suffix *-bile* is potential, with *-are* or *-ere* is the action by itself, and the suffix *-tiuus* means the formal realization of any motion:

> According to the three species mentioned above [*coniunctionis, mensurarum, extremitatum*], the middle [*medium*] is the elemental tree's root, which has in itself several middles [*media*] to drive the natural agents to act. As in the pepper, where there are the aforesaid middles, they exist within the pepper at one point, which is the center of the circumference; and there is still heating in it which connects what heats with what is heated. The same as the lines, which are the middles to delimit the existence of the surfaces' boundaries.[37]

For Ramon Llull, *medium* is the instrument to delimit flowing motion and its extreme points. Thus, he assumes that medium flowing and its points, regarding elemental composition, should be described as geometrical objects. Points are minimal parts, essential for the elemental composition and motion flowing, but their geometrical properties do not break the motion flowing; they rather allow elemental mixture through the flowing of medium relations (see Chart 1).

[36] Josep Enric Rubio, "The Art", in *Raimundus Lullus. An Introduction to his Life, Works and Thought*, edited by A. Fidora and J. E. Rubio, Supplementum Lullianum II (Turnhout: Brepols, 2008), 252-282.

[37] "Secundum tres species antedictas [coniunctionis, mensurarum, extremitatum] est medium radix Arboris elementalis, quod habet in se plura media disposita ad ducendum per agentia naturalia in actu. Sicut in pipere, ubi sunt media antedicta, existente intra piper uno puncto, qui est centrum ad circumferentias; adhuc in illo est calefacere, quod calefaciens et calefactum coniungit, et lineae, quae sunt media terminata existentia intra extremitates superficierum", Ramon Llull, *Arbor scientiae* I, 25-26.

Aristotle	**Verb Tenses (Ryle-Ackrill)**	**Albertus Magnus**	**Ramon Llull**
Dúnamis Δύναμις	Present Perfect (Finished Motion-Alterations)	*aedificabile*	-bile (Bonifica-*bilis*)
Enérgeia ἐνέργειᾰ		*aedificabilis*	-tivus (Bonifica-*tiui*)
Kinêsis κίνησις	Present Continuous (Finished-Unfinished/ Motion-Alterations)	*aedificatio*	-are (Bonific-*are*)
Entelékheia ἐντελέχεια		*Formam aedificii- aedificatum*	-atum (bonific-*atum*)/ Bonitas

Chart 1

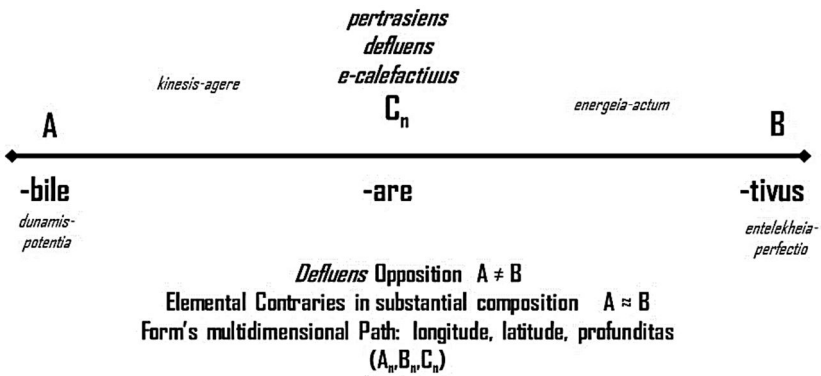
Those reciprocal denominations are called *correlatiua* by Llull, which means: the language of motion flowing and the substantial composition that connotates the Aristotelian vocabulary of physical phenomena. That vocabulary also highlights the realistic conception of points as elemental minimal parts that achieve a breakthrough when Llull states that points are not just lineal longitudes, they are also latitudes (*latitudo*) and depth (*profunditas*). The correlative vocabulary and its flowing points build surfaces and solids. In these dimensions, points are able to spot degree variations, such as decrease and increase, because of the addition of lines to develop surfaces, and the flowing of surfaces to compose bodies does not change the essential nature of substance composition. This addition of lines in Avicenna's continuity conception takes place in other qualities as "becoming black" (*nigrescere*). This is the reason why "getting black" and "being black" are not essentially different, the same as the line and the section added. As Jandun stated later, those additions could be degree variations from minimal to maximal, and the observer should verify these degree variations. According to Llull, the degree' variations characterize latitudes and depths in the multidimensional analysis of motion flowing/elapsing.

Conclusion

The disruption of correlative language was not adhered to much by the masters of the late 13th century, only Jandun criticized the excessive realism of the identification between geometric points and lexical variations: longitude is not latitude just by the

addition of an extra line's segment, since its geometrical properties are different from physical aspects[38]. Like Averroes, Jandun sought the perceptual contrast of philosophical conceptions. This means that a set of denominations has sense if describing physical phenomena; the phenomena resemblance is not enough without the natural verification. Beyond this critic, Llull developed a specific vocabulary about natural motion and change to mean the Aristotelian awareness about the intermediate parts of motion. The suffixes *-bile, tivus, -are, -atum*, placed at the end of the element's qualities addresses how they behave in the physical world regarding the intermediate parts of a process, such as heating, coldness, dryness, wetness. For Llull, each term represents the parts of those physical actions, perhaps the same as Avicenna had stated: "Alii vero dixerunt quod hoc nomen motus cadit super maneries quae sunt in illo sola *causali participatione nominis*."[39] In the following scheme, one can see the matching between Aristotelian vocabulary, the heritage of Arabic interpretation of motion as "intermediateness" and the Lullian suffixation of elemental terms to show a complete linguistic apparatus for the physical knowledge of motion as a process connoting its intermediate parts.

Img. 1



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[38] Jean of Jandun, *Quaestiones*, 381.
[39] Avicenna, *Sufficientia*, 24v.

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AN (APPARENT) EXCEPTION IN THE ARISTOTELIAN NATURAL PHILOSOPHY: ANTIPERISTASIS AS ACTION ON CONTRARY QUALITIES AND ITS INTERPRETATION IN THE MEDIEVAL PHILOSOPHICAL AND MEDICAL COMMENTARY TRADITION

UNA (APARENTE) EXCEPCIÓN EN LA FILOSOFÍA NATURAL ARISTOTÉLICA: ANTIPERÍSTASIS COMO ACCIÓN EN LAS CUALIDADES CONTRARIAS Y SU INTERPRETACIÓN EN LA TRADICIÓN DEL COMENTARIO MÉDICO Y FILOSÓFICO MEDIEVAL

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Abstract

This paper explores the scholastic debate about *antiperistasis*, a mechanism in Aristotle's dynamics described in the first book of *Meteorology* as an intensification of a quality caused by the action of the contrary one. After having distinguished this process from a homonymous, but totally different, principle concerning the dynamics of fluids that Aristotle describes in his *Physics*, I focus on the medieval reception of the former. Scholastic commentators oriented their exegetical effort in elaborating a consistent explanation of an apparently paradoxical process like the intensification of a quality by the opposite one. From the fourteenth century onwards, most of the commentators resorted to the theory of the multiplication of species, according to which each entity acts through the emission of *simulacra* of the objects (*species*) that spread spherically in the medium. When these rays encounter an obstacle, such as a contrary quality, they are pushed back towards their source. The reflection of the *species* determined by the surrounding and opposite quality produces a concentration of the first one, which is therefore intensified. Another distinctive feature of the scholastic interpretation of Aristotle's antiperistasis is the convergence between the discussions on inorganic and organic matter, physical and medical discourse. This convergence found its most significant expression in the adoption of the model described in the first book of Aristotle's *Meteorology* to the biological context of Hippocrates's *Aphorisms* I, 15. Following Galen's exegesis of this passage, medieval commentators established a link between physics and medicine substantially extraneous to Aristotle's theory.

Keywords

Antiperistasis; Aristotle's *Meteorology*; Aristotle's *Physics*; Multiplication of Species; Hippocratic Tradition in the Middle Ages

Resumen

Este artículo explora los debates escolásticos sobre la antiperístasis, un mecanismo en la dinámica de Aristóteles descrito en el primer libro de la *Meteorología* como una intensificación de una cualidad provocada por la acción de la cualidad contraria. Después de haber distinguido este proceso de un principio homónimo, relativo a la dinámica de los fluidos que Aristóteles describe en su *Física*, mi análisis se centra en la recepción medieval del primer proceso. Los comentaristas escolásticos orientaron su esfuerzo exegético hacia la elaboración de una explicación consistente de un proceso aparentemente paradójico como la intensificación de una cualidad por su cualidad contraria. A partir del siglo XIV, la mayoría de los comentaristas recurrió a la teoría de la multiplicación de especies, según la cual cada entidad actúa mediante la emisión de rayos virtuales (*species*) que se difunden de forma esférica en el medio. Cuando estos rayos encuentran un obstáculo, como una cualidad contraria, son empujados hacia su fuente. El reflejo de los rayos virtuales determinado por la cualidad circundante y contraria produce una concentración de la primera cualidad, que, como consecuencia, se intensifica. Otro rasgo distintivo de la interpretación escolástica de la antiperístasis de Aristóteles es la convergencia entre la reflexión sobre la materia orgánica e inorgánica, el discurso físico y médico. Esta convergencia encontró su expresión más significativa en la adopción del modelo descrito en el primer libro de la *Meteorología* de Aristóteles al contexto biológico de los *Aforismos* de Hipócrates I, 15. Siguiendo la exégesis de Galeno, los comentaristas medievales establecieron un vínculo entre la física y la medicina sustancialmente ajeno a la teoría de Aristóteles.

Palabras clave

Antiperistasis; *Meteorología* de Aristóteles; *Física* de Aristóteles; multiplicación de especies; tradición hipocrática en la Edad Media

Introduction[1]

The term *antiperistasis* (ἀντιπερίστασις) is employed in Aristotle's works with two different meanings, both related to dynamics. The first one concerns the interactions between the active qualities, hot and cold, and describes the process by which a quality surrounded by the contrary one is concentrated and intensified. The second meaning expresses a redistribution of portions of a fluid, such as air and water, in order to prevent the formation of a void. It is only in the first meaning that the process of antiperistasis can be seen as an (apparent) exception within Aristotle's natural philosophy.

If a monograph on antiperistasis is still a *desideratum*,[2] in the last years several studies have contributed to a better understanding of this process, particularly in the sense described in the *Physics*, casting light on its pre-Aristotelian history, its reception in Late Antiquity, in the Arab and in the Latin world, and its meaning for the history of science.[3] The antiperistasis in Aristotle's *Meteorology* seems to be more neglected by modern scholarship. I will therefore focus on it, and particularly on its interpretation

[1] I wish to express my gratitude to Valérie Cordonier, who made me realize the importance of this topic in Aristotle's natural philosophy, to Daniel Di Liscia, for his precious comments on a draft of this paper, to Stefania Fortuna and Alessandra Foscati, for their bibliographical suggestions concerning the medical tradition, as well as to Nicolas Weill-Parot, who kindly shared with me his recent study on medieval interpretations of antiperistasis in the commentary tradition on Aristotle's *Physics*. Research for this paper has been carried out within the project "P500PH_206632/1", financed by the Swiss National Science Foundation.

[2] Hans Strohm, *Meteorologie. Über die Welt* (Berlin: Wissenschaftliche Buchgesellschaft, 1984), 152.

[3] On the pre-Aristotelian history of this concept, see Jan Opsomer, "Antiperistasis: a Platonic theory", in *Plutarco, Platón y Aristóteles*. Actas del V Congreso Internacional de la I.P.S. Madrid-Cuenca, 4-7 de mayo de 1999, edited by A. Pérez Jiménez, J. García López, R. María Aguilar (Madrid: Ediciones Clásicas, 1999), 417-430. For some remarks on the reception of this concept in Theophrastus's *De igne*, see David Furley, "The Mechanics of Meteorologica IV. A Prolegomenon to Biology", in *Zweifelhaftes im Corpus Aristotelicum. Studien zu einigen Dubia. Akten des 9. Symposium Aristotelicum (Berlin, 7.-16. September 1981)*, edited by P. Moraux and J. Wiesner (Berlin and New York: Walter de Gruyter, 1983), 73-93, at 83, 90, which refers to Peter Steinmetz, *Die Physik des Theophrast von Eresos* (Bad Homburg, 1964). On the reception in the Arab world, see Shlomo Pines, "Quelques tendances antipéripatéticiennes de la pensée scientifique islamique", *Thalès* 4 (1937): 210-219, at 210-215; Ahmad Hasnawi, "Avicenne et le livre IV des *Météorologiques*", in *Aristoteles Chemicus. Il IV libro dei Meteorologica nella tradizione antica e medievale*, edited by C. Viano (Sankt Augustin: Academia Verlag, 2002), 133-143, at 137-139, and Nicolas Weill-Parot, "Les projectiles et les fluctuations de l'antipéristase dans les commentaires latins de la *Physique*: d'Averroès à Paul de Venise". *Studi sull'Aristotelismo medievale* 1 (2021): 263-318, at 276-280 (for Averroes's position in his *Great Commentary on the Physics*). On the meaning of this concept for the history of science, see Norwood Russell Hanson, "Aristotle (and Others) on Motion through Air". *The Review of Metaphysics* 19.1 (1965): 133-147. On the interpretations of antiperistasis in scholastic commentaries, see Weill-Parot, "Les projectiles", 265-318.

by Latin commentators on Aristotle's *Meteorology*. Before coming to them, I shall introduce what, with Michel Federspiel, we may call "Aristotle's double antiperistasis".[4]

1. Aristotle's double *antiperistasis*

The fact that Aristotle uses the term 'antiperistasis' to refer to two distinct processes, together with the absence of a clear definition and distinction of these two concepts in the Aristotelian works, led to some confusion in modern scholarship.[5] These meanings have correctly been distinguished by Henry D. P. Lee, David Furley and Michel Federspiel. The latter has reviewed, in the Aristotelian works on natural philosophy, six occurrences in which this term refers to a redistribution of fluids and seven in which it indicates an intensification by the contrary quality.[6] The process of antiperistasis is rapidly mentioned also in the *Posterior Analytics*, but this reference, which occurs in a logical context, is too general to infer which one of the two processes Aristotle had in mind.[7] Nine mentions of this term (two with the first meaning, and seven with the second one) can be found in the *Problemata*, a voluminous work which probably originated from an Aristotelian core and was enriched within the peripatetic school.[8] Leaving aside the *Problemata*, let us start with an overview of the significant *loci* in the works of assured Aristotelian paternity before coming to a closer study of some of them.

I. Antiperistasis as redistribution of fluids.

a) *Phys*. IV, 8, 215a14-17 (motion of projectiles);

b) *Phys*. VIII, 10, 266b28-267a20 (motion of projectiles);

c) *Meteor*. II, 4, 369b25 (mutual replacement of the exhalations);

d) *Meteor*. IV, 4, 382 a11-14 (definition of soft matter as something whose "surface yields, but not by displacement").

II. Antiperistasis as intensification by the contrary quality:

[4] Michel Federspiel, "Le Soleil comme movens repellens dans le *De ventis* de Théophraste et la double antipéristase", in *La météorologie dans l'Antiquité. Entre science et croyance. Actes du Colloque international interdisciplinaire de Toulouse, 2-4 mai 2002*, edited by Ch. Cusset (Saint-Etienne: Publications de l'Université de Saint-Etienne, 2003), 415-436.

[5] Federspiel mentions some examples of incorrect translations in modern editions of Aristotle's *Meteorology*: Federspiel, "L'action du soleil", 426, fn. 43.

[6] *Henry D. P. Lee, Aristotle, Meteorologica* with an *English* translation (Camdridge MA: Camdridge University Press, 1952), 82-83; Furley, "The Mechanics of Meteorologica IV", 90, particularly on the passage I (d) in our list.

[7] Aristoteles, *Analytica posteriora*, 2, 98a24; Federspiel, "L'action du soleil", 433.

[8] Federspiel, "L'action du soleil", 428, fn. 48 and 49. On the dissemination of the *Problemata* see *Aristotle's "Problemata" in Different Times and Tongues*, edited by M. Goyens and P. De Leemans (Louvain: Leuven University Press, 2006).

a) *Meteor*. I, 10, 347b6 (formation of dew in the region of the Euxine sea);

b) *Meteor*. I, 12, 348b2-15 (formation of hail);

c) *Meteor*. I, 12, 349a8 (violent rain in Arabia and Ethiopia during summer);

d) *Meteor*. II, 4, 361a1 (formation of rain);

e) *Meteor*. IV, 5, 382b10 (coldness sometimes burns by concentrating heat);

f) *De somno et vigilia*, 457b1-458a32 (sleep caused by a concentration of heat inside the body).

Of these occurrences mentioned by Federspiel,[9] I shall focus particularly on the passages from the *Physics* (I *a* and *b*), which illustrate the process of redistribution of fluids, and the passage concerning the formation of hail (II *b*), which illustrates the action on contrary qualities. But before starting with this analysis, a terminological note is necessary. Federspiel remarks that, although morphologically identical, the two meanings of the term antiperistasis employed by Aristotle are etymologically distinct, since the Greek preposition ἀντί could have two different meanings:

1. "in front of" and "against", thus expressing both proximity in the space and opposition. Aristotle uses the term antiperistasis in this sense to refer to the process of expulsion by the contrary quality.

2. "in the place of", thus expressing replacement. Aristotle uses the term antiperistasis in this sense to refer to the process of redistribution of fluids.[10]

Let us first focus on the process of redistribution of fluids. While the references in Aristotle's *Meteorology*[11] are too succinct to allow a precise characterization of this phenomenon, in the *Physics* we find a more detailed description, though not a real definition nor a systematic account of this process. The first mention of the term occurs in book IV, chapter 8. Aristotle is proving the impossibility of void, showing that it would impede on the ability for anything to move (IV, 8, 215ass). The motion of projectiles is a particular case which, according to Aristotle, confirms this impossibility, as the two explanations that have been elaborated both exclude void. The first explanation comes down to redistribution (antiperistasis). According to the second explanation, which reflects Aristotle's own position, the impulse conferred to the air by the thrower exceeds the natural tendency of a body to reach its proper place. The consequence is that, instead of falling down, a heavy body continues moving straight for a limited amount of time (215a14-18).

[9] Federspiel, "L'action du soleil", 427, fn. 46.

[10] Federspiel, "L'action du soleil", 425-426.

[11] *Meteor*. II, 4, 369b25 (mutual replacement of the exhalations); *Meteor*. IV, 4, 382 a12 (definition of soft matter as something whose "surface yields, but not by displacement").

The second passage provides a more detailed account. We are in the last chapter of the *Physics* (VIII, 10), where Aristotle addresses the problem of the transmission of motion from the first mover. Starting from the consideration that, with the exception of self-movers, every moving body is moved by something, Aristotle asks how it is possible that projectiles keep moving when they are no longer in contact with the thrower (266b26-39). He criticizes the idea that the mover A imparts its motion to the contiguous mover B, and that the latter imparts its motion on C *only because they are themselves moving*. In fact, this would imply that when A stops or is no longer in contact with B, B stops as well and no longer transfers any motion: since every member in the causal chain of motion is simultaneously mover and moved, once one element stops, the whole chain will stop (266b30-33; 267a15-18).

Aristotle remains vague on the source of the theory of redistribution of fluids (antiperistasis) that he mentions in *Phys*. IV, 215a14-16 and criticizes in VIII, 10, 267a17-20, limiting himself to ascribe it to some ἄλλοι (215a16; 267a17). This theory was employed by Plato in the *Timaeus* (79A-80C) in order to explain the process of breathing.[12] Plato maintains that the air inside the body gets heated up and exits through mouth, nostrils and the pores of the skin. Cold air is then absorbed by these orifices and interstices in order to replace the escaped air. Once the air coming from outside is heated up, it moves outwards, and the whole process is repeated. This explanation presupposes that the body is endowed with an innate heat, which causes the air to heat up, and that the heated air tends to move outwards. In this regard, Plato's conception is not too far from Aristotle's theory of natural places.[13] The simultaneity of the processes of absorption of external, cold air and expulsion of internal, warm air, prevents the formation of a void within or outside the body. Plato does not expand on other phenomena that, as he states, can be explained by the same mechanism, namely swallowing, the motion of projectiles, water currents, and the descent of thunderbolts, but limits himself to short remarks on the acoustics of harmonic sounds.[14]

In the case of projectiles, according to the antiperistasis theory criticized by Aristotle, a moving object displaces the air it is facing, causing the air to move towards the rear of the object in order to impede the formation of a void in the space left by the moving object.[15] The air gathered at the rear of the object does not only have a passive,

[12] Plato implicitly adopted this explanation in other passages of the same dialogue: 59A; D-E; 60D. Plato did not use the term *antiperistasis*, but rather περίωσις. See Francis MacDonald Cornford, *Plato's Cosmology. The* Timaeus *of Plato* (Indianapolis and Cambridge: Hackett Publishing Company, 1997), 315-316.

[13] Opsomer, "Antiperistasis", 427.

[14] Plato, *Timaeus*, 1004 DE. As shown in detail by Jan Opsomer, in the seventh of his *Platonic Questions* Plutarch elaborates an explanation of these processes consistent with Plato's thought: Opsomer, "Antiperistasis", 424.

[15] On Aristotle's antiperistasis in the *Physics*, see also Pierre Duhem, *Le système du monde* (Paris: A. Hermann, 1913-1959), vol. 1, 371-374; Anneliese Maier, *Zwei Grundprobleme der Scholastischen Naturphilosophie. Das Problem der Intensiven Grösse. Die Impetustheorie* (Roma: Edizioni di Storia e

filling function: it also has an active, propulsive purpose, which, for a limited time, pushes the mover in its direction.

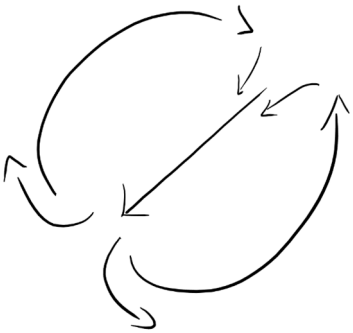

Figure 1. The theory of antiperistasis rejected by Aristotle in Phys. VIII, 10, 266b27-267a21.

Aristotle rejects this theory for the motion of projectiles and for breathing (*De inspiratione et respiratione*, 472b6-473a2), and proposes his own explanation (*Phys*. VIII, 10, 267a2-12), according to which the mover does not just move a consecutive body, but also communicates a motive force to the medium, be it air or water.[16] This means that the mover A of the causal chain imparts together motion *and* the property of causing motion to something that is contiguous to it (B), and this in turn does the same to what is contiguous to it (C). The motive force decreases when each consecutive member of the chain has less force to cause motion, and the movement stops when the impulse imparted to a member of the chain (let us say, by A to B), is only capable of making B move, but not of making B capable of moving C. Aristotle stresses the fact that, despite their appearance, these movements are not continuous, but successive, as they do not involve a single mover, but a number of discrete movers (267a12-16).

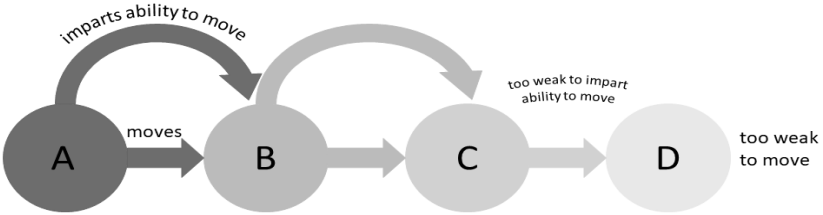

Figure 2. Aristotle's theory of motion in Phys. VIII, 10, 267a2-12.

letteratura, 1968), 117, fn 6; Opsomer, "Antiperistasis", 419; Jean De Groot, *Aristotle's Empiricism: Experience and Mechanics in the 4th century BC* (Las Vegas, Zurich and Athens: Parmenides, 2014), 256-259; Weill-Parot, "Les projectiles", 265-267.

[16] Aristotle discards Plato's theory because it is only applicable to land animals, and does not account for respiration in other species. Following Plato's text, Aristotle uses here the term περίωσις, and not antiperistasis.

This theory, which is applicable not only to the motion of projectiles, but also to magnetic attraction and the suction of fluids, was already criticized by Late-Ancient philosophers, such as John Philoponus (490-570).[17] A recent survey of these discussions in medieval commentaries on Aristotle's *Physics* has illuminated an interesting and still partly unexplored chapter in the history of dynamics.[18]

In this paper, I will instead focus on the independent medieval history of the other sense of the Aristotelian term antipersitasis, the sense used mainly in Aristotle's *Meteorology* to refer to the dynamics of hot and cold. Also in this case we have to start

[17] Iohannes Philoponus, *In Aristotelis Physicorum libros quinque posteriores commentaria*, edited by H. Vitelli (Berolini: Reimer 1888), lib. IV, ch. VIII, 639-642.

[18] Weill-Parot, "Les projectiles". In the Greek-Latin translation of the *Physics* (*translatio vetus*) by James of Venice (dead after 1147), we do not find any transliteration of the term *antiperistasis*. In the first occurrence in the *Physics* (IV, 8, 215a14-16), the Greek term is translated by "repercussio" ("Amplius nunc quidem moventur proiecta proiecturo non tangent aut propter repercussionem, sicut quidam dicunt", *Physica. Translatio vetus*, edited by F. Bossier and J. Brams; *Translatio Vaticana*, 2 vols., edited by A. Mansion (Leiden and New York: Brill, 1990), vol. 1, 160, 10-12). In the second occurrence (VIII, 10, 267a15-18), James of Venice simply introduces the Greek form of the term: "Unde et in aere et in aqua fit huiusmodi motus, quem dicunt quidam ἀντιπερίστασιν εἶναι", vol. 1, 338,18-339,1. The Latin transliteration can be found in Moerbeke's revision of this translation: "Amplius, nunc quidem proiecta moventur, proiectore non tangente, aut propter antiparistasim, sicut quidam dicunt, aut ex eo quod pellit pulsus aer velociore motu quam latio pulsi, secundum quam fertur in proprium locum", *Phys.* IV, 8, 215a14, 215a 14, AL VII. 3 (Aristoteles Latinus database, third release), 18, 46; "Quem dicunt quidam antiperistasim esse: impossibile autem aliter opposita solvere nisi dicto modo: antiperistasis autem simul omnia moveri facit et movere: quare et quiescent", VIII, 10, 267a15-18, 452, 28-30. For a discussion of the Greek-Latin translations by James of Venise and Wilhelm of Moerbeke, as well as the Arab-Latin translation incorporated in Averroes's commentary and ascribed to Michael Scot, see Weill-Parot, "Les projectiles", 268-275. On the reception of the antiperistasis theory in the scholastic commentary tradition on Aristotle's *Physics*, see Duhem, *Le système du monde*, 8, 187 (Gilles of Rome); 202-203 (John Buridan); 216-217 (Albert of Saxony) and, more recently, Weill-Parot, "Les projectiles", 280-315, who studies in detail passages from Albert the Great, Thomas Aquinas, Richard Rufus of Corwall, Roger Bacon, John Dumbleton, John Buridan, Gilles of Rome and Paul of Venice. Discussions on antiperistasis are obviously closely linked to other problems of dynamics, namely the motion of projectiles and the acceleration of falling bodies, on which Duhem's and Maier's classical studies are still very useful: Duhem, *Le système du monde*, vol. 1, 356-398; vol. 8, 169-345; vol. 10, 57, 64-65, 84-86, 103-104, 108-110, 115-116, 164-172, 216-227, 422-435; Anneliese Maier, *Die Vorläufer Galileis im 14. Jahrhundert* (Roma: Edizioni di Storia e Letteratura, 1942), 132-154; Maier, *Zwei Grundprobleme der Scholastischen Naturphilosophie* (Roma: Edizioni di Storia e letteratura, 1951), 132-154. On this topic see also Mieczysław Markowski, "Studien zu den Krakauer mittelalterlichen Physikkommentaren. Die Impetustheorie", *Archives d'histoires doctrinale et littéraire du Moyen Âge* 43 (1968): 187-210; Michael Wolff, *Geschichte der Impetustheorie: Untersuchungen zum Ursprung der klassischen Mechanik* (Frankfurt am Main: Suhrkamp, 1978); Jürgen Sarnowski, "Concepts of Impetus and the History of Mechanics", in *Mechanics and Natural Philosophiy before the Scientific Revolution*, edited by W. Roy Laird and S. Roux (London: Dodrecht, 2008), 121-148; Daniel A. Di Liscia, "Breakings and Continuities: The Fourteenth Century and Galileo's Impetus Theory as a Complex Case of Conceptual and Historical Transmission", in *Spreading Knowledge in a Changing World*, edited by Ch. Burnett and P. Mantas España (London and Córdoba: UCO Press, 2018), 175-201.

from the Aristotelian text in order to understand the doctrinal and historical roots of the subsequent debates.

Aristotle uses the principle of antiperistasis to explain some atmospheric phenomena that seem to defy the principle of his physics. These phenomena take place in the upper atmosphere as well as in the middle region of the air, and concern hot and dry as well as cold and wet bodies. An example of the first type is the movement of shooting stars. These bodies are ejected violently downwards even though, because of their warm and light nature, they should rather move upwards. Aristotle resolves this apparent paradox by explaining that when the coldness of the air causes the middle region to condense, the pressure pushes the heat out by ejecting it downwards (*Meteor.* I, 4, 341b36-342a10). An example of the second type of phenomenon is represented by the formation of dew in the Black Sea region. Aristotle underlines that there, unlike what happens elsewhere, dew is formed by northern winds. In fact, in this cold region, the southern winds do not carry enough heat to cause the evaporation necessary for the formation of dew. Northern winds, on the other hand, determine the concentration of heat by antiperistasis, which causes an increase in evaporation (I, 10, 347a36-b11).

But the most detailed explanation devoted to the action of contrary qualities occurs in relation to the formation of another humid atmospheric phenomenon: hail. Although hail is made of frozen water, it appears in spring and summer, two hot seasons. According to Anaxagoras, this apparent paradox can be solved by admitting that hail is generated in the upper region of the air, which is cold. Aristotle refuses this explanation, claiming that hail is generated in the lower region of the air, close to the Earth's surface. This supposition seems to be confirmed by the fact that hail is often accompanied by strong thunderbolts, which would be inaudible if the clouds were not close to the Earth's surface. Moreover, hailstones are often big and have irregular shapes: facts which would be impossible if hail were formed in the upper region of the air, as in this case hailstones would wear down in the course of their descent, thus becoming round in shape and smaller in size. To explain the formation of hail close to the earth surface, Aristotle presents an analogy with what happens inside the Earth. He remarks that when the Earth's surface is hot, it is cold on the inside, and vice versa. This phenomenon is due to the fact that heat and cold that are inside the earth, when surrounded by the opposite quality, are concentrated and intensified. Similarly, during summer, cold vapor in the region of air reacts against the heat by condensing and thereby determining the formation of rain and hail. It is for this reason, continues Aristotle, that raindrops are larger and thunderstorms more violent in hot countries and in hot seasons (I, 12, 348b4-7; 349a4-8). This is also the reason why water that has been previously heated up freezes faster than cold water. To illustrate this principle, Aristotle introduces the example of the fishermen in the Black Sea region. When fishing in cold weather, they use ice to secure their fishing rods to the ground, and pour hot water around them to make them freeze faster (I, 12, 348b31-349a3).

In short, the principle of antiperistasis enables Aristotle to explain a certain number of processes determined by the condensation of hot or cold matter under the action of the opposite quality. This applies equally to phenomena that occur in the upper atmosphere, like shooting stars, in the lower part of it, like hail and winds, or below the Earth's surface, in the subterranean caves. In all of these processes, three steps can be distinguished: 1) a condensation of a quality A caused by the action of a contrary quality B; 2) a subsequent intensification of quality A; 3) the expulsion of quality A from the surrounding mass of quality B. The prevailing quality condensates the losing one, reinforces it, and expels it.

As we have seen, antiperistasis as described in *Physics* (IV, 8, 215a14-18; VIII, 10, 267b27-267a21) is a different mechanism, which consists of the replacement of some bodies moving simultaneously. If this mechanism also presupposes a local movement, it implies neither a condensation nor an intensification of the moving bodies. In both cases, we are dealing with a violent motion, namely a motion that is not caused by an internal principle of the mover. In this sense, the antiperistatic motion is not essential to the mover in the way it is essential for a stone to move downwards if nothing impedes it. Both in the *Physics* and in *Meteorology*, the antiperistatic motion can rather be described as an expulsive motion. The difference is that in *Meteorology* this motion is caused by a reaction to an opposite quality, while qualities play no role in the antipersitasis of the *Physics*.[19] In any case, the *Physics* and *Meteorology* describe, under the name *antipersitasis*, two distinct processes that should not be assimilated.[20] The process described in the *Physics* concerns the dynamics of fluids, while the process described in *Meteorology* applies to the interactions between the primary qualities.[21] In the next pages, I will focus on scholastic debates on the latter, less studied process.

2. The medieval commentators

I have already devoted some pages to scholastic discussions on antiperistasis in commentaries on Aristotle's *Meteorology*.[22] For this contribution, I shall return to some of these remarks and integrate them with the study of some sources and traditions I had not taken into account in my previous analysis. As for the commentary tradition on the *translatio vetus*, I shall consider some English commentaries, which attest the early reception of Aristotle's *Meteorology* in the Latin West. Concerning the commentary tradition on the *nova translatio*, I will explore the relations between the philosophical

[19] Or at least, they play no role in the antiperistasis as described by Aristotle in the *Physics*. In fact, we have seen that, for Plato, the opposition between hot air inside the body and cold air outside it was the starting point for "his" antiperistasis, namely the process he called περίωσις.

[20] Federspiel, "L'action du soleil", 425.

[21] Federspiel, "L'action du soleil", 415.

[22] Aurora Panzica, *De la Lune à la Terre: les débats sur le premier livre des* Météorologiques *d'Aristote au Moyen Âge latin (XII^e^-XV^e^ siècles)*, ch. 16.2, forthcoming in the series *Studia Artistarum*, Brepols.

tradition of commentaries on Aristotle's *Meteorology* and the medical tradition of commentaries on the Hippocratic corpus. The analysis of these new sources will enable me to update some of my previous considerations and conclusions.[23]

A methodological premise is necessary in order to approach the corpus of medieval commentaries on Aristotle's *Meteorology* and on Hippocrates's *Aphorisms*. Commenting on authoritative texts in medieval universities was not an individual task, but rather a collective enterprise. In this sense, we have to look at these texts more as a choral work than as single voices in the history of scientific thought. Medieval masters heavily relied on their predecessors and colleagues, to the extent that the starting point of a scholastic commentary was not only the commented text, but also its previous interpretations. Although – at least up to the end of the fourteenth century – (explicit) references to other masters were not very frequent in medieval commentaries, commentators always took into account, sometimes in a polemical way, their colleagues's positions. The same should apply to the historian of medieval philosophy in order to be faithful to the object of his inquiry.

2a. The readers of the *translatio vetus*: *antiperistasis* without the term

Aristotle's text was heavily modified in the Arabic-Latin version of *Meteorology* (*translatio vetus*), which does not translate the Aristotelian treatise directly, but rather an Arabic paraphrase of it.[24] This paraphrase maintains the substantial features of the Aristotelian explanation of antiperistasis as action on contraries qualities – a process for which, though, we find no specific name in the *vetus* –, but departs from the original text on many points.

As we have seen, the first mention of this process occurs in the passage concerning shooting stars, which are pushed downwards by the coldness of the air. This passage of the Aristotelian text, in which the process of antiperistasis is rapidly evoked without a name, is too concise to appreciate the differences between the two translations, and too marginal to serve as a basis for philosophical developments in medieval commentaries.[25] We therefore have to focus on the passages concerning humid

[23] A complete overview of scholastic discussions on antiperistasis as action on contrary qualities should take into account not only the commentary tradition on Aristotle's *Meteorology*, but also the commentary tradition on the *Parva naturalia*, in which, as we have seen above, this process appears to explain sleep as a concentration of vital warmth inside the body (*De somno et vigilia*, 457b1-458a32).

[24] Pieter L. Schoonheim, *Aristotle's* Meteorology *in the Arabico-Latin Tradition: A Critical Edition of the Texts, with Introduction and Indices* (Leiden, Boston and Köln: Brill, 2000). For information on this text, see Schoonheim's introduction and Gudrun Vuillemin-Diem's introduction to *Meteorologica. Recensio et Translatio Guillelmi de Mœrbeka*, 2 vols. (Bruxelles: Brepols, 2008), vol. 1, 6-8.

[25] Aristoteles, *Meteorologica*, translatio vetus I, 6, 28,24-30,2: "Et fit assub iterum, quando expellitur caliditas, quae est in aere, qui est sub illo loco ex frigiditate quae accidit, quare apparet assuub exiens ex eo. Verum huiusmodi assuub color est turbidus, et procedit ex aere sicut manat ignis, qui expellitur ex canna."

phenomena. The term first occurs in the explaination of the formation of dew, a passage in which the text of the Arabic version replaces the city of Corinthus in Aristotle's original with the region of the Black Sea.[26] More substantial interventions concern the formation of hail, the longest passage in Aristotle's *Meteorology* devoted to antiperistasis as action on contrary qualities. According to the *vetus*, hail is generated in hot rather than cold seasons because heat concentrates cold in the interior part of the cloud, thus freezing the vapor contained in it into hail. On the contrary, during cold seasons, cold is not concentrated in one place, but is scattered throughout the air.[27] This text is however quite vague on the process that leads cold contrite under the action of the contrary quality. Some elements of the Greek original text – and, as a consequence, of the text of Moerbeke's Greek-Latin translation, which faithfully follows it[28] – are missing in this version, such as the analogy between what happens under the ground and in the atmosphere (348b3-4); the statement that the formation of hail occurs when condensation is faster than the downwards motion of water (348b18-22); the refutation of Anaxagoras's theory, according to which hail is generated in the upper part of the atmosphere (348b13-15); as well as Aristotle's arguments showing that hail is generated in the lower part of the atmosphere, close to the Earth's surface (348a24-36). The text of the *vetus* states that hailstones which come from afar are smaller and have a rounded shape, while those which come from the lower part of the atmosphere are larger and irregular in shape, but does not state that hail, unlike rain and snow, freezes below the region of the clouds. On the contrary, we read that hail is formed in the clouds far from

[26] On the transformation of this passage, and on the questions it aroused among medieval commentators, see Joëlle Ducos, *La météorologie en français au Moyen Âge: XIII^e - XIV^e siècles* (Paris: Honoré Champion, 1998), 118-122.

[27] Aristoteles, *Meteorologica*, translatio vetus I, 7, 40,18-44,7: "Dico ergo sermone aggregato quod grando non fit nisi in locis multae serenitatis nisi ex caliditate exsistente in eis, plus quam sit exsistentia eius in temporibus frigidis quae sunt in locis vehementis frigoris sempiterni in eis. Sequitur ergo illud necessario quod fit grando in temporibus calidis plus quam sit exsistentia eius et in temporibus frigidis, quoniam tempora calida similiora sunt locis in quibus fit grando quam tempora frigida. Et non fit in temporibus calidis absque temporibus frigidis nisi propterea quod calor contractus est frigori, quare recipitur frigus ad interiora nubis ex multitudine caliditatis aeris in illa hora, quare congelat quid in ea est de aqua et separat eam grandinem. In temporibus autem frigidis frigus est sparsum in aere toto, non in proprietate [the manuscript Città del Vaticano, Biblioteca Apostolica Vaticana, Urb. lat. 206, f. 218r, reads instead: "propinquitate", which seems to me to fit better in this context] nubis. Et non est illic caliditas quae possit contraria esse ei ei et [I think the lectio "et" should be corrected into "ut"] contrahatur propter eam ad interiora. Grando autem rotunda parva descendit ex locis supremis in alto. (...) Dico ergo, quia quando in aere est calor, est velocior congelatio aquae. Et demonstratio super illud est quod quando aqua calefit, deinde funditur in locis frigidis, est velocior ad frigus suum, propterea quod, quando cum contrarius fit frigori, calor est magis apparens virtuti suae et vehementius ad operationem suam quam quando non est illic contrarium. Et iterum piscatores, quando volunt permutare arundinem, qua venantur in glaciem – ut sit velocior ad submersionem suam in aqua – fundunt super eam aquam calidam, deinde ponunt eam in loco frigido. Quare congelatur super eam glacies statim propter apparitionem virtutis frigoris et vehementiam operationis eius propter contrarietatem ex calore."

[28] Aristoteles, *Meteorologica,* I, 12, 348b3-349a9; translatio nova, 32,631-33,667.

the Earth.[29] Moreover, as we have seen, the text of the *vetus* does not indicate a specific name for the process of the action on contrary qualities. Confronted with a quite elliptic text, early scholastic commentators on Aristotle's *Meteorology* had to elaborate a consistent Latin terminology to describe a phenomenon that seemed to be an exception in Aristotelian physics.

The oldest medieval commentaries on Aristotle's *Meteorology* stem from England, where this text was frequently transmitted into manuscripts containing Aristotle's treatises (and medieval commentaries on) *Physics*, *De caelo*, *De generatione et corruptione*, *De anima*, *Parva naturalia*, and some short pseudo-Aristotelian works belonging to the *corpus vetustius*, namely Costa ben Luca's *De differentia spiritus et anime*, and the pseudo-Aristotelian treatises *De mineralibus* and *De plantis*. The last two texts were translated from Arabic into Latin by Alfred of Sareshel, to whom we owe the first surviving commentary on Aristotle's *Meteorology*.[30] This commentary takes the form of glosses to particular passages. As far as the formation of hail is concerned, Alfred states that when the air is particularly hot, the cold is *chased* (fugatur) into the interior part of the cloud.[31] Alfred's terminology of flight and chase (fugare) would later be adopted by all the other commentators of the *translatio vetus*.

An important manuscript gathering all the texts mentioned above is kept at the Vatican Library under the signature Urb. lat. 206.[32] The text of the *translatio vetus* of Aristotle's *Meteorology* transmitted in this codex is accompanied, in the inferior margin, by Adam of Buckfeld's (ca. 1220-1294) literal commentary.[33] This commentator starts

[29] Aristoteles, *Meteorologica*, translatio vetus I, 7, 38,17-20: "Dico ergo quod aqua non congelatur nisi in loco in quo sunt nubes, et quia descendunt ex loco nubium tria corpora, quorum generatio et essentia est per frigus, scilicet aqua et nix et grando."

[30] James K. Otte, *Alfred of Sareshel's Commentary on the* Metheora *of Aristotle: Critical Edition, Introduction, and Notes* (Leiden, New York, Kobenhavn and Köln: Brill, 1988).

[31] Alfred of Sareshel, *Glose in Meteorologica*, 44, n. 42: "Accidit quoque cum vehemens inflammavit aerem caliditas, frigus ad nubis valde humide interiora vehementer fugari." The text of Otte's edition should be emended: instead of "fugari", Otte writes "frigari", a passive form of a quite rare verb, "frigare", attested as a seconday form of "frigerare" (to make cool) or "frigēre" (to be cold) in the *Dictionary of Medieval Latin from British Sources* (Oxford: Oxford University Press, 1975-2013), fasc. 4/5, 1009, col. b-c. I have also consulted the base manuscript used by Otte, namely ms. Durham, Chapter Library, C III 15, ff. 11v-18r, at f. 13ra, which clearly reads "fugari". The second manuscript transmitting this text, namely Oxford, Bodleian Library, Selden Supra 24, ff. 84r-109r (*in marg.*), at f. 89r (*marg. dext.*) also reads "fugari". The example of the wrong lecture "frigari" is by far not the only one in Otte's text: the necessity to correct and integrate it has recently been stressed by Henryk Anzulewicz and Philipp A.C. Anzulewicz, "Alfred von Sareshels Glossenkommentar zu den 'Meteorologica' des Aristoteles", *Przegląd Tomistyczny* 27 (2021): 7-60, esp. 18.

[32] Georges Lacombe [*et al.*], *Aristoteles Latinus, Pars posterior*, I (Bruges, Roma and Cambridge: Desclée de Brouwer, Libreria dello Stato and Cambridge University Press, 1955), 1204-1205.

[33] For information on this text and its manuscript tradition, see Olga Weijers, *Le travail intellectuel à la Faculté des arts de Paris: textes et maîtres (ca. 1200-1500)*, I. *Répertoire des noms commençant par A-B* (Turnhout: Brepols, 1994), 24-30, at 29; Charles Lohr, *Latin Aristotle Commentaries, I.1 Medieval Authors* A-L, 2 vols. (Firenze: Olschki, 2010-2013), vol. 1, 3-9, at 6. For easier identification of Adam's *Sententia*

with a close rendering of Aristotle's text. He explains that in hot seasons, the heat of the air surrounding the coldness of the vapor chases it into the interior part of the cloud, where it is strongly compressed, thus condensing the vapor and freezing it. Hail is the result of this process.[34] Then Adam provides a second explanation, according to which, when the vapor that constitutes the material cause of hail is hot enough, it is intensified by its contrary: the cold. This happens because the cold, perceiving its contrary, is reinforced and acts strongly against it, as if it were aimed at its conservation (*salus*) and at the destruction of its contrary. In this sense, we can say that hail is generated from humid vapor in a hot place, or from hot matter in a cold place.[35] Some

on Aristotle's *Meteorology*, I have transcribed the incipits and the explicits of each of its four books from ms. Roma, Biblioteca del Collegio di San Isidoro, I/10, which I was able to inspect personally: I, ff. 135ra-143rb: "*Postquam precessit etc*. Intentio est in hoc libro de corpore mobili contracto ad corpus mobile generabile et corruptibile compositum et generatum ex vapore ascendente ex terra et aqua et ad compositum generatum ex ventre terre. Cum enim subiectum totius naturalis philosophie sit corpus mobile ...X... non manent loca illorum fluminum in eadem dispositione, immo transmutantur a fertilitate in sterilitatem. Et sic terminatur primus liber secundum Alvredum"; II, ff. 143rb-147ra: "<U>*t iam complevimus*. Hic intendit de mari, et differt hec determinatio a determinatione predicta de mari, quia in parte precedenti determinatum est de mari in quantum est aqua ...X... et propter illam distantiam secundum eos habet illam tortuositatem. Et in hoc completur liber secundus"; III, ff. 147ra-151ra: "<Q>*uia ergo iam diximus ventos*. Postquam actum est in duobus libris precedentibus <de hiis> que fiunt in loco alto, non tamen ex vapore, de hiis autem impressionibus que primo et principaliter generantur ex vapore tam humido quam sicco ...X... hoc enim fit per irradiationem Solis in nube, adhuc hoc solum apparet de die; ista autem de nocte, etc. Et sic finitur sententia tertii libri Metheororum"; IV, ff. 151rb-161rb: "<Q>*uia ergo iam diximinus operatione*. In tribus libris precedentibus actum est sufficienter de hiis que generantur ex vapore ascendente terra. In isto quarto est intentio de hiis que generantur ex vapore incluso in ventre terre ...X... sciret ex omnibus facere aurum, et dicunt istam abstractionem per artificium esse possibilem. Et sic terminatur sententia totius libri Metheororum"; colophon: "Finitur sententia quarti libri Metheororum de Magistro A. de Bockfeld." The reference to Alfred of Sareshel we find at the end of book II is far for being the only one: Adam frequently refers to this commentator, as noticed by Otte, *Alfred's commentary on the Meteora*, 28.

[34] Adam of Buckfeld, *Sententia in Meteorologica*, ms. Città del Vaticano, BAV, Urb. lat. 206, f. 218rb, *marg. inf.*: "Dat causam propter quam in temporibus calidis fit grando, et est propter contrarietatem caliditatis ad frigiditatem. Propter hoc est <quod>, cum tempus fuerit calidum, calidum circumstans frigidum aeris in loco generationis grandinis fugat ipsum frigidum et facit ipsum comprimi vehementer in profundum nubis, qui quidem frigus ex vehementi fuga comprimit vaporem aqueum in profundo nubis repertum et congelat in grandinem."

[35] Adam of Buckfeld, *Sententia in Meteorologica*, ms. Città del Vaticano, BAV, Urb. lat. 206, f. 218rb, *marg. inf.*: "Vel posset dici quod, <cum> causa materialis grandinis elevatur, si fuerit multum calida, cum obviaverit suo contrario, quod est frigus, ipsum frigus ex perceptione sui contrarii vigoratur et fortiter agit in ipsum, ipsum vincendo, quare intendens salutem propriam et remotionem contrarii fugat et expellit calorem ab illa materia et excitatum a suo contrario vehementer comprimit ipsam in grandinem. Unde potest sic dici grandinem generari ex vapore humido prius existente in loco generationis grandinis, calidum [*ms.:* calido] temporis supervinciendo, vel ex materia calida elevata frigore loci ex suo contrario excitato vincente. Sic generatur grando in temporibus calidis. In temporibus autem frigidis non fit, ymo frigus aeris est sparsum per totum aera et non concurrit tantum in profundum nubis propter hoc quod non est ibi calor contrarius excitans ipsum ut

important concepts in Adam's explanation were to later establish themselves in medieval discussion on antiperistasis. The most important idea is that each entity, be it animated or inanimate matter, aims at its conservation ("intendit salutem propriam"). It is this tendency which leads the cold to escape the heat of the surrounding air and the heat of the air to push the cold and let it concentrate in the interior part of the cloud. The distinction between animated and inanimate matter seems moreover less rigid in a description that, like Adam's, employs the verb "intendere" to express the natural tendency to conservation, and which states that cold is reinforced by the *perception* of its contrary ("frigus ex perceptione sui contrarii vigoratur"). Adam's rendering of the process of antiperistasis seems to therefore attribute faculties of the animated world, such as perception and intentionality, to the elementary qualities, hot and cold. The semantic field of chase and flight ("fugare, fugari") somehow reinforces this impression. However, it should be noticed that the verb "intendere", when applied to inanimate bodies, simply indicates a natural tendency, inherent to the moving body.

This terminology can be found in a set of anonymous English questions on Aristotle's *Meteorology* stemming from the same period. Just like Adam's commentary in codex Urb. lat. 206, this text, contained in ms. Firenze, Biblioteca Nazionale Centrale, Conv. Sopp. G 3 464, ff. 28ra-41rb, is accompanied by commentaries on *De anima*, *De vegetabilibus*, *De mineralibus* and *Parva naturalia*.[36] A similar combination of texts can be found in another thirteenth-century manuscript of English origin, kept in an Italian library: Siena, Biblioteca comunale degli Intronati, L III 21. The commentary transmitted at ff. 196r-234v of this codex applies an important distinction of Aristotelian physics to the process of antiperistasis: the one between essential and accidental qualities. The anonymous commentator caracterizes the cold required to the formation of hail as accidental with respect to the heat of the air in the seasons when hail is generated.[37]

contrahatur vigorando se ad interiora nubis nec etiam ut excitetur ad fortiter agendum in materiam elevatam suum contrarium expellendo, propter quod tunc non generatur grando."

[36] Anonymus, *Scriptum super libros Meteororum*, Firenze, Biblioteca Nazionale Centrale, Conv. Sopp. G 3 464, ff. 28ra-41rb, at f. 31ra: "Grando magis generatur in locis calidis quam in frigidis, non tamen generatur in temporibus summe calidis, sed quibus admiscetur aliquid de frigiditate, ut calor fuget frigus et comprimat ipsum in locum unum. Per calorem enim fugatur frigus ad interiora nubis ut [*ms.*: et] comprimatur ibi et comprimat quod e<s>t de aqua in nube in grandinem, quod non fit in absentia caloris." For a description of this manuscript, see *Catalogo dei manoscritti filosofici nelle biblioteche italiane*, vol. 3, edited by G. C. Garfagnini, M. R. Pagnoni Sturlese, G. Pomaro and S. Zamponi (Firenze: Olschki, 1982), 68-70.

[37] Anonymus, *Questiones in Meteorologica*, ms. Siena, Biblioteca comunale degli Intronati, L III 21, An fuerit frigus in medio interstitio aeris potens congregare et congelare nubem, f. 214rb: "Contraria invicem approximata fortius agent, ideo, cum fugatur ista frigiditas per calorem exteriorem et excitatur per ipsum, fortius agent congelando vaporem ibi repertam in impressione, et ideo vult Aristoteles quod grando non generatur nisi in temporibus calidis et in locis similiter, quando scilicet est vehemens calidum potens fugare frigiditatem accidentalem aeris ad interius nubium." According to Giancarlo Fioravanti, this commentary can be dated between 1255 and 1270, as it

A copy of Adam of Buckfeld's commentary is transmitted in manuscript I/10 of the library of St. Isidore's College in Rome (ff. 58ra-79rb), a codex which contains several texts on natural philosophy and which has been copied by different English hands of the first half of the thirteenth century. At ff. 113ra-134v, this manuscript transmits a set of questions on Aristotle's *Meteorology* that should probably be ascribed to Roger Bacon.[38] This commentary addresses the process of antiperistasis in two questions devoted to hail. The first one concerns the season of generation of hail. Our commentator explains that the vapor in the clouds does not freeze in winter because, in this season, the cold is distributed homogeneously in the air; now the formation of hail requires a more intense cold than the other atmospheric phenomena, and should therefore take place when cold is less dispersed. This condition does not happen in winter, but in the intermediary seasons: spring and autumn.[39] The following question inquires about the efficient cause of hail, and particularly whether or not heat is necessary to the generation of this phenomenon. The starting point of this explanation is that when hot and cold happen to be in the same place, their action is mutually reinforced. In the generation of hail, this means that hot chases away ("fugat") cold, thereby reinforcing it. In this sense, hot can be considered as an accidental cause of hail, while cold is its essential cause.[40] The dichotomy essential/accidental that we have found in the Siena commentary is thus inverted. The reason is that in the commentary

mentions book XII of Aristotle's *Metaphysics* as XI (I.14, An elementa in suis speris sint continua an contigua: "Habent res duplicem ordinem, scilicet inter se et ad ipsum Primum, et primus ordo non est nisi propter secundum sicut in famulis vel in exercitu. Ab unitate autem istius ordinis ad ipsum Primum quod est unum et simplex dicitur universum esse unum. Hec verba Aristotilis in XI", f. 204ra, quoted in Giancarlo Fioravanti, "I *Meteorologica*, Alberto e oltre", *Cosmogonie e cosmologie nel Medioevo*, edited by C. Martello, Ch. Militello and A. Vella (Louvain-la-Neuve: Brepols, 2008): 68-76, at 68.

[38] On the attribution to Bacon, see Roger Bacon, *Questiones supra libros octo Physicorum Aristotelis* in *Opera hactenus inedita Rogeri Baconi*, edited by R. Steele and F. M. Delorme, 16 vol. (Oxford: Clarendon, 1909-1940), vol. 13 (1935), 31. The attribution of this commentary to Bacon is presented as doubtful in Weijers's and Lohr's inventories: *Le travail intellectuel à la Faculté des arts de Paris: textes et maîtres (ca. 1200-1500), VIII. Répertoire des noms commençant par R*, vol. 8, edited by O. Weijers and M. Calma (Turnhout: Brepols, 2010), 220-252, at 239; and Lohr, *Latin Aristotle Commentaries*, vol. 2, 141-145, at 144.

[39] Anonymus (Roger Bacon?), *Questiones super libros Meteororum*, ms. Roma, Collegio di San Isidoro, I/10, f. 120ra: "Maxima congelatio nubium non fit in yeme propter dispercionem frigoris per totum aerem, unde maius frigus exigitur ad grandinem quam ad aliquam aliam huiusmodi impressionem. Oportet ergo quod generetur in illo tempore in quo virtus frigoris magis unitur et minus dispergitur. Hoc autem est in vere et autumpno, non autem in yeme."

[40] Anonymus (Roger Bacon?), *Questiones super libros Meteororum*, ms. Roma, Collegio di San Isidoro, I/10, f. 120rb: "Dicendum quod, si calidum et frigidum sunt in eodem loco, per excellentiam unum semper distruit [*sic pro* destruit] alterum, si in diversis non. Sed utrumque veementius [*sic*] agit propter presentiam alterius, et sic est calor causa per accidens grandinis, quia fugit frigidum, et ad talem fugam sequitur veemens operatio frigi [*sic*]. Et per hoc patet ad secundum. Ad primum dicendum quod duplex est causa infrigidationis: causa per se et causa per accidens. Per se, ut frigus, per accidens, ut calor."

ascribed to Roger Bacon the focus is on the freezing process, for which hot can only be an accidental cause. As we will see, the notion of accident will be an important feature of scholastic discussions on the formation of hail and, more generally, on the process of antipersistasis, among the commentators of the *nova translatio*.

2b. The readers of the *nova translatio* and their dialogue with the physicians: from a deeper understanding of the Aristotelian theory to a new model of antiperistasis

With Wilhelm of Moerbeke's literal translations of the Greek Aristotelian originals and their Greek commentators, prepared between 1260 and 1270, a new term enriched the Latin philosophical thesaurus: *antiperistasis* (also frequently spelled *antiparistasis*), a transliteration from the Greek.[41] This term, absent in Latin classical texts, appears in Moerbeke's revisions of James of Venice's translations of the *Posterior Analytics*[42] and of the *Physics*,[43] in Moerbeke's translations of Aristotle's *Meteorology*[44] and the

[41] In order to contextualize Moerbeke's activity in the wider process of translating philosophical (and particularly Aristotelian) texts into Latin, see the useful overview provided by Valérie Cordonier, Peter De Leemans, and Carlos Steel, "Die Zusammenstellung des *corpus aristotelicum* und die Kommentartradition", in *Grundriss der Geschichte der Philosophie begründet von Friedrich Ueberweg. Völlig neu bearbeitete Ausgabe herausgegeben von Helmut Holzhey*, *Die Philosophie des Mittelalters*, Bd 4: 13. Jahrhundert, edited by A. Brungs, V. Murdoch and P. Schulthess (Basel: Schwabe, 2017), 149-161. The term "antiperístasis" is absent in Charles du Fresne Du Cange, *Glossarium Mediae et infimae latinitatis* (Paris: L. Favre, 1883-1887; reprint Graz: Akademische Druck-U. Verlagsanstalt, 1954), vol. 1, and in the *Mittellateinisches Wörterbuch*. The *Dictionnary of Medieval Latin from British Sources*, contains an entry in which the term is spelled *antiperistasis* (fasc I, 95), although in the text it quotes it is spelled *antiparistasis*. This process is described as an "interchange" and a "reciprocal replacement", a definition that corresponds to the treatment of this concept in in Aristotle's *Physics*, despite the fact that both texts quoted to exemplify this process refer to the intensification caused by the contrary quality, namely the process Aristotle describes in *Meteorology*. More complete and precise information is contained in the *Lexicon Latinitatis Nederlandicae Medii Aevi*, edited by J. W. Fuchs † and O. Weijers, vol. 1 (Leiden: Brill, 1977), 269-270, which mentions many concurrent spellings (*antiparastasis*; *-istasis*; - *istesis*; *-istisis*; *antipharistasis*) and provides examples for both meanings: the one of *Physics* and the one of *Meteorology*. The latter is treated in more detail, which correctly accounts for a larger use of this meaning by medieval authors. The plurality of medieval spellings is also attested in the *Latinitatis medii aevi Lexicon Bohemorum*, vol. 1, edited by L. Varcl and J. Martínek (Pragae: Academia, 1987), 202, which however mentions only the sense of this term used in *Meteorology*, namely the fortification by the contrary quality.

[42] Aristoteles, *Analytica posteriora. Translationes Iacobi, Anonymi sive 'Ioannis', Gerardi et Recensio Guillelmi de Moerbeka*, edited by L. Minio-Paluello and B. G. Dod (Bruges and Paris: Desclée De Brouwer, 1968), II, 15, 98a24, 338, 23.

[43] Aristoteles, *Physica*, *Recensio Guillelmi de Morbeka*, IV, 8, 215a14, 215a 14, AL VII.3 (Aristoteles Latinus database, third release), 18, 46.

[44] Aristoteles, *Meteorologica*, translatio nova, 347b6 (29,566); 348b3 (32,632); 348b6 (32,635); 348b16 (32,644); 349a8 (33,666); 360b25 (61,458-9). The form I encountered the most in medieval commentators on Aristotle's *Meteorology* is *antiparistasis*, spelled with *a*. Vuillemin Diem's edition of

corresponding commentary by Alexander of Aphrodisias,[45] as well as in Moerbeke's translation of Simplicius's Commentary on Aristotle's *De caelo*.[46] The introduction of a new, polysemantic term did not come without some confusion, particularly in the first generations of commentators. For instance, the Cistercian friar Humbert from Preuilly seems to mix the two senses of Aristotle's antiperistasis in his commentary on the *Metaphysics*, where he refers to the eighth book of Aristotle's *Physics* for the principle according to which fire cools down by accident, namely "because of a certain antiperistasis".[47] Now we have seen that the antiperistatic process described in Aristotle's *Physics* applies to the dynamics of fluids, and not to the action of contrary qualities.

This action was explored in great depth by the commentators of the Greek-Latin translation of Aristotle's *Meteorology*, who continued and deepened the exegetical effort of their predecessors.[48] Their aim was to elaborate a consistent explanation of the

Moerebeke's Greek-Latin translation of Aristotle's *Meteorology* adopts instead the reading *antiperistasis*, spelled with *e* (Index graeco-latinus, 155a). The apparatus however mentions the concurrent form *antiparistasis*. It is indeed very difficult for an editor of scholastic texts who does not follow an autograph or a base text to make a decision regarding this point, as the scribes are often inconsistent in the spelling of this transliteration from the Greek. Moreover, the prefixes *per* and *par* have sometimes the same appearence in the Gothic system of abbreviations, namely a *p* with a horizontal stroke intersecting its leg.

[45] Alexander Aphrodisiensis, *Commentarium in Meteorologica*, recensio Guillemi de Moerbeka, in *Commentaire sur les Météores d'Aristote. Traduction de Guillaume de Mœrbeke*, edited by A. J. Smet (Leuven and Paris: Publications Universitaires de Louvain and Éditions Béatrice-Nauwelaerts, 1968), I, 10 (75, 57; 76, 68-69), 11 (81, 69-70); 12 (83, 17; 84, 53); II, 4 (145, 75; 146, 90); II, 8 (192, 67).

[46] Simplicius, *Commentarium in De caelo*, in *Commentaire sur le Traité du ciel d'Aristote. Traduction de Guillaume de Mœrbeke*, vol. 1, edited by F. Bossier † (Leuven: Leuven University Press, 2004), I, 3 (102,78; 103,23; 215,26; 372,51).

[47] Humbertus de Prulliaco, Sententia super librum Metaphisice Aristotelis. Liber I-V, edited by M. Brînzei and N. Wicki † (Turnhout: Brepols, 2013), lib. 5, lect. 3, 487, 317: "Primo dividit causam penes per se et per accidens, sicut ignis per se calefacit, per accidens autem frigefacit, scilicet per quandam antiperistasim, ut dicitur in VIII Phisicorum." The variant apparatus does not mention alternative spellings for the form "antiperistasim". "Primo dividit causam penes per se et per accidens, sicut ignis per se calefacit, per accidens autem frigefacit, scilicet per quandam antiperistasim, ut dicitur in VIII *Phisicorum.*" The variant apparatus does not mention alternative spellings for the form "antiperistasim".

[48] In this paper I will limit myself to the Latin commentary tradition, without addressing the vernacular translations of Aristotle's *Meteorology*. It should however be noticed that the process of antiperistasis stimulated interesting developments also in this vernaculare literature, as stressed by Joëlle Ducos, who pointed out that the Norman philosopher Mahieu le Vilain, author of a French reworking of the Aristotelian text, mentions many possible applications of this principle. According to Mahieu le Vilain, antiperistasis allows to explain why plants happen to burn due to intense cold, why fricating the fingers in winter further cools them, and even why a corpse bleeds when it is placed close to its murderer. See Joëlle Ducos, "Progrès scientifique et autorité: l'exemple de la météorologie médiévale au XIII^{e} siècle", in *Progrès, réaction, décadence dans l'Occident médiéval*, edited by E. Baumgartner and L. Harf-Lancner (Genève: Librairie Droz, 2003), 184-197, at 191. The passage

Aristotelian theory of antiperistasis as action on contrary qualities which could be reconciled with experience. A first difficulty, of exclusively exegetical nature, was the discordance between the two available translations of Aristotle's *Meteorology*, particularly concerning the place of generation of hail. As we have seen, according to the Greek text, hail is generated in the lowest part of the atmosphere, close to the Earth's surface, while reading the Arabic-Latin translation it seems that hail comes from the upper part of the atmosphere. Now, this is not a minor detail, as it may appear at first glance, because the place of generation of hail clearly affects its process of generation, and therefore the theory used to explain this phenomenon. The commentators of the *nova translatio*, which literally followed the Greek text, should therefore reconcile the two versions of the Aristotelian treatise, as well as the authority of the exegetical tradition related to them. This is the reason why Radulphus Brito ascribed the theory according to which hail is generated in the region of the clouds to the old translation and to Albert the Great, who commented on it, and the idea that it is generated close to the Earth's surface to the new translation.[49] Brito holds that both explanations are correct: hail is generated in the region of the clouds because of cold, and close to the Earth's surface because of antiperistasis. The second process requires hot temperatures, which cause the cold in the clouds to concentrate and intensify.[50] This conciliatory solution will be generally adopted by the commentators of the *nova translatio*, interested in finding exegetical solutions that would not invalidate the authority of one of the translations – and of the interpretative tradition – of the Aristotelian text.[51] The notion of accident will help the commentators achieve this

on antiperistasis can be found in Mahieu le Vilain, *Les metheores d'Aristote*, traduction du XIII[e] siècle, edited by R. Edgren (Uppsala, Dissertation Thesis, 1945), 55-56.

[49] Radulphus Brito, *Questiones in Meteorologica* I, 39 *Utrum grando generetur in loco nubium propinquiori vel remotiori*, ed. A. Panyzica, in preparation: "Albertus autem et Philosophus secundum antiquam translationem videntur velle quod locus medius aeris sit locum generationis grandinis. Verumptamen Philosophus in nova translatione videtur sentire contrarium, unde secundum novam translationem hic Philosophus videtur dicere quod grando generatur in loco nubium propinquo terre."

[50] Radulphus Brito, *Questiones in Meteorologica* I, 39 *Utrum grando generetur in loco nubium propinquiori vel remotiori,* ed. A. Panzica in preparation: "Unde propter hoc duo dico. Primo, quod grando potest generari in medio interstitii; etiam secundo, quod potest generari in loco propinquo terre. Primum patet, quia ibi potest grando generari ubi est materia et efficiens grandinis; sed in loco medio aeris possibile est reperiri materia et efficiens grandinis, quod est frigidum congelans, eo quod ille locus est eccellenter frigidus, et etiam cum vapor qui est materia grandinis possit elevari usque ad illum locum et ideo ibi potest converti in aquam et cito etiam in grandinem congelari. Dico autem secundo quod grando potest congelari in loco aeris propinquo prope terram, quia cum aliquando nubes frigida, si incidit circa terram, maxime in tempore calido, propter antiperistasim comprimitur et fortificatur frigiditas in ipsa, et tunc ab illa frigiditate intensa partes nubis possunt congelari. Et sic patet quare in loco nubis propinquo terre potest grando congelari, quia ibi potest esse causa efficiens et materia grandinis, ut ostensum est, et grando sic generata habet fieri in vere et autumno magis quam aliis temporibus."

[51] The case of the Milky Way represents a serious defeat to this attitude. According to the Arabic-Latin translation, this phenomenon results from the light of a group of stars, and belongs therefore

conciliation by weakening the assertive force of the commented text and give nuance to their own explanation. This notion allowed, moreover, some flexibility. While, according to Albert the Great, the proper place for the generation of hail – that is, the place where hail is generated most of the time – is the region of clouds, the commentators of the *nova translatio* hold on the contrary that hail is generated more frequently in the lowest part of the atmosphere and only rarely and accidentally in the region of clouds.[52]

But let us return to Brito's explanation. As far as action on contrary qualities is concerned, he first remarks that the same cause cannot produce contrary effects. Cold causes cold, but not cold *and* hot. In the ordinary course of nature, a quality cannot in itself (*per se*) reinforce the contrary one. This happens only by accident, due to some circumstances that interfere with the ordinary interactions between the qualities.[53] This remark clearly qualifies the antiperistatic action as an accidental one: the intensification by the contrary quality is the exception, and not the rule.

Brito explains that two conditions are required for a quality A to strengthen the opposite quality B: first, A should not be much stronger than B, otherwise A would destroy B. Secondly, A must surround B, otherwise B would just be pushed away from

to the celestial sphere; on the contrary, according to the new translation – and to the original Greek text – the Milky Way is located in the terrestrial region and is caused by the inflammation of the dry exhalation. None of the commentators I have consulted aims at – or even tries to – combine these opposite explanations.

[52] Albertus Magnus, *Meteora*, lib. II, tract. 1, ch. 24, edited by P. Hossfeld (Münster in Westfalien: Aschendorff, 2003), 59,42-59. As an example of the attitude of the commentators of the *nova translatio*, see Nicole Oresme, *Questiones in Meteorologica de prima lectura* I, 27, edited by A. Panzica (Leiden and Boston: Brill, forthcoming): "Probatur primo quia non fit in montibus multum altis, ut patet in littera nove translationis, et ideo signum est quod magis basse generatur quam nix et pluvia, que inveniuntur in illis montibus et fiunt in media regione. Secundo patet alio signo, quia aliquando in nube ex qua venit grando auditur sonus terribilis, et ideo signum est quod illa nubes non est nimis longe nec alte. Tertio, sepe fit grando figure cornute, et non rotunde; modo, si veniret a multum alto, tunc isti anguli et coni destruerentur et ex confricatione cum aere esset quasi rotunda. Quantum ad primum, duplex est opinio. Una est moderna, que ponitur in nova translatione, quod grando generatur satis prope, sub media regione et in loco calido (...). Alia est opinio que videtur trahi ex antiqua translatione, quam ponit Albertus, quod duo sunt loca generationis grandinis; unde quandoque et ut in pluribus generatur bene sursum in media regione, et hoc est sibi essentiale (...). Comparando ista ad invicem, dicendum est quod ut in pluribus grando basse generatur propter signa prius dicta. Etiam aliquando homines de montibus altis videbant sub se nubem ex qua veniebat grando."

[53] Radulphus Brito, *Questiones in Meteorologica* I, 38, ed. A. Panzica, in preparation: "Dico duo. Primo, quod unum contrarium non habet per se fortificare alterum, quia idem non potest esse causa per se contrariorum (...) Secundo dico quod unum contrarium fortificat alterum per accidens." See Radulphus Brito, *Questiones super Analytica Priora*, II, 5, edited by G. A. Wilson (Leuven: Leuven University Press, 2016), 461,40: "Ad aliam, cum dicitur 'oppositum non est causa sui oppositi', verum est per se, sed per accidens bene potest esse causa sicut frigidum additum calido per antiperistasim est causa fortitudinis suae."

A and would move towards the opposite direction, thus escaping A.[54] These two requisites for the process of antiperistasis – a certain balance in the intensity of the contrary qualities, and a particular position they should occupy in order for one to reinforce the other – are clearly stated in other Parisian commentaries on Aristotle's *Meteorology* from the third quarter of the thirteenth century, namely the *Questions* transmitted in ms. Paris, Bibliothèque Nationale de France, latin 14698, ff. 62va-82vb and the *Questions* transmitted in ms. Paris, Bibliothèque Mazarine, 3493, ff. 143ra-190rb, both of them anonymous.[55] The latter commentary further clarifies a notion only implied in the other two texts, namely the concept of resistance: the surrounding quality should not be much stronger than the surrounded one in order to allow the latter to exert some resistance. Antiperistasis is the result of this resistance.

In order to explain how a quality reinforces the contrary one, Brito and his Parisian colleagues adopt the physical model of the multiplication of species, according to which each entity acts through the emission of virtual rays (species), which propagate in the medium and produce different effects according to the nature of the receiving object. The commentators explain that as these rays encounter an obstacle, they are reflected towards the body which emitted them and, therefore, are concentrated and strengthened. The intensification results from the fact that the reflected force is added to the one newly produced by the agent. According to the commentators, this principle explains the overheating of ovens and chimneys, where the flame of the fire encounters an obstacle and is pushed back.[56]

[54] Radulphus Brito, *Questiones in Meteorologica* I, 38 38, ed. A. Panzica, in preparation: "Ad cuius evidentiam sciendum quod ad hoc quod unum contrarium fortificet alterum duo requiruntur. Primum est quod unum contrarium non multum excellat alterum, quia tunc corrumperet ipsum, et per consequens non fortificaret. Secundum est quod unum illorum circumdet alterum, quia si unum non circumdaret alterum, tunc prius compelleret ipsum quam fortificaret."

[55] Anonymus, *Questiones in Meteorologica*, ms. Paris, Bibliothèque Nationale de France, latin 14698, I, 48, f. 78va: "Primo requiritur quod istud contrarium quod fortificatur non sit ita debile quod statim a contrario corrumpatur; secundo requiritur quod illud contrarium sit inclusum, ita quod contrarium ad ipsum non posset undique attingere. Istis duobus concurrentibus, contingit quod contrarium fortificat suum contrarium, et hoc per hanc viam, quia contrarium circumstans sic suum contrarium ipsum adiuvat et non permittit ipsum dispergi"; Anonymus, *Questiones in Meteorologica*, ms. Paris, Bibliothèque Mazarine, 3493, f. 159rb: "Dico tunc quod per accidens unum contarium fortificat reliquum; tamen due condiciones requiruntur ad hoc. Prima est quod contrarium quod debet confortari non <sit> nimis [*ms.*: minus] debile, ita quod aliqualiter possit resistere. Secunda est quod includatur totaliter in alio, ita quod nullo modo possit exire. For information on the manuscript transmission, dating and content of these two commentaries, see the Appendix in Panzica, *De la Lune à la Terre*, forthcoming. A critical edition of the anonymous commentary transmitted in ms. Paris, BnF, latin 14698 is in preparation by Iacopo Costa.

[56] Radulphus Brito, *Questiones in Meteorologica* I, 38, ed. A. Panzica, in preparation: "Unum contrarium circumdatum ab alio reflectitur super se ipsum, sicut nos videmus de igne si sit in fornace vel in aliquo concavo quod per reflexionem flamme et caloris corroboratur et fortificatur, et sic est in contrario quod, si unum si unum circumdat alterum et obstruatur ab ipso, tunc reflectitur supra se ipsum, et per consequens fortificatur et colliditur in se"; Anonymus, *Questiones*

This explanation of the process of antiperistasis would later be adopted by most of the fourteenth and fifteenth-century commentators on Aristotle's *Meteorology*. The analysis of John Buridan and Nicole Oresme, both active at the Paris Arts Faculty, would serve as a reference for many other later commentators. Buridan further develops the concept of balance between the two acting qualities and resistance opposed by the surrounded quality. He distinguishes between two kinds of contraries: a penetrating (*penetrans*) quality is much stronger than the surrounded one, and therefore destroys it, while a surrounding (*circumdans*) quality does not corrupt the contrary quality, but fortifies it by concentration: this is known as antiperistasis. This process, as Buridan explains, happens especially in the body of men and animals. When the exterior cold is intense (*penetrans*) and the natural heat of the body cannot escape it or oppose enough resistance, the latter is weakened and destroyed. On the contrary, if the coldness of the air is moderate and the interior natural heat is stronger, the latter can resist the cold and, in this process, get reinforced.[57] This happens because, in winter, the coldness of the air closes the pores on the surface of the skin; as a consequence, the vital warmth, which cannot exit throughout the skin, is reinforced within the body.[58] The application

in Meteorologica, ms. Paris, Bibliothèque Nationale de France, latin 14698, f. 78va: "Istis duobus concurrentibus, contingit quod contrarium fortificat suum contrarium, et hoc per hanc viam, quia contrarium circumstans sic suum contrarium ipsum adiuvat et non permittit ipsum dispergi. Unde etiam simile est <quando> nos videmus quod ignis in camino, quia non potest agere ad oppositum, reflectitur ad aliam partem et in se ipsum, propter quod ille ignis calidior est quam si non haberet obstaculum"; Anonymus, *Questiones in Meteorologica*, ms. Paris, Bibliothèque Mazarine, 3493, f. 159rb: "Contrarium sic inclusum nititur penetrare frigidum aliquando, et ideo reducitur in se ipsum et fortificatur. Sic maxime patet de igne in camino vel in furno; quare, etc."; Sigerus de Brabantia (?), *Questiones in Meteorologica*, ms. München, Bayerische Staatsbibliothek, Clm 9559, f. 61rb: "Intelligendum autem quod unum contrarium per se non fortificat alterum (...). Per accidens tamen contingit. Omnis enim forma naturalis generativa est sui ipsius in materia susceptiva ipsius. Forme enim, secundum quod forma, est agere; et ideo, cum non agat nisi per suam virtutem, necesse est quod in illud in quod agit diffundat virtutem eius. Quando ergo contingit quod repellatur, tunc virtus eius refrangitur in subiectum suum, ita quod ista virtus que extendebatur in aliud, refrangitur in ipsam, sicut est videre in motu proiectionis. Cum enim aliquid proicitur usque ad aliquod obstaculum, refrangitur, et ita contingit esse in alteratione luminis et refractione radiorum. Et ideo, cum aliquid agit in aliud et contingat quod virtus eius repellatur ab alio, tunc refrangitur in se ipsam et fortificatur. Sic autem est cum unum contrarium approximatur alteri contrario." On the ascription of this anonymous commentary to Siger of Brabant, see the Appendix in Panzica, *De la Lune à la Terre*, forthcoming.

[57] Iohannes Buridanus, *Questiones in Meteorologica* I, 7, edited by S. Bages, in *Les Questiones super tres libros Metheororum Aristotelis de Jean Buridan: étude suivie de l'édition du livre I*, 2 vols. (Thèse de Doctorat de l'École des Chartes, 1986), vol. 2, 111: "Et de hoc ponunt medici aliqui quamdam distinctionem rationabilem, scilicet quod aliquando est contrarium circumdans non penetrans, et aliquando, ex nimia eius fortitudine, est penetrans, vel etiam ex debili resistentia passivi. Dicunt ergo quod in nobis et animalibus frigidum circumdans non penetrans debilitat ipsum vel corrumpit."

[58] Iohannes Buridanus, *Questiones in Meteorologica* I, 7, vol. 2, 112: "sed tunc dicitur non penetrans si non obtineat sed fortificatur interius quia spiritus calidi a corde missi ad singula membra non multum possunt exalari nec exire, tum quia pori exteriores sunt magis clausi, tum quia frigus

of the process of antiperistasis to organic matter is particularly evident in Blasius of Parma's commentary. Referring to Aristotle's *Politics*, Blasius asks why men born in cold places are more courageous than men born in warm places. He explains that at the moment of their generation, the vital warmth of men born in cold places is compressed in the innermost part of the body in order not to be destroyed by the cold air. This compression determines the intensification of the vital warmth and, as a consequence, the strengthening of the natural complexion of these men, who become more courageous than others. In warm places, on the contrary, the similarity of temperature between the air and the inside of the body spreads the vital warmth throughout the whole body and often dissolves it. That is the reason why these men have a weak natural complexion and are fainthearted.[59]

Buridan, just like many other medieval commentators on Aristotle's *Meteorology*, ascribes this explanation of the process of antiperistasis to some physicians (*medici*). Buridan does not justify his assertion, for which I therefore tried to provide some historical and doctrinal foundation. A preliminary analysis led me to find a possible answer in the medieval Hippocratic tradition.[60] In fact, in the first book of Hippocrates's *Aphorisms*, we read that in winter and in spring, the belly is naturally warmer, and that

obvians et circumdans repellit eos ad interiora. Et hec dicta quodam speciali modo pertinent ad corpora humana vel animalium, de quibus etiam medici magis in speciali considerant."

[59] Blasius de Parma, *Questiones in Meteorologica* I, 5, ms. Città del Vaticano, Biblioteca Apostolica Vaticana, Vat. lat. 2160, f. 72ra: "Et iuxta hoc Philosophus, libro *Politicorum*, proponit tale problemata: propter quid est quod homines generati in locis frigidis sunt animosiores hominibus generatis in locis calidis? Ratio est una et eadem. Primo, quia in nativitate istorum propter frigiditatem aeris calor naturalis ad intra revocatur, per quam revocationem multum fortiter intenditur. Et ad eius intensionem fortificatur naturalis complexio ipsorum et habitudo ipsorum, et fiunt magis animosiores aliis, quia in aliis, propter similitudinem continentis, calor naturalis expanditur per totum corpus et sepe dissolvitur, et tales fiunt pusilanimes et debiliores complexionis." On Blasius of Parma's *problemata*, to which this extract from his *Questions on Meteorology* belongs, see the footnote in Graziella Federici-Vescovini, *Astrologia e scienza. La crisi dell'aristotelismo sul cadere del Trecento e Biagio Pelacani da Parma* (Firenze: Vallechi, 1979), 48-49, which is only concerned with the appearance of *problemata* in Blasius's *Questions on the Physics*, leaving aside the *Questions on Meteorology*. Research on Blasius's *problemata* is in preparation by Sabine Rommevaux and Aurora Panzica. On the scholastic academic practice of problemata, see Alfonso Maierù, *University Training in Medieval Europe* (Leiden: Brill, 1993), 130-131; Olga Weijers "*Problema*. Une enquête", in *Etudes sur la Faculté des arts dans les universités médiévales* (Turnhout: Brepols, 2011), 58-76.

[60] A first, highly incomplete inventory of Greek and Latin manuscripts transmitting medical texts was compiled by Hermann Alexander Diels, *Die Handschriften der antiken Ärzte. I. Hippokrates und Galenos. II. Die übrigen griechischen Ärzte. III. Nachtrag* (Leipzig: Abhandlungen der Preußischen Akad. der Wiss., philosophisch-historische Klasse, 1905-1907; reprint Leipzig-Amsterdam: Zentralantiquariat der Deutschen Demokratischen Republik Hakkert, 1970). Corrections and additions were published by Richard Jasper Durling, "Corrigenda and Addenda to Diels' Galenica. I. Codices Vaticani", *Traditio* 23 (1967): 461-476; "Corrigenda and Addenda to Diels' Galenica. II. Codices Miscellanei", *Traditio* 37 (1981): 373-81, and Stefania Fortuna and Anna Maria Raia, "Corrigenda and Addenda to Diels' Galenica by Richard J. Durling. III. Manuscripts and Editions", *Traditio* 61 (2006): 1-30.

the innate heat is more abundant than in the other seasons.[61] In his commentary on the *Aphorisms*, Galen of Pergamum (129-216 AD) explains this phenomenon by the process of antiperistasis. While the term antiperistasis does not appear in Galen's text, the description he provides clearly corresponds to the one in Aristotle's *Meteorology*, to which Galen explicitly refers.[62]

Galen's commentary was translated from Ḥunayn Ibn Isḥāq's Arabic version into Latin by Constantinus Africanus († 1093). This translation had a wide dissemination in the Salernitan milieu and was included in a medicine handbook compiled in the twelfth century at the Salernitan School and soon adopted in other European universities, the *Ars parva* or *Articella*, as it was called in incunabula printings.[63] Soon, Constantinus's translation was no longer the only one available to the Latin public. Burgundius of Pisa (c. 1110-1193) translated the first four books from Greek into Latin, based on a lost

[61] *Œuvres complètes d'Hippocrate*, 10 vols., edited by É. Littré (Paris: Baillière, 1839-1861), vol. 4, 466-467. A modern critical edition of this aphorism can be found in *Hippocrates, Histoire du texte et édition critique, traduite et commentée, des Aphorismes d'Hippocrate, I–III*, edited by C. Magdelaine, Thèse pour le Doctorat Nouveau Régime, soutenue à l'Université de Paris Sorbonne, Paris 1994.

[62] No critical edition of Galen's commentary on Hippocrates's *Aphorisms* is available yet. Christina Savino prepared the critical edition of book VI: Galeno, *Commento agli Aforismi di Ippocrate. Libro VI*, edited by Ch. Savino (Berlin: De Gruyter, 2020). For the remaining books, we still have to refer to Galen's *Opera omnia* published in the ninenteenth century: *Claudii Galeni Opera omnia*, 20 vols., edited by C. Gottlob Kühn (Leipzig: K. Knobloch, 1821-1833), vol. 17, *In Hippocratis Aphorismos commentarius* I, 15, 415-425, at 416: "Sed cur is calor hieme augeatur etiam Aristoteles explicuit, quia in profundum extrinsecus circumstante frigore refugiat, quemadmodum contra aestate ad congenerem calorem externum protenditur. Atque ita contingit discuti quidem ac dissipari ejus substantiam per aestatem; contineri vero et coërceri ac in profundum secedere per hiemem." The Latin text published by Kühn is drawn from the Greek-Latin edition of Hippocrates and Galen's works by the French physician René Chartier (Paris, 1679, 13 vols.), who in turn relies, for the *Aphorisms* (vol. 9), on the edition by the Humanist physician Nicolò Leoniceno (1428-1524). On the Latin sources of Chartier see, Stefania Fortuna, "René Chartier e le edizioni latine di Galeno", in *René Chartier, 1572-1654: éditeur et traducteur d'Hippocrate et Galien. Actes du colloque international de Paris, 7 et 8 octobre 2010*, edited by V. Boudon-Millot, G. Cobolet, and J. Jouanna (Paris: De Boccard, 2012), 303-324. The Appendix (317-324) presents a list of Chartier's Latin sources, particular relevant to our purpose because Kühn reproduced Chartier's text.

[63] On the constitution of this corpus see Paul Oskar Kristeller, "The School of Salerno: Its Development and Its Contribution to the History of Learning", *Bulletin of the History of Medicine* 17 (1945): 138-194 and Tiziana Presenti, "Arti e medicina: la formazione del curriculum medico", in *Luoghi e metodi di insegnamento nell'Italia Medioevale (secoli XII-XIV). Atti del Convegno Internazionale di studi Lecce-Otranto 6-8 ottobre 1986*, edited by L. Gargan and O. Limone (Galatina: Congedo Editore, 1989), 153-178. A chronological list of medieval commentaries on the *Articella* has been established by Paul Oskar Kristeller, "Bartholomaeus, Musandinus and Maurus of Salerno and Other Early Commentators of the *Articella*, with a Tentative List of Texts and Manuscripts, *Italia medioevale e umanistica* 19 (1976): 57-87; Italian translation, with corrections and additions: Paul Oskar Kristeller, *Studi sulla scuola medica salernitana* (Napoli: Istituto italiano per gli studi filosofici, 1986), 97-151. On the *Articella* see also Faith Wallis, "The *Articella* commentaries of Bartholomaeus of Salerno", in *La scuola medica salernitana. Gli autori e i testi*, edited by D. Jacquart and A. Paravicini Bagliani (Firenze: Sismel – Edizioni del Galluzzo, 2007), 125-164, and the bibliography listed there.

Greek manuscript; his translation was completed by Niccolò da Regio (1280-1350), a Greek physician active at the Salernitan school.[64] By means of this tradition, Galen's "Aristotelian" interpretation of Hippocrates's aphorism I,15 established itself among scholastic masters. The *Aphorisms*, which was in fact the most widespread Hippocratic writing, was included, together with Galen's commentary, in the curricula of the faculties of medicine.[65]

A systematical examination of the commentary tradition on Hippocrates's *Aphorisms* I, 15 clearly lies beyond the scope of this study. A first, selective survey can, however, give us a glimpse at the main lines of development of the medieval commentary tradition on *Aphorisms* I, 15 and his connection with the first book of Aristotle's *Meteorology*, in order to understand why Buridan and his colleagues refer to the physicians dealing with antipersitasis.

Maurus of Salerno (ca. 1130-1214), whose commentary on the *Aphorisms* precedes the assimilation of Aristotle's *Meteorology* in the Latin West, begins his exegesis of I, 15 with a terminological clarification. He explains that the Ancients divided the interior organs in two sections: the first one, comprised between the chest and the genitals, was called belly (*venter*). This part was in turn divided into two parts: the upper one, situated above the diaphragm, was called spiritual (*spiritualia*); the lower one, beneath it, was called nutritive (*nutritiva*). This latter part is meant by Hippocrates in *Aphorisms* I, 15. Maurus explains that, in winter, this part of the body is warmer than in summer because the coldness of the air closes the pores at the surface of the skin, thus preventing the vital warmth to exit the body. The spirits and the vital warmth are therefore multiplied inside the body.[66]

[64] On Burgundius, see Peter Classen, *Burgundio von Pisa, Richter, Gesandter, Übersetzer* (Heidelberg: C. Winter Universitätsverlag, 1974). On Niccolò da Regio's translations see Lynn Thorndike, "Translations of Works of Galen from the Greek by Niccolò da Reggio (c. 1308-1345)", *Byzantina Metabyzantina* 1 (1946): 213-235, and Roberto Weiss, "The Translators from the Greek of the Angevin court of Naples", *Rinascimento* 1 (1950): 195-226, esp. 216-225.

[65] An inventory of medieval Latin manuscripts transmitting Hippocrates's and Galen's works and commentaries on them was compiled by Pearl Kibre under the title "Hippocrates latinus. Repertorium of Hippocratic Writings in the Latin Middle Ages", and was published in a series of issues of *Traditio* 31 (1975): 99-126; 32 (1976): 257-292; 33 (1977): 253-295; 34 (1978): 371-412. A revised version was published in 1985 (New York: Fordham University Press). My quotations are from the original version. On the early medieval dissemination of Hippocrates's *Aphorisms* and on an early medieval commentary on it, see Pearl Kibre, "Hippocratic Writings in the Middle Ages", *Bulletin of the History of Medicine* 18 (1945): 371-412; Augusto Beccaria, "Sulle trace di un antico canone latino di Ippocrate e di Galeno", *Italia Medioevale e umanistica* 2 (1959): 1-56; 4 (1961): 1-75; 14 (1971): 1-23; Kibre, "Hippocrates Latinus II", 259-260, 262-268.

[66] Maurus Salernitanus, *Commentarium de Articella*, *In Aphorismos*, in *Collectio Salernitana ossia Documenti inediti e trattati di medicina appartenenti alla Scuola medica salernitana*, 5 vols., edited by S. De Renzi, vol. 4 (Napoli: Tipografia del Filiatre-Sebezio, 1856), 532. I have added some punctuation in the nineteenth-century edition, which I have also corrected with three thirteenth-century manuscripts: Paris, Bibliothèque Nationale de France, lat. 18499, f. 62ra-b (*P1*), and, secondarily, lat.

The closure of the pores at the surface of the skin as a cause of the strengthening of the vital warmth in winter, is also invoked in the commentary by master Cardinalis, active at the University of Montpellier around 1240.[67] Our master accompanies this practical consideration to the theoretical principle according to which a given quality is stronger when it is united than when it is dispersed.[68] This principle, which is mentioned in the neoplatonic *Liber de causis* and included in the florilegium of the

6956, f. 77va-b (*P2*) and Città del Vaticano, Biblioteca Apostolica Vaticana, Vat. lat. 4477, f. 5rb (*V*): "Sciendum vero quod antiqui membrorum interiorum [membrorum interiorum *om. ed*.] dispositionem humani corporis perscrutantes eam in duo diviserunt; unam a furcula pectoris inferius usque ad genitalia, et eam ventrem vocaverunt. Ipsumque in duas partes diviserunt: unam a diafragmate superius, et eam spiritualia vocaverunt [a diafragmate superius, et eam spiritualia vocaverunt aliam *om. ed*.]; aliam a diafragmate inferius et eam nutritivam nuncupaverunt. Et per ventrem hic intelligimus regionem continentem nutritivam et ideo potius discit de ventre tanquam de centro totius corporis. Frigidi igitur [*ed.*: nam] aeris inspiratione pori diafragmatis cohartantur [*ed.*: cohartantis] et constringuntur, quare calor naturalis et spiritus per poros ipsius nequeunt evaporare, frigiditate etiam [*ed.*: et sic per frigidi !] ipsius aeris continentis pori corporis superficiales constringuntur [*ed.*: constringentur], unde per poros constrictos calor et spiritus evaporare non possunt. Retenti ergo in nutritiva multiplicantur, et quia ver in maiori parte immitatur natura hyemis, in frigiditate scilicet ratione predicta caloris et spirituum multiplicatio fit in nutritivis." On Maurus of Salerno's life, works and influence, see Morris Harold Saffron, *Maurus of Salerno. Twelfth-century Optimus Physicus. With his Commentary on the Prognostics of Hippocrates* (Philadelphia: Transactions of the American Philosophical Society, 1972), 5-140, at 5-17. On the twelfth-century dissemination of the Aristotelian writings in Salerno, see Danielle Jacquart, "Aristotelian Thought in Salerno", in *A History of Twelfth-Century Western Philosophy*, edited by P. Dronke (Cambridge, New York, New Rochelle, Melbourne and Sydney: Cambridge University Press, 1988), 407-428, who updates the hypotheses on the relationships between medical and philosophical thought presented by Alexander Birkenmajer, "Le rôle joué par les médecins et les naturalistes dans la réception d'Aristote au XII^{e} et XIII^{e} siècle", in *La Pologne au VI^{e} Congrès International des Sciences Historiques*, Oslo 1928 (Warsaw, 1930), 1-15, reprinted in Alexander Birkenmajer, *Études d'histoire des sciences et de la philosophie du Moyen Âge* (Wrocław, Warsaw and Cracow: Zaklad Narodowy Imienia Ossolinskich and Wydawnictwo Polskiej Akademii Nauk, 1970), 73-87.

[67] On this master, see Kibre, "Hippocrates Latinus", III, 263; Ernest Wickersheimer, *Dictionnaire biographique des médecins en France au Moyen Âge*, 2 vols. (Genève: Libraire Droz, 1979) 1, 74; Geneviève Dumas, *Santé et société à Montpellier à la fin du Moyen Âge* (Leiden: Brill, 2014), 34, 36, 41, 50, 147, 210; *L'Université de Médecine de Montpellier et son rayonnement (XIII^{e}-XV^{e} siècles)*. Actes du colloque international de Montpellier organisé par le Centre historique de recherches et d'études médiévales sur la Méditerranée occidentale (Université Paul Valéry – Montpellier III), 17-19 mai 2001, edited by D. Le Blévec (Turnhout: Brepols, 2004), 17, 67, 72, 137.

[68] Cardinalis, *Commentarium in Aphorismos Hippocratis*, Paris, Bibliothèque Nationale de France, lat. 6847, ff. 1ra-79rb, f. 5vb: "Causa autem quare ventres sunt calidissimi in vere et hyeme est quia a frigiditate exteriori, scilicet continentis, clauduntur pori corporis, et sic calor coadiuvatur in interioribus et fortificatur. Calor enim coaddunatus maior est se ipso disperso, et ita ventres hyeme et vere, scilicet in principio veris, calidissimi sunt, et etiam in toto vere, quando simile est hyemi. Hoc autem non est intelligendum generaliter, sed in illis in quibus calor fortis est (...). Nam enim calor esset debilis et ipsi essent exdenuati [*sic*], frigus continentis penetraret ad interiora et postea [*conieci*: potius?] diminuetur calor quam augmentaret."

Auctoritates Aristotelis,[69] is almost universally quoted in scholastic explanations of the process of antiperistasis in commentaries on the first book of *Meteorology*. The Montpellier commentary also contains a third feature that will help us understand the evolution within the debates in *Meteorology* commentaries, namely the assertion that the strengthening of vital warmth in winter does not concern every body, but only those in which the vital warmth is strong enough. In fact, if the vital warmth is weak, the coldness of the air penetrates the body, further weakening the vital warmth instead of reinforcing it. This remark clearly corresponds to the distinction between penetrating (*penetrans*) and non-penetrating (*non penetrans*) cold, presented by Buridan and by the masters who follow him.

Buridan stresses the limits of the explanation of antiperistasis he ascribes to the physicians: according to him, in most of the cases the amount of cold or heat which is generated by antiperistasis is such that it cannot be explained only by a concentration of preexisting heat or cold. That is why Buridan resorts to the theory of the multiplication of species, which shows that the intensification of a quality that takes place in the antiperistatic process cannot be reduced to the concentration of a preexisting quality, but implies the generation of a new one.[70]

It seems that, at least starting from the second half of the fourteenth century, the physicians also adopted this model. The Italian physicians Iacopo da Forlì, Ugo Benzi, and Giovanni Sermoneta, for instance, all resort to this theory for their exegesis of *Aphorisms* I, 15. Iacopo da Forlì (1364-1414)[71] mentions two ways in which a quality can intensify the opposite one. First, by concentrating its parts, which therefore become stronger in acting and resisting. Iacopo explains that this fortification results from the fact that a concentrated quality acts through shorter – and therefore stronger – lines of action. A further, accidental cause of fortification comes from the better disposition (*melior applicatio*) of these parts. It is for these reasons, Iacopo explains, that a concentrated virtue is stronger than a dispersed one.[72] According to the second

[69] *Les* Auctoritates Aristotelis*: un florilège médiéval. Étude historique et édition critique*, edited by J. Hamesse (Louvain-la-Neuve and Paris: Béatrice-Nauwelaerts, 1974), 232, n. 13; *Liber de causis*, edited by A. Pattin in "Le Liber de causis. Edition établie à l'aide de 90 manuscrits avec introduction et notes", *Tijdschrift voor filosofie* 28 (1966): 138, 15-16.

[70] Iohannes Buridanus, *Questiones in Meteorologica* I, 7, vol. 2, 113.

[71] On Iacopo da Forlì, see *Dizionario biografico degli Italiani* (Roma: Istituto della Enciclopedia italiana, 1960-2021), vol. 37, 555-558.

[72] Iacopo da Forlì, *In Hippocratis Aphorismos et Galeni super eisdem commentarios, expositio et quaestiones* (Venetiis: Iuncta, 1547), *Utrum ventres et corpora humana sunt calidiora tempore hyemis quam tempore aestatis vel autumni*, f. 126vb: "Quantum ad primum erunt notata et conclusiones. Primo praemitto. Dupliciter imaginari possumus unum contrarium alterum vigorare et fortificare. Primo uniendo et congregando partes eius, quare ipse redduntur potentiores ad agendum et resistendum quam prius. Ipsis enim ad invicem melius applicatis unaqueque melius aliam conservat. Ipse etiam melius se iuvant ad agendum, tum quia agunt per breviores lineas, tum etiam quia melius sunt applicatae fit maius in actione accidentale iuvamentum. Ex quo patet quare virtus unita fortior est seipsa dispersa."

explanation mentioned by Iacopo, a quality can intensify the opposite one by strengthening its form. Iacopo's favorite explanation is the second one. According to him, the intensification of one of the first qualities requires the participation of an agent that immediately produces it. As a consequence, a first quality cannot be produced by the sole concentration of its parts.[73] Iacopo admits that a quality can intensify a contrary one, but only by accident. This happens when this quality surrounds the first one and strengthens its substantial form, as in the processes of formation of hail and freezing of hot water mentioned in the first book of Aristotle's *Meteorology*.[74] Having established that the essential cause of these phenomena cannot be the simple concentration of a quality, Iacopo resorts to the theory of multiplication of species, which we have already found to explain the process of antiperistasis in commentaries on Aristotle's *Meteorology*. According to Iacopo's rendering of this theory, the first qualities act through the emission of insensible qualities, the species. Although the species have a different form of being in the medium, such as the *lumen* that results in the medium from light (*lux*), they vehiculate the first qualities and are capable of producing them in other bodies. When the species encounter a contrary quality, they are reflected back towards the body which emitted them, in the same way that light is reflected by a mirror. This reflection causes a concentration, and, as a consequence, an

[73] Iacopo da Forlì, *In Hippocratis Aphorismos*, f. 126vb: "Secundo imaginari possumus unum contrarium aliud fortificare quia ipsum intendit in forma, quod qualiter sit possibile declarabitur. Secundo principaliter praemittendum est: non posse in aliquo subiecto intendi caliditatem vel qualitatem aliquam de primis nisi ad illius intensionem vel productionem per se concurrat aliquod agens immediate illam intendens vel producens. Ex quo patet non esse possibile per solam subiecti partium aggregationem vel unionem fieri alicuius qualitatum primarum de novo productionem."

[74] Iacopo da Forlì, *In Hippocratis Aphorismos*, f. 126vb: "Tertio praemittendum est quod numquam unum contrarium per se et immediate concurrit ad alterius contrarii productionem. Patet, quia quodlibet contrarium intendit aliud contrarium naturaliter corrumpere; ergo etc. Patet consequentia cum antecedente. Quarto est praemittendum quod possibile est unum contrarium ab alio contrario circumdatum fieri in forma qua illi contrariatur intensius quam prius erat. Patet hoc grandine et similibus. Aqua etiam praecalefacta ad maiorem reducitur frigiditatem quam si non praecalefiat, ut primo *Metheororum*, capitulo quarto, quia magis passibilis est a contrario circumdante propter eius raritatem. Confert autem ad hoc ac ad caliditatem congelationis praecalefactam esse aquam, primo *Metheororum*, capitulo quarto." Iacopo's wording (almost) literally reproduces Moerbeke's *nova translatio*, I, 12, 348 b 30-32. The text established by Gudrun Vuillemin-Diem reads: "Confert autem adhuc ad celeritatem coagulationis et precalefactam esse aquam", vol. 1, 33, 656-657. The variant apparatus does not mention any variant corresponding to Iacopo's quotation according to the Venice edition, whose text is probably faulty. In fact, the copy of Iacopo's commentary contained in manuscript Città del Vaticano, Biblioteca Apostolica Vaticana, Vat. lat. 2464, transmits a version of the Aristotelian passage more similar to that printed in Vuillemin-Diem's edition: "Confert adhuc ad celeritatem coagulationis aquam precalefactam esse", f. 109vb. The reference to the fourth chapter of Aristotle's *Meteorology* in the Venice edition does not correspond either to the division of the text in the *nova translatio*, in which the chapter on hail is the twelfth (ed. Vuillemin-Diem, 1, 412; 2, 30), or to the division of the *vetus*, in which hail is discussed in the seventh chapter. This reference to the fourth chapter is missing in the manuscript Vat. lat. 2464.

intensification of the quality.[75] According to Iacopo, this theory allows for the explanation of many problems related to meteorological phenomena, namely why caves and subterranean waters are warmer in winter and colder in summer; why hail is generated in spring, summer and autumn, rather than in winter; and why the coldness of the region of clouds (called by the scholastic masters "middle region of the air") is more intense in summer than in winter.[76]

The same theory is put forward in the commentary on Hippocrates's *Aphorisms* by Ugo Benzi (Siena, 1360-Ferrara, 1439). Ugo studied in Florence and Bologna, and taught in Pavia before moving to Ferrara, where he was appointed personal physician of the duke, Niccolò III d'Este.[77] It is to the said duke that his commentary, probably completed

[75] Iacopo da Forlì, *In Hippocratis Aphorismos*, f. 126vb: "Prima conclusio. Ad salvandum intensionem unius contrarii ab altero in corporibus simplicibus necesse est praeter qualitates primas in corporibus simplicibus repertas poni aliam vel alias qualitates ad huius intensionem effective concurrentes. Patet, quia oportet poni aliquam qualitatem per se intensionis illius effectivam, sed illa non potest esse qualitas prima, quia una non est per se alterius productiva; igitur etc. Patet consequentia et assumptum similiter intelligenti. Item talis intensio non fit per se et immediate a sibi contrario, per tertiam suppositionem, nec per solam partium unionem, per primam, nec a qualitate quae est in passo [*ed.*: passio], quia pono ipsum totum uniforme. Et patet nullam partem posse agere in aliam nec in se per qualitatem per quam ipsa est uniformis. Relinquitur igitur aliud vel aliam qualitatem per se et immediate ad hoc concurrere effective. Secunda conclusio sequitur. Huiusmodi qualitas talis qualitatis productiva est species vel radius a qualitate subiective in corpore cuius qualitas intenditur existente decisus vel productus. Patet, quia non est aliqua qualitatum in istis corporibus existentium, igitur necessario est aliquid ab istis vel ab aliquo istorum causatum vel productum, sed non apparet aliud quam radius vel species alicuius istarum qualitatum; igitur. Imaginandum est enim quod, sicut color [*ed.*: calor] est sui speciei multiplicativus in medio, ita calor et frigiditas, et quod, sicut caliditas est qualitas magis activa quam color [*ed.*: calor] et odor, ita et eius species. Est enim immutativa non solum specialiter, sed etiam est talis qualitatis quale est obiectum a quo deciditur productiva. Imaginandum ulterius quod, sicut ab opaco vel a speculo reflectitur lumen et species coloris, ita a frigido species caloris, et a calido frigiditatis. Ex quo patet modus quod unum contrarium ab alio circumdante intenditur et e contra, quia a calido circumdante multiplicatur radius ad frigidum, qui reflexus ad calidum in subiecto a quo fuit decisus producit caliditatem, et sic de aliis." I have corrected the edition with manuscripts Città del Vaticano, Biblioteca Apostolica Vaticana, Vat. Lat. 2464, f. 109vb and 2466, f. 72ra.

[76] Iacopo da Forlì, *In Hippocratis Aphorismos*, f. 126vb: "Ex quo solvi possunt probleumata multa. Primum, quare in cavernis terrae profundis in [127ra] hyeme reperitur intensa caliditas, aestate vero intensa frigiditas. Et per idem aquae puteales in hyeme sunt calidae, aestate vero multum frigidae. Similiter quare in hyeme non generantur grandines, in vere autem et aestate, sic etiam in autumno. Et multa alia. Et quare frigiditas intensior est in media regione aeris in aestate quam in hyeme. Et quo modo intensior potest in aestate esse frigiditas generans grandinem quam frigiditas generans nivem tempore hyemis, etc. Patet enim ad haec omnia responsio ex fundamento iam dicto."

[77] On Ugo Benzi, see Dean Putnam Lockwood, *Ugo Benzi. Medieval Philosopher and Physician (1376-1439)* (Chicago: The University of Chicago Press, 1951), esp. 35-43 for his commentaries on medical works. The preface of Ugo Benzi's commentary on Galen was published by Lockwood, *Ugo Benzi*, 212-213. Ugo Benzi also commented on Aristotle's *De somno et vigilia*: Ugo Benzi, *Scriptum De somno et vigilia*, edited by G. Fioravanti and A. Idato (Siena: La Nuova Italia, 1991). I could not find any mention

in 1414, is dedicated.[78] In his exegesis of *Aphorisms* I, 15, Ugo Benzi states that, in some circumstances, one quality can strengthen the contrary one. The examples he gives to illustrate this principle are directly taken from the first book of Aristotle's *Meteorology*, to which he explicitly refers. Ugo explains that, in summer, when vapor rises in the atmosphere, it condensates into hail. This strong condensation does not happen when the air is not warm enough, in which case the vapor only condensates into water. In the same way, ground waters are colder in summer and warmer in winter, because of the contrast with the outside temperature.[79] Similarly to Iacopo, Ugo provides two explanations of the fortification by the contrary quality. According to the first one, when a quality is completely surrounded by the contrary one, it tends to escape its contrary by concentrating towards its own center. Since a concentrated virtue is stronger than a dispersed one, the surrounded quality gets reinforced. Ugo stresses that this process does not happen in every kind of body, but in gaseous matter, such as vapor, which gives rise to the precipitations, and exhalation, which gives rise to winds, rather than in solid matter. He then redirects his reader to Aristotle's *Meteorology* for further details.[80] According to the second explanation provided by Ugo, the surrounding quality strengthens the surrounded one by letting its parts mix. As the weakest parts are intensified by the stronger ones and tend to be assimilated by them, by the end of the process all the parts of the surrounded quality are reinforced. This explanation applies particularly to heterogeneous bodies, in which some parts are stronger than others, but does not seem to fit for uniform bodies.[81] To explain how the

of the process of antiperistasis corresponding to the passage where Aristotle explains sleep as a concentration of heat within the body (457b2, 458a27).

[78] For his commentary, see Kibre, "Hippocrates latinus III", 266-267.

[79] Ugo Benzi, *Expositio super Aphorismos Hippocratis et super Galeni commentum* (Venetiis: Ottaviano Scoto, 1498), f. 25va: "Nota tertio quod per contrarii iuxtapositionem quandoque aliud contrarium fortificatur, ut experientia [docet et] notat quod vapor ascendens in aere tempore estatis convertitur et fit glacies cum fit grando. Qui tamen vapor, cum medium non est vehementer calidum, non ita in glacie convertitur, sed fit pluvia. Hoc idem videmus quia aque puteales sunt estate frigidiores [*ed.*: frigidioris], hyeme vero calidiores, et talem fortificationem dicit Aristotelem fieri per antiperistasim, id est contrarii iuxtapositionem." I have corrected the text of this edition (on which see Lockwood, *Ugo Benzi*, 387) with the manuscripts Paris, Bibliothèque Nationale de France, lat. 6848, ff. 1r-222va, at f. 37v; Città del Vaticano, Biblioteca Apostolica Vaticana, Vat. Lat. 2471, ff. 61r-151r, at 88v and 2489, ff. 1r-133r, at f. 40r.

[80] Ugo Benzi, *Expositio super Aphorismos*, f. 25va: "Notandum quarto quod hec contrarii fortificatio duobus modis contingit: unus est <quod> contrarium circumdatum a contrario undique ab illo fugiens secundum omnes suas partes petit centrum, et ita uniuntur sue partes, et ita unaqueque ab alia recipit maius iuvamentum aliis partibus quam prius. Et hoc modo dicitur quod virtus unita est fortior seipsa dispersa. Hec autem fortificatio fit a natura talium corporum que refugiunt iuxtaposito contrario. Talis autem natura maxime in corporibus vaporosis invenitur, nam ferrum et lapides aut talia non videntur hanc habere virtutem, sed vapores et venti videntur, et res vaporose subtiles, et hoc est magis in libro *Metheororum* videndum."

[81] Ugo Benzi, *Expositio super Aphorismos*, f. 25va: "Secundus modus fortitudinis est quia non solum partes magis uniuntur, sed qualitas contraria qualitati circumdanti fortius intendatur quam si contrarium non approximaretur, et tunc illud in rebus difformibus facilem habet causam, quia

intensification by the contrary quality also happens in homogeneous bodies, Ugo therefore resorts to a more general explanation, which he ascribes to some *quidam*. This is the theory of the multiplication of species, which Ugo presents in a very similar way to Iacopo.[82]

Iacopo's explanation, and even wording, can also be found in the commentary by another Italian physician, Giovanni Sermoneta, active between 1411 and 1444.[83] Interestingly, both Iacopo da Forlì and Giovanni Sermoneta, who probably follows him, state that this explanation of the concentration of vital warmth in winter is more philosophical than medical.[84] Just like Buridan ascribed to the physicians the distinction between penetrating and non-penetrating cold, as well as the view according to which the body is warmer in winter because of the closure of the pores at the surface of the skin, the physicians ascribe to the philosophers the explanation of *Aphorism* I, 15 based on the theory of the multiplication of species. This double movement clearly shows the interrelations between medical and physical discourse on the subject of antiperistasis, a feature that seems to be a peculiarity of scholastic debates. In fact, Aristotle only

partes minus intense partibus intensioribus appropinquantur et ab eis assimilantur et intenduntur, ita quod totum redditur intensius quam prius esset."

[82] Ugo Benzi, *Expositio super Aphorismos*, f. 25va: "Sed supposito vapore uniformi frigido, videre [*ed.*: videtur] quomodo per antiparistasim intendatur non est tam facile. Quidam tamen imaginantur hunc modum quod qualitates prime agunt sibi similes qualitates per species spirituales que sunt alie a qualitatibus primis, sicut lumen a luce, habent tamen virtutes generandi similes illis a quibus deciduntur. Imaginantur secundo quod quemadmodum species visibilis reflectitur a speculo denso et opaco, ita species caliditatis et frigiditatis et aliarum qualitatum reflectuntur a corpore contrario qualitate forti informato. Et ideo ille species supra subiectum suum reflexe talia corpora intendunt."

[83] Giovanni Sermoneta, *Quaestiones super Aphorismos Hippocratis* (Venetiis: Bonetus Locatellus, 1498) I, 17, *Utrum corpora humana sint calidiora tempore hyemis quam estatis vel autumni*, f. 17va: "Tertio est notandum quod dupliciter possumus imaginari unum contrarium alterum vigorare et fortificare. Primo uniendo et aggregando partes, que redduntur potentiores ad agendum et resistendum quam prius, ipsis ad invicem melius applicatis; tunc enim unaqueque istarum partium melius conservat alteram. Melius etiam iuvat alteram ad agendum, tum quia fit actio per breviores lineas, tum etiam quia ipsis melius applicatis fit in actione iuvamentum accidentale maius. Et propter hoc dixerunt quod virtus unita fortior est seipsa dispersa. Secundo imaginari possumus unum contrarium fortificare aliud quia ipsum intendat in forma." It may be remarked that the text almost literally corresponds to that of Iacopo, quoted above at fns. 72 and 73. On Giovanni Sermoneta, see *Dizionario biografico degli Italiani* (Roma: Istituto della Enciclopedia italiana, 1960-2021), vol. 92, 161.

[84] Iacopo da Forlì, *In Hippocratis Aphorismos*, f. 126va: "Respondendo ad istam quaestionem, primo tangetur quidam probabilis modus respondendi, et magis naturalis quam medicinalis." And again, after having exposed this theory: "Et secundum haec dicta consequenter non solum dicendum Hippocratem dixisse ventres esse calidiores propter maiorem spirituum multitudinem, sed etiam quia gradualiter spiritus sunt calidiores et adhuc membra. Haec autem responsio est magis physica quam medicinalis, ideo philosophis dimittatur", f. 127ra. Giovanni Sermoneta, *Quaestiones super Aphorismos Hippocratis*, f. 17va: "fuit opinio quorundam magis philosophantium quam medicinaliter loquentium, dicentium quod corpora humana sunt intensive calidiora tempore hyemis quam estatis, quorum fundamentum est quia unum contrarium ab alio circumdatum intenditur."

rapidly proposes an application of antiperistasis to organic matter in the treatise *De somno*, but not in *Meteorology*. On the contrary, it seems that among scholastic masters this interaction was current also beyond the tradition of commenting on Aristotle's *Meteorology*. Thomas Bradwardine's *De causa Dei contra Pelagium* provides a significant example of the medical application of antiperistasis. In order to exemplify God's providential action, which only tolerates evil as a means for emphasizing good, Bradwardine introduces the example of the drugs prepared by the physicians, which act by antiperistasis, stimulating a contrary reaction.[85] Bradwardine does not expand on this analogy, which should therefore have been evident to his readers.

As shown by the texts of Ugo Benzi and Iacopo da Forlì, the main reason that seems to have led the philosophers and the physicians to resort to the theory of the multiplication of species is the idea that a new quality cannot be produced by the simple concentration of a preexisting one. Now, if we assimilate the fortification of a quality by antiperstasis to the production of the same quality, and if we admit that these processes cannot be caused immediately by the contrary quality, we have to postulate a positive, essential cause of antiperistasis – namely, for our masters, the multiplication of species.

The question as to whether the intensification caused by the process of antiperistasis implies the generation of a new quality was indeed rather controversial. Some commentators, including Blasius of Parma (1355-1416) and Nicolaus Theoderici from Amsterdam († before 1456), pointed out that the strengthening of a quality cannot be caused by its simple reflection towards the interior part of the body. In fact, this assertion would imply that an accident (the quality in question) passes from one subject (the extremities of the body affected by antiperistasis) to another (the central parts of this body), a possibility excluded by the Aristotelian natural philosophy (*De gener. et corrupt*. I, 10, 327b22).[86] This is why Blasius concludes that, when a quality is intensified by antiperistasis, one must admit that a new quality is generated in the course of this process.[87] Nicole Oresme solves this problem differently. According to him, it is not

[85] Thomas Bradwardine, *De causa Dei contra Pelagium et de virtute causarum ad suos Mertonenses libri tres*, ch. 34, edited by H. Savile (London: apud Ioannem Billium, 1618; reprint Frankfurt am Main: Minerva, 1964), 301 B: "[Deus] Non enim vult peccatum nisi forsan sicut Medicus in medicamentibus suis vult venenum, in quantum scilicet valet ad exercitium bonorum, ad punitionem malorum, ad pulchritudinem universi per antiparistasin contemplandam."

[86] On this principle, see Silvia Donati, "*Utrum accidens possit existere sine subiecto*. Aristotelische Metaphysik und christliche Theologie in den Physikkommentaren des 13. Jahrhunderts", in *Nach der Verurteilung von 1277. Philosophie und Theologie an der Universität von Paris im letzten Viertel des 13. Jahrhunderts*, edited by J. A. Aertsen, K. Emery and A. Speer (Berlin and New York: Walter de Gruyter, 2001), 377-617.

[87] Blasius de Parma, *Questiones in Meteorologica* I, 5, ms. Città del Vaticano, BAV, lat. 2160, f. 72vb: "Queratur an huiusmodi intensio fiat per renovationem an per novam generationem, quod volo dicere. Verum est quod aliqui ponunt talem modum quod frigiditas intendit caliditatem revocando ipsam a partibus circumferentialibus ad centrum, et sic dicunt medici quod humana corpora fiunt calidiora in yeme per revocationem caloris ad intra. Dicamus ergo ad hanc dubitationem duo.

necessary to postulate the generation of a new quality in the process of antiperistasis. In fact, Oresme does not consider the quality itself to move from the extremities of a body towards its center, but the parts of said body to move in this way, carrying along the quality in question.[88]

The movement of a body involved in the process of antiperistasis was in itself a problematic question to be solved within the Aristotelian theory of motion. Aristotle distinguishes two kinds of movements: natural movements, which result from a principle intrinsic to the moving body, and violent ones, which are caused by a principle external to it. Each simple body has only one natural movement, which takes it to its natural place. The natural motion of fire, for instance, raises it towards the sphere of fire, located above the sphere of air, but underneath the celestial sphere. This is why the flame of a candle moves upwards. Starting from this principle, it seems that the motion of lightning, which has a fiery nature, but moves downwards to escape the coldness of the clouds, should be considered violent. Yet this movement, just like the other ones that are caused by a process of antiperistasis, results from the natural and intrinsic principle of self-conservation, which leads a body to escape from another with contrary qualities, in order not to be destroyed by it. For this reason, scholastic commentators commonly considered the antiperistatic motion as natural.[89] This qualification is rather problematic, as Aristotle maintains that a natural body only has

Primum est: unum contrarium non intendit aliud per revocationem talis qualitatis a circumferentia versus centrum. Patet, quia si ille modus est verus, oportet concedere accidens transire de subiecto ad subiectum, quod quilibet naturalis negat [73ra]. Secunda propositio: unum contrarium fortificat et intendit aliud per novam generationem talis qualitatis. Et modus iste est, unde declarando in uno proposito aque puteales in yeme calefiunt et corpora humana, pro tanto quia corpus humanum, cum sit ex se calidum, difundit [*sic*] a se caliditatem, que caliditas sic difusa [*sic*] per continens reflectitur a suo contario, et in hac reflexione fit nova generatio caliditatis in proprium subiectum, sicut patet cum radii solar[i]es flectuntur ad unam partem, generant magnam caliditatem et ignem consequenter. Notice the reference to the physicians (*medici*).

[88] Nicole Oresme, *Questiones in Meteorologica* I, 10, in *Questiones in Meteorologica de ultima lectura, recensio parisiensis. Study of the Manuscript Tradition and Critical Edition of Books I-II.10*, edited by A. Panzica (Leiden and Boston: Brill, 2021), 175: "Ad quintam: sequitur quod accidentia migrarent de subiecto, etc., dico negando consequentiam, quia non solum caliditas que est in partibus extremalibus movetur versus partes centrales, verum etiam partes extreme in quibus est ipsa caliditas."

[89] Iohannes Buridanus, *Questiones in Meteorologica* I, 7, vol. 2, 114; Nicole Oresme, *Questiones in Meteorologica de ultima lectura* I, 10, 172; Blasius de Parma, *Questiones in Meteorologica* I, 5, ms. Città del Vaticano, BAV, lat. 2160, f. 72va: "Prima difficultas sit de motu quo unum contrarium fugit ab alio, et queratur an iste motus sit naturalis an violentus. Quod sit violentus patet, quia fit a principio extrinseco suo contrario. Quod sit naturalis patet, quia quodlibet ens diliget permanere; ideo naturaliter unum contrarium fugit ab altero. Et ad hanc respondeo quod iste motus est naturalis, et hoc propter rationem adductam (...). Ad rationem in contrarium, cum dicitur: 'iste motus fit a principio extrinseco', negatur hoc; unde non est ymaginandum quod unum contrarium repellet a se suum contrarium, sed unum contrarium propter conservationem sui ipsius movetur a principio intrinseco fugiendo a suo contrario."

one natural motion (*De caelo*, I, 2, 268b30-269a2). If the fire of the exhalation within lightning has a natural tendency to move upwards, it can not have another, contrary, natural tendency to move downwards. Some fifteenth-century commentators solve this problem by ascribing the antiperistatic motion to the common nature (*natura communis*), a universal principle which can lead the bodies to move against their natural tendency in order to preserve the general order of nature and to avoid inadmissible consequences (at least within Aristotle's physics), such as the formation of a void.[90]

Interestingly, the difficulty of describing the antiperistatic motion within the Aristotelian dichotomy between natural and violent motions was perceived also in the medical tradition. The Italian thirteenth-century physician Taddeo Alderotti (1215-1295), for instance, tried to describe the intensification caused in the process of antiperistasis – for which he does not use a proper name – in light of the Aristotelian distinctions of motion. In his commentary on the *Aphorisms*, Taddeo explains that the augmentation of heat in the inside of the body in winter is partly natural, because of the increased intake of food during this time of the year, and partly violent, because of the exterior cold. Taddeo stresses the fact that even though the origin of this intensification is a violent one, the intensification itself may be said to be natural, because it results from the subject that is intensified and from its goal, which is its natural activity (*operatio*). In fact, this accidental intensification makes the natural activity of the subject stronger. Now, everything that makes the natural activity of a subject stronger should be considered natural to it.[91] Differently from the

[90] This is the case for the Parisian master Iohannes Versoris, whose lectures on the Aristotelian corpus date back from the '40s and the '50s of the fifteenth century: "Et si queratur an naturaliter et a principio intrinseco unum contrarium moveat fugiendo reliquum, respondetur quod fit secundum naturam communem et non secundum naturam propriam", *Questiones in libros I–IV Meteororum* (Köln: Konrad Welker, 1488), f. 4ra. Outside Paris, this position was adopted, for instance, by an anonymous German master whose commentary is transmitted in ms. Frankfurt (Main), Stadt- und Universitätsbibliothek, Ms. Barth. 146: "Tertio dubitatur utrum motus localis quo partes extremales aque moventur versus partes centrales (...) sit naturalis vel violentus. Et videtur quod sit naturalis simpliciter, quia fit a principio intrinseco passo (...). In oppositum arguitur, quia tunc eidem corpori simplici convenirent plures motus simplices, quod est contra Philosophum primo *Celi*. Respondetur quod talis motus aque est simpliciter naturalis, non tamen secundum naturam propriam, recte sicut motus aque sursum ad replendum vacuum, et ita talis motus est aque naturalis secundum naturam communem, et per consequens posset dici motus preter naturam", ff. 333v-334r. On the common nature, see Nicolas Weill-Parot, *Points aveugles de la nature. La rationalité scientifique médiévale face à l'occulte, l'attraction magnétique et l'horreur du vide (XIII^e^-milieu du XV^e^ siècle)* (Paris: Les Belles Lettres, 2013), 271-339.

[91] Taddeo Alderotti, *In Aphorismos Hippocratis Expositio*, ms. Città del Vaticano, Biblioteca Apostolica Vaticana, Vat. lat. 4465, f. 7vb: "Preterea dicitur quod venter yeme est calidum violenter, quia frigus aeris violenter facit calorem fortiorem. Preterea, augmentatio caloris fit a frigore per accidens, eo quod unum contrariorum auget aliud per accidens et non per se, ergo non augetur calor naturaliter, sed potius accidentaliter. Ad primum dico quod augmentum quod recipitur calor in yeme dupliciter fit, scilicet partim violenter a frigore aeris et partim naturaliter ab augmentatione nutrimenti, tamen principium illius augmenti est solum a frigore. Sed licet augmentum eius factum

commentators on Aristotle's *Meteorology* we have just reviewed, Taddeo is not interested in the local motion caused in the process of antiperistasis, but in the passage from a certain degree of a quality to a superior one. Be it in its local or in its quantitative sense, the antiperistatic motion did not stop raising questions among the philosophers and the physicians permeated by the peripatetic concept of motion.

Conclusions and research perspectives

Let us now sum up the main results of this inquiry. Differently from the antipersitasis to which Aristotle refers in the *Physics*, which is a principle of the dynamics of fluids, the antipersitasis described in *Meteorology* applies to the dynamics of the primary active qualities, hot and cold. If the redistribution of fluids caused by a violent motion expresses a constant in Aristotle's physics, the intensification by the contrary quality is the exception, and not the rule.[92] This second kind of antiperistasis can be described as the result of a resistive effort which leads a quality surrounded by the contrary one to concentrate in order not to be corrupted. This mechanism represents thus a particular application of the general law according to which each entity aims at its preservation. In spite of this, Aristotle applies this process mainly to inorganic matter, as he makes abundant use of this explanation in a treatise devoted to inanimate matter, as *Meteorology* is, and only a pretty spare use of it in his biological treatises. The rapid mention in the treatise *On respiration*, in which Aristotle expresses criticism on Plato's theory, concerns the process of antiperistasis described in the *Physics*. Thus, the only explicit reference to antiperistasis as action on contrary qualities in Aristotle's biological works seems to be that in the treatise *De somno*, where Aristotle states that sleep is caused by a concentration of the vital warmth within the body (457b2, 458a27). Contrary to the Aristotelian treatment of antipersistasis, medieval analyses in commentaries on *Meteorology* would later develop a link between physics and biology, in an implicit as well as in an explicit way. On the one side, scholastic masters ascribed ascribed to the inorganic agents of the process of antiperistasis, hot and cold, features of the animate matter, like the perception of its contrary and the tendency of escaping it. On the other side, medieval commentators on Aristotle's *Meteorology* explicitly borrowed distinctions (such as the one between penetrating and

sit a violentia, nichilominus dicitur tale 'natura', quia recipit denominationem a subiecto cui fit aditio [*sic pro* additio, *ut semper*] et a fine, que est sua operatio, nam operatio naturalis efficitur per eum fortius et melius quam primo, licet aditio <sit> facta violenter ratione qualitatis caloris que fugit suum contrarium. Ad secundum dico quod patet solutio per hec omnia que dixi iam, nam calor ille sic augmentatus non dicitur 'naturalis' propter modum secundum quem est augmentatum per causam exteriorem, sed propter utilitatem et bonitatem sue actionis, nam omnia opera natura bene agit."

[92] Nicolaus Oresme, *Questiones super Physicam*, II, 11, edited by S. Caroti, J. Celeyrette, S. Kirschner and E. Mazet (Leiden and Boston: Brill, 2013), 249, 52-250, 53: "sicut ignis determinatur ad calefaciendum et non frigefaciendum nisi raro et per accidens, sicut in antiperistasi."

non-penetrating cold) and explanations (such as the intensification of vital warmth due to the closure of the pores at the surface of the skin) from the physicians. Moreover, the medieval commentators (both on Aristotle's *Meteorology* and on Hippocrates's *Aphorisms*) applied the model of antiperistasis to organic matter, particularly to land animals and even to men, whose complexion they explained based on the climate, as we have seen in Blasius of Parma's commentary. The references to the medical tradition in medieval discussions on antiperistasis can be traced back to a remark in Galen's commentary to Hippocrates's *Aphorisms* I, 15, where Galen explains that the belly is warmer in winter than in summer because of the antiperistasis exerted by the cold air on the vital warmth of the body. This interpretation was adopted and further developed by medieval commentators on the *Aphorisms*. Following Galen's path, many of them explicitly applied the model of antiperistasis described in the first book of Aristotle's *Meteorology* to a biological context, thus establishing a link between physics and medicine substantially extraneous to Aristotle's theory.

The medieval commentators also tried to reinsert an apparent exception in Aristotle's natural philosophy, as the intensification due to the contrary quality was, in a coherent model of physical causation. In order to achieve this goal, they had to clarify some key notions in this process, such as the resistance exerted by the surrounded quality. Starting from the mid fourteenth century, they explained antiperistasis in the light of the model of the multiplication of species, according to which the strengthening caused by antiperistasis is due to the reflection of the virtual rays of a quality against the surrounding contrary quality. Yet even within this model, the antiperistatic motion remained somehow problematic: first, because it was difficult to determine the exact conditions for antiperistasis to take place, since in most cases a quality is weakened, and not reinforced, by the contrary quality; secondly, because this notion seemed to escape to the Aristotelian opposition between natural and violent movements. I consider that the interest of studying medieval discussion on antiperistasis lies exactly in this (partial) incompatibility with the categories of Aristotelian physics, which the medieval commentators tried to deepen, and also to adapt, in order to include the apparent paradoxical phenomena for which Aristotle elaborated this explanation.

Mentions of the process of antiperistasis in later authors and outside the commentary tradition on Aristotle's *Meteorology* show that it more frequently indicated the fortification of a quality caused by the contrary one than the redistribution of fluids described in the *Physics*. As the example of Bradwardine's *De causa Dei* has shown, the process of antiperistasis was sometimes mentioned in this sense in theological contexts. This is also the case for John Gerson (1363-1429), who mentions antiperistasis in a rhetorical enumeration illustrating the tribulations endured by the soul in its path towards contemplation. The image of a "spiritual antiperistasis, which reinforces its contrary", is evoked by Gerson to illustrate the purification of the soul together with other examples taken from physical processes, such as sharpening of iron with a stone, souring of children with wormwood, stretching with hammers, polishing with a file,

purifying gold in a furnace.[93] It seems moreover that the concept of antiperistasis as action on contrary qualities remained familiar to the readers of scholarly texts in Latin, if in his *De dignitate et augmentis scientiarum*, a text published in 1623, a fiery opponent to Aristotelism and Scholasticism like Francis Bacon, resorts to the example of antiperistasis to explain that desire increases when resistance and prohibitions oppose it, in the same way that cold increases vapor exhaled by plants.[94] Some thirty years after Bacon, Thomas Hobbes mocks the vacuity and multiplicity of scholastic concepts employed to explain natural phenomena. In the *Leviathan* (1651), Hobbes mentions antiperistasis as part of a philosophical arsenal encompassing species, potency, substantial form, incorporeal substance, instinct of nature, sympathy and antipathy, occult and specific qualities, chance and fortune: all concepts that, according to Hobbes, merely serve to hide the ignorance of their proponents.[95] Despite Hobbes's criticism,

[93] Iohannes Gerson, *De mystica theologia practica*, consideratio 9, in Jean Gerson, *Œuvres complètes*, edited by P. Glorieux, vol. 8, *L'œuvre spirituelle et pastorale (399-422)* (Paris: Desclée & Cie, 1971), 38: "Haec est antiperistasis quaedam spiritualis quae contrarium fortificat; haec est cos ferrum exacuens, haec absinthium pueros ablactans avellens que ab uberibus; hoc malleus dilatans et extendens sicut psalmista inquit: in tribulatione dilatasti mihi; haec lima poliens, mundans, eruginans eruginans et clarificans; haec fornax quae aurum purgat ut rutilet; haec est virga quae percussos erigit ab inferno ut dicat tribulatus conformans se perceptae gratiae: Domine, si sic vivitur et in talibus vita spiritus mei, corripies me et vivificabis me, ecce in pace amaritudo mea amarissima; illud quoque: Ingrediatur putredo in ossibus meis et subter me scateat, ut requiescam in die tribulationis et ascendam ad populum accinctum, civium videlicet supernorum." A second reference to the antiperistasis described in Aristotle's *Meteorology* as the fortification of a quality caused by the contrary one can be found in another theological work by Gerson, the *Collectorium super Magnificat*, which evokes the distinction between "penetrating" (*penetrans*) and "not penetrating" (*non penetrans*) contrary that we have found in Buridan's *Questions on Meteorology* and in the commentaries influenced by it: Iohannes Gerson, *Collectorium super Magnificat*, pars 2, tract. 9, in Jean Gerson, *Œuvres complètes*, edited by P. Glorieux, vol. 8, 430: "Habet virtus suam antiperistasim; coadunatur in se ex circumstante, non penetrante, contrario ac perinde fortificatur. Sed et Job percussus ulcere pessimo, sedet in sterquilinio ubi velut in throno regio concionatur."

[94] Francis Bacon, *De dignitate et augmentis scientiarum*, lib. II, ch. XIII, in *The Works of Francis Bacon*, vol. 2, edited by J. Spedding, R. Leslie Ellis and D. Denon Heath (New York: Hurd and Houghton, 1864), 249: "Quod ad primum enim attinet, omnis cupiditas per renitentiam et vetitum et tanquam antiperistasin (veluti per frigora brumae hedera) virescit, ac vigorem acquirit." Another example of the same metaphorical use of the concept of antiperistasis in moral matters can be found in book III, ch. I, 255: "*Augetur vis agentis per antiperistasin contrarii*, regula est in Physicis. Eadem mira præstat in Politicis; cum omnis factio, ex contraria ingruente, vehementer irritetur."

[95] Thomas Hobbes, *Leviathan*, pars IV: Of the Kindome of Darknesse, ch. 46, 3 vols., edited by N. Malcolm (Oxford: Clarendon Press, 2012), vol. 3, 1088-1090 (Latin translation, 1089-1091): "And in many occasions they put for cause of Naturall events, their own Ignorance; but disguised in other words: As when they say, Fortune is the cause of things contingent; that is, of things whereof they know no cause: And as when they attribute many Effects to *occult qualities*; that is, qualities not known to them; and therefore also (as they thinke) to no Man else. And to *Sympathy*, *Antipathy*, *Antiperistasis*, *Specificall Qualities*, and other like Termes, which signifie neither the Agent that produceth them, nor the Operation by which they are produced. If such *Metaphysiques* and *Physiques*

however, antiperistasis still remained for a while in the repertorium of Western philosophical terms and concepts, as shown by Johannes Micraelius's and Étienne Chavin's lexica.[96]

These rapid mentions show that a survey of physical and metaphorical uses of the concept of antiperistasis in modern authors would not be without interest for retracing the history of this neglected Aristotelian theory. This is a task for further investigation on a tradition that still remains unexplored. If the weight of the medical tradition in medieval discussions on antiperistasis should be studied in greater detail, the subsequent Latin reception of this concept in Renaissance and Early modern commentaries, as well as a wider contextualization within the Greek and Arabic exegetic tradition of Aristotle's *Meteorology*, need to be taken into account.

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as this, be not Vain Philosophy, there was never any; nor needed St. Paul to give us warning to avoid it."

[96] Micraelius remarks that antiperistasis explains the causes of many meteorological phenomena, such as lightning and thunderbolts, as well as many diseases, thus confirming the link between meteorology and medicine on this topic: "Antiperistasis, Circumobsistentia est circumstantia contrariae qualitatis: unde fit, ut inclusa qualitas vim suam intra se uniat, et fortius deinde erumpat, juxta illud: *Vis unita fortificat.* Sic cum frigida circumstant calorem, ille intus occlusus vires suas intra se cogit. Idem faciunt frigida, si circumstat calor. Et per ἀντιπερίστασιν causae redduntur plurium meteororum, et imprimis fulminis et tonitrui; apud medicos etiam plurium morborum. Dicitur etiam *compressio et cohibitio mutua*", Johannes Micraelius, *Lexicon philosophicum terminorum philosophis usitatorum* (Stetini: Mamphrasius, 1661, second edition corrected by the author), vol. 1, col. 139. The link between meteorology and medicine is also evident in the long article dedicated to antiperistasis in Chauvin's lexicon, which mentions Hippocrates's principle according to which the belly is warmer in winter than in summer as an example of antiperistasis and refers to the explanation of the multiplication of species: Étienne Chauvin, *Lexicon Rationale, sive Thesaurus Philosophicus* (Rotterdam, 1692; new augmented edition: Leeuwarden, 1713), f. 2v.

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ROBERT HALIFAX, AN OXFORD CALCULATOR OF SHADOWS[1]

ROBERT HALIFAX, UN CALCULADOR DE SOMBRAS DE OXFORD

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Abstract

In his commentary on Lombard's *Sentences*, question 1, Robert Halifax OFM presents a remarkably original and inventive optical argument. It compares two pairs of luminous and opaque bodies with two shadow cones until the luminous bodies reach the zenith. In placing two moving human beings into the shadow cones whose moral evolution parallels the size of the shadows, Halifax creates an unprecedented shadow theater equipped with mathematics and theorems of motion from Thomas Bradwardine's *Treatise on Proportions*. This paper is a first attempt at analyzing this imaginary experiment and the mathematics of the infinite it implies. It also shows that optics had new aims through its connexion with the theorems of motion of the Oxford Calculators.

Keywords

Proportions; Motion; Calculators; Optics; Astronomy; Thomas Bradwardine; Robert Halifax; Commentaries on the *Sentences*

Resumen

En su *Comentario a las Sentencias de Pedro Lombardo*, cuestión 1, Robert Halifax OFM presenta un argumento óptico notablemente original e inventivo. Compara dos pares de cuerpos luminosos y opacos con dos conos de sombra hasta que los cuerpos luminosos alcanzan el cenit. Al situar en los conos de sombra a dos seres humanos en movimiento cuya evolución moral es

[1] This paper is a revised version of the talk I gave at Munich. I remain utterly convinced that optics and astronomy were essential for the development of the Oxford Calculators' theorem of mean speed. I thank Keith Snedegar, Monika Michałowska, György Geréby, Lukáš Lička and Luke DeWeese for insight, enthusiasm or friendship shared over Halifax. The Issue Editor and the Reviewers of this paper have also to be acknowledged.

paralela al tamaño de las sombras, Halifax crea un teatro de sombras sin precedentes, dotado con la matemática y los teoremas del movimiento derivados del *Tratado de las Proporciones* de Thomas Bradwardine. Este artículo es un primer intento de analizar este experimento imaginario y las matemáticas del infinito por él implicadas. Muestra además que la óptica ha tenido nuevos objetivos a través de su conexión con los teoremas del movimiento de los Calculadores de Oxford.

Palabras clave

Proporciones; movimiento; calculadores; óptica; astronomía; Thomas Bradwardine; Robert Halifax; Comentarios de las *Sentencias*

In an essay written forty years ago, John Murdoch and Edith Sylla characterized Thomas Bradwardine's *Treatise on Proportions* as enacting a "rather dramatic change" on the science of motion at Oxford in the 1330s. This change can be viewed on two levels. One level is formal: the *Treatise*, dated to 1328, analyzed motion outside the context in which medieval discussions about motion usually took place, that is, in commenting on one of Aristotle's relevant texts. The other level concerns content: Bradwardine departed from Aristotle's calculation of velocity in proposing that velocities "vary arithmetically when the proportions of force to resistance determining these velocities vary geometrically."[2] The arguments in favor of the new calculation were drawn from a few concrete or imaginary physical cases and entailed the application of mathematics beyond physics to metaphysics, ethics, and theology. Also, fourteenth-century Oxford science of motion evolved within the context of disputational logic, which dominated many writings that Bradwardine's seminal treatise gave rise to.[3] In this paper, I will argue that a further discipline should be added, namely, the "science of perspective" or optics. In this field, the Oxford educated Franciscan Robert Halifax proposed arguments regarding the new calculation of motion, which are both remarkably original and inventive.

We possess only scarce information regarding Robert Halifax. We know that he became the fifty-sixth Franciscan lector at Cambridge around 1336. Before taking up his teaching position, he studied at Oxford and was licensed in theology. His university years were the most significant period for the Oxford Calculators, who contributed to or developed the method and theorems Bradwardine posited in the *Treatise on*

[2] John E. Murdoch and Edith D. Sylla, "The Science of Motion", in *Science in the Middle Ages*, edited by D. C. Lindberg (Chicago: Chicago University Press, 1978), 206-264, 224, 225, and 227.

[3] Edith D. Sylla, "The Oxford Calculators", in *The Cambridge History of Later Medieval Philosophy: From the Rediscovery of Aristotle to the Disintegration of Scholasticism, 1100–1600*, edited by N. Kretzmann, A. Kenny, J. Pinborg and E. Stump (Cambridge: Cambridge University Press, 1982), 540-563, esp. 542-543; and Daniel A. Di Liscia, "Perfections and Latitudes. The Development of the Calculators' Tradition and the Geometrisation of Metaphysics and Theology", in *Quantifying Aristotle. The Impact, Spread, and Decline of the* Calculatores *Tradition*, edited by D. A. Di Liscia and E. D. Sylla (Leiden: Brill, 2022), 278-327.

Proportions.[4] Despite this governing trend in natural philosophy, Halifax is not known to have left any writing in the field; so far, scholarship attributes to him only a philosophical dialogue between an Ockhamist and a Scotist, which remains of doubtful authorship, and a commentary on Peter Lombard's *Sentences* that he read at the University of Oxford in the early 1330s.[5] Extant in seventeen, more or less complete witnesses on the continent, Halifax's theological writing left a lively, long-lasting impact on masters at the Universities of Paris and Vienna until at least ca. 1420.[6]

This commentary proves not only of theological interest. Almost every argument in it contains an analogy from physical motion and change, and draws on proportional calculation, the mathematics of the infinite, or a sophism. One such argument is probably his most complex thought experience, mixing optics, geometry, astronomy, proportional calculation of motion, and ethics, which Halifax placed at the beginning of his commentary. While the argument remains a sophisticated hypothetical case, unique for calculating motion from the size of shadows, it aims at demonstrating the rather simple claim that divine justice functions according to arithmetical proportions. In what follows, I will inquire into the main part of this argument, which provides unique evidence for the history of the science of motion at the University of Oxford in the 1330s.

The argument "about shadows"[7]

Halifax's commentary on the *Sentences*, like many Oxford commentaries of the period, concerns only Books 1 and 2 of Lombard's work. It is enough to read only the

[4] For a description of the group of scholars called Oxford Calculators and its members, see Sylla, "The Oxford Calculators", 540.

[5] Earlier Franciscans sources suggested that Halifax studied theology at Paris, a thesis that recent scholarship has rejected. William Courtenay dates Halifax's lecture on the *Sentences* to around 1336-1338, whereas Emden indicates the rather earlier date of 1332. See William J. Courtenay, "Some Notes on Robert of Halifax, OFM", *Franciscan Studies* 33 (1977): 135-142; and Alfred B. Emden, *A Biographical Register of the University of Oxford to A.D. 1500* (Oxford: Clarendon Press, 1958), II, 850-851. See also, Alfred B. Emden, *A Biographical Register of the University of Cambridge to 1500* (Cambridge: Cambridge University Press, 1963), 280.

[6] Murdoch investigated a few elements of Halifax's influence at Paris. See John E. Murdoch, "*Subtilitates Anglicanae* in Fourteenth-Century Paris: John of Mirecourt and Peter Ceffons", in *Machaut's World. Science and Art in the Fourteenth Century*, edited by M. P. Cosman and B. Chandler (New York: New York Academy of Sciences, 1978), 51-86. For Halifax's influence at Vienna, see Edit A. Lukács, "Robert Halifax on the Middle Act of the Will", forthcoming.

[7] The passages from Robert Halifax's commentary on the *Sentences*, Question 1 quoted in this paper are based on transcriptions from two witnesses: Paris, Bibliothèque Nationale de France, Lat. 15880, fol. 21^{rb}-23^{ra}, and Vatican, Vat. Lat. 1111, fol. 13^{va}-14^{rb}. Orthograph has been rendered standard. I indicate additions in angle brackets, and corrections in square brackets. All translations from the Latin are mine. The manuscript transmission of Halifax's commentary is complex. In case of the argument in question, the different manuscripts attest to variant readings, which give way to different interpretations of the optical experiment.

titles of the nine questions that compose it to notice that the acts of human will were of utmost importance and interest to Halifax:

> Question 1: Whether the commensuration of reward to merit and of punishment to sin, which can be recognized through theological study of Scripture, is justly ordered by God.
>
> Question 2: Whether, through the practice of studying theological truths, a theologian can attain a greater knowledge than the knowledge of faith.
>
> Question 3: Whether the science that a theologian can have through the practice of studying theological truths is practical or theoretical.
>
> Question 4: Whether between enjoyment and use, there is a middle act of the will that is neither enjoyment nor use.
>
> Question 5: Whether any act of the will can be suddenly produced by the will.
>
> Question 6: Whether the will is free with respect to any of its acts and objects.
>
> Question 7: Whether only the divine essence is an intensively infinite perfection.
>
> Question 8: Whether the blessed angels make progress in merit.
>
> Question 9: Whether every act of the will, if chosen in disagreement with one's erroneous conscience, would be without merit.[8]

Question 1, probably read as an introductory lecture, focuses on commensuration.[9] As Halifax posits it, commensuration is established from theological studies of the Scripture, yet its just character has to be proved. This seems easy to do with mathematics, especially with the mathematics of proportions, a science to which commensuration was not unfamiliar. In Bradwardine's formulation, commensuration was a relationship between commensurable or rational quantities according to a common, exact measure.[10]

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[8] Raymond Edwards, "Themes and Personalities in *Sentences* Commentaries at Oxford in the 1330's", in *Mediaeval Commentaries on the* Sentences *of Peter Lombard: Current Research*, edited by G. R. Evans (Leiden: Brill, 2002), I 378-393 and 381-382. For the Latin title of the questions, see Courtenay, "Some Notes", 141. Together with Monika Michałowska, I am currently working on a critical edition of questions 5 and 6 from Halifax's *Sentences* commentary.

[9] "Quest. 1 [Principium I (?)]: Utrum commensuratio praemii ad meritum et poenae ad peccatum, quae per studium theologiae ex Scriptura potest cognosci, sit iuste a Deo ordinata", BNF, Lat. 15880, fol. 1ra.

[10] "'Communicative', 'commensurable', or 'rational' quantities are those for which there exists a common measure which measures them exactly", Thomas of Bradwardine, *His Tractatus de proportionibus: Its Significance for the Development of Mathematical Physics*, edited and translated by H. L. Crosby, Jr. (Madison, WI: The University of Wisconsin Press, 1955), 66-67. For Aristotle, distributive justice was proportional. See *Nicomachean Ethics* 5.3 (1131a4-6). For more concrete cases of commensuration calculated in Halifax's Question 1, see n. 38, 39, 42 and 43.

Halifax presents a long series of *dubia*, articles, and arguments in favour of a justly ordered commensuration. The last argument in the series has a specific scope: it aims at demonstrating that, through arithmetical compensation, first more and then less intensely virtuous moral beings achieve the same reward as continuously evolving ones. The argument is imaginary;[11] it starts with the following premises:

> Let us posit two opaque bodies that are equal in quantity and have the same shape. And I take two luminous bodies, which are bigger than these opaque bodies; they are equal in size and both have the same figure. Now let one luminous body be placed next to one of the opaque bodies at a certain distance, in a medium that can shed light. In the same way, let the other luminous body be placed next to the other opaque body at the same distance and a medium entirely similar to the first one. It is clear that these two opaque bodies cause two shadows of equal size, which have the same conical shape.[12]

None of the manuscripts have figures to represent the optical experiment. Thus, Halifax's audience was supposed to be equipped with the knowledge required for understanding an argument of this complexity without visual support. This figure shall represent the argument at this stage:

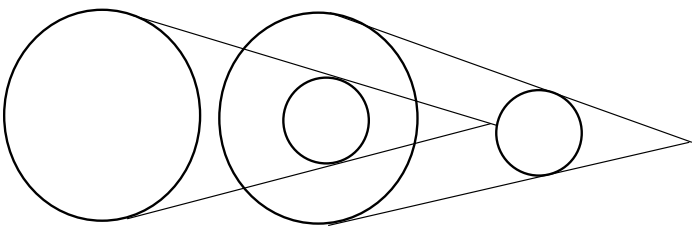

Figure 1: Reconstruction

The bigger circles represent the luminous bodies, the smaller circles the opaque bodies with their cones of shadows.

The schema corresponds to twice the astronomical case of the shadow the Earth casts within sunlight: this is the classical example astronomical optics proposes for conical shadows that can only be cast by bigger spheres on smaller spheres. In his argument, Halifax did not define the shape of neither the luminous, nor the opaque

[11] On the role of imaginary or thought experiments by the Oxford Calculators see Sylla, "The Oxford Calculators".

[12] "Ponantur duo corpora opaca aequalia in quantitate et eiusdem figurae. Et capio duo corpora lucida maiora hiis opacis, et sint aequalia et eiusdem figurae inter se. Et ponatur unum lucidum iuxta unum opacum in certa distantia in tali medio quod possit illuminare. Et eodem modo ponatur aliud lucidum iuxta aliquod opacum et in aequali distantia et consimili medio sicut primum. Ab istis corporibus opacis causantur duae umbrae aequales concurrentes in cono, manifestum est", BNF, Lat. 15880, fol. 21^{rb}.

bodies, yet, his conclusions will imply that the opaque bodies are in fact flat shields. This matter of fact is corroborated in another argument, in which Halifax does not assume the same spherical shape for the Earth he assumes for the Sun.[13]

In the geometrical and optical settings he initially stated, Halifax adds two human beings into the cones of shadows: "I take two humans who are equal in merit at the beginning of hour *(a)*. Let the first be placed in the cone of one shadow, and the second in the cone of the other."[14] Next, luminous bodies start an ascent and the human beings a moral life:

> Let one opaque body be *a* and the other *b*. I want opaque body *a* to start to diminish at the beginning of that hour, and to diminish continuously such that its total quantity disappears and ceases to be by the end of that hour. And I want the luminous body positioned next to *a* to start to ascend at the beginning of that hour to the point directly over body *a* that is called its zenith, and to ascend such that by the end of that hour, it is at that point. And I mainly want luminous body *a'* to move precisely in the same way for that hour to the point directly over opaque body *b*, such that by the end of that hour, it is at that point. After the first instant of that hour, these shadows were ever shorter than they were before, and the shadow caused by body *a* was ever shorter for the entire hour than the other. Then, I want one of the men to move continuously with the shadow of the body such that he shall be ever in the cone of that shadow, and the other man to be in the cone of the other shadow. And [I want] them to merit by two acts according to the same proportion wherewith they move, and wherewith the shadows are shortened.[15]

[13] The length of the Earth's shadow was calculated first by Ptolemy, then Kepler focused on it: Ptolemy, *Almagest* 5.9; and Raz Chen-Morris, *Measuring Shadows: Kepler's Optics of Invisibility* (University Park, PA: Penn State University Press, 2016), 40-44. On the three different types of shadows spherical objects can cast see Lukáš Lička, "Shadows in Medieval Optics, Practical Geometry, and Astronomy: On a *Perspectiva* Ascribed to Thomas Bradwardine", *Early Science and Medicine* 27 (2022): 195-198 and 198, n. 51. In his other argument, Halifax writes: "Et ad probationem dico quod si supponatur quod sit corpus sphericum illuminosum, puta sol, positum in medio infinito secundum imaginationem intensivum lumen lucens ut est aer, et quod ponatur iuxta illud corpus opacum minoris quantitatis, puta terra...", Vat. Lat. 1111, fol. 69^{vb}. On this thought experiment, see also n. 37.

[14] "Capio duos homines aequales in merito in principio *a* horae. Et ponatur unus in cono unius umbrae, et alius in cono alterius", BNF, Lat. 15880, fol. 21ra.

[15] "Et sit unum corpus opacum *a* et aliud *b*. Et volo quod *a* corpus opacum incipiat diminui in principio illius horae, et sic diminuatur continue quod quantitas sua tota corrumpatur et desinat esse in fine illius horae. Et volo cum hoc quod corpus lucidum iuxta *a* positum incipiat in principio illius horae ascendere [corrected from *descendere*] usque ad illum punctum directe supra *a* corpus qui dicitur chemb, et ascendat sic quod in fine illius horae sit in illo puncto. Et volo principaliter quod *a* corpus lucidum moveatur praecise per illam horam eodem modo ad punctum illum directum supra *b* opacum ita quod <sit> in illius puncti fine horae. Post primum instans illius horae erant istae umbrae semper breviores quam prius erant, et umbra causata ab *a* corpore semper erat per totam horam brevior alia. Volo tunc quod unus homo continue moveatur cum

Initially, every fact and figure is identical. When the luminous bodies begin to move, the figures become different, and subject to comparison or, more adequately, commensuration. One opaque figure continuously shrinks, changing both the size of the shadow it casts and the motion of the body placed in it, while the other opaque body remains the same, its shadow changing "naturally" as the luminous body rises over it toward the zenith, with the mobile body moving with continuous motion in it. This figure actualizes the previous figure:

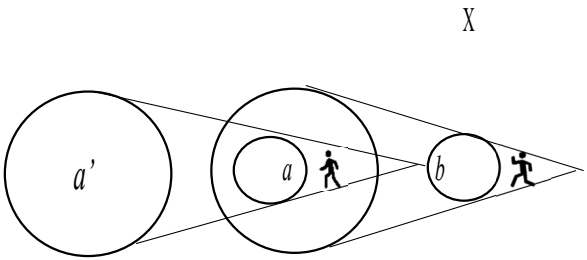

Figure 2: Reconstruction

This figure completes Figure 1 with the letters *a'*, *a* and *b*, and the human beings that move in the shadows of the opaque bodies. X corresponds to the zenith toward which the bigger circles accomplish their motion.

Different kinds of motions are involved in the argument. The two luminous bodies move with circular motion the quarter circle from the horizon to the zenith. Opaque body *a* is subject to diminution. The human beings that move in the shadows are subject to the motion of alteration in the ethical sense (they earn rewards or pains), whereas Halifax says them to move with local motion. Of the identical facts, some become identical again by the end of motion, when the shrinking figure *a* and the shadow of both figures disappear. In that moment, motion ceases again.

We must note that the analogy between physical motion and moral change corresponds to Richard Kilvington's understanding of ethics: Halifax's merit and demerit are, as Kilvington's virtues and vices, physical "things"; therefore, motion of change—increase or decrease—applies to them. Kilvington was the first among the

umbra corporis ita quod semper sit in cono illius umbrae et alius in cono alterius umbrae, et quod mereantur duobus actibus secundum eandem proportionem secundum quam moventur localiter et secundum quam umbrae istae abbreviantur", BNF, Lat. 15880, fol. 21ra. The letters *a* and *b* have a threefold meaning I distinguished in the main text with the help of different diacritic signs; they refer to: 1) the period of change (one hour *(a)*); 2) the opaque bodies and the human beings placed into their shadows (*a* and *b*); 3) the luminous body placed next to opaque body *a* (*a'*).

Oxford Calculators to apply a physical approach to ethics, and the only one, whose methodologically developed approach came down to us in a commentary on Aristotle's *Nicomachean Ethics*.[16] While Halifax's adhesion to Kilvington's new approach underlines his proximity with the Oxford Calculators, his argument is outstanding even in this context. It unifies perfection and imperfection, the motion in the celestial spheres, that is the circular motion of a planet, and motion in the inner region of the universe, "within which all was subject to continual alteration, growth and decay", that is the moral evolution of human beings.[17]

By the end of this peculiar experiment, the shadows disappear because the luminous body reaches a peak, the zenith. The zenith was a concept possibly more familiar in optical than in astronomical treatises at Oxford.[18] It appears in the works of Robert Grosseteste and Roger Bacon, followed by John Peckham and the astronomer Richard of Wallingford. More interestingly, the Oxford optical tradition devoted special interest not only to the zenith, but also to its mean degree: "finding the height of an object, when the solar altitude is 45°" was one of the specific aims optics was tasked with.[19] Reaching 45° also had an important implication for the proportions of the shadows, to which I shall come back below.

At this point of the argument, Halifax draws two conclusions, one scientific, the other theological: (1) In the first conclusion, he enunciates a theorem[20] valid for natural sciences and physical motions, which has no immediate theological relevance. This theorem could find its place in any work on physics: "Two moving bodies move precisely at the same time through two equal magnitudes, and one of them moves continuously faster than the other for the whole time; and yet, by the end of that time, an altogether equal space will have been traversed by each of them."[21] (2) In the second

[16] Monika Michałowska, "Kilvington's Use of Physical and Logical Arguments in Ethical Dilemmas", *Documenti e studi sulla tradizione filosofica medievale* 22 (2011): 467-494 and 470-471; Richard Kilvington, *Quaestiones super libros Ethicorum*, edited by M. Michałowska (Leiden: Brill, 2016).

[17] John D. North, *Stars, Minds and Fate. Essays in Ancient and Medieval Cosmology* (London: The Hambledon Press, 1989), 312.

[18] Follow http:-www.dmlbs.ox.ac.uk/web/dmlbs.html while citing the *DMLBS*, and https://logeion.uchicago.edu/lexidium while searching the corpus (28.6.2022).

[19] See Lička, "Shadows in Medieval Optics", 207.

[20] For the word 'theorem' and and its use about the mathematics of proportions in Thomas Bradwardine's *De causa Dei*, see Edit A. Lukács, "Calculations in Thomas Bradwardine's *De causa Dei*, Book I", in *Quantifying Aristotle*, 117.

[21] "Duo mobilia in eodem tempore praecise moventur per duas magnitudines aequales, et unum illorum continue per totum tempus movetur velocius alio, et tamen in fine temporis ab utroque illorum erit aequale <spatium> omnino pertransitum", BNF, Lat. 15880, fol. 21ra. This theorem seems to be a reformulation of Thomas Bradwardine's theorem 9 in chapter 3 of his *Treatise on Proportions*: "An object may fall in the same medium both faster, slower, and equally with some other object that is lighter than itself", Bradwardine, *Tractatus de proportionibus*, 115. This analogy would explain why BNF, Lat. 15880 has first *descendere*, although a descent would

conclusion, Halifax states that the theorem works analogically in theology: Equal human beings eliciting unequally meritorious acts can gain equal merits. Even though Halifax separates natural science from theology, he further states that the latter functions like the former: theology reflects natural science and not the reverse; hence, natural science is primary; theological speculation, derivative.

Next, Halifax proposes a proof of the argument that is based on a definition and a sophism related to the nature of space and the quicker motion. The proof is centred on the velocity of the moving body that follows the shadow of body *a*, a uniformly increasing motion. This mobile body moves continuously faster and traverses more space than the other mobile. Yet, what does being quicker mean? To define it, Halifax quotes one of Aristotle's texts debated by the Calculators in the context of the proportional calculation of motion:

> The mobile following the shadow of body *a* shall move continuously quicker for the whole hour according to the definition of quickness and slowness that the Philosopher gives in *Physics* 4. For the quicker is that which traverses more space in the same time, or an equal space in less time, or more <space> in less time. But at any part of that hour and continuously for the whole hour, the moving body *b*, which follows the shadow of body *a*, has traversed more space. Therefore, it moves faster, because it traverses more space.[22]

At the beginning of the argument, Halifax defined the same time frame for the two motions; therefore, he has to keep to the first definition of the quicker:

> Always after the first instant of that time, the shadow of body *a* becomes shorter, and consequently, in every instant, its cone was less distant from the *terminus ad quem* and more distant from the *terminus a quo* than the cone of the other shadow, and, thus, the mobile body extant in the other cone. And yet, by the end of the time, they will have traversed equal space, because the shadows will disappear in the same instant, namely, in the last instant of that hour, when the luminous bodies are at the points directly above the opaque bodies, therefore both mobile bodies will be in the place where the opaque body was. And thus, I have proved my point, that in the end they have traversed

constitute a case for the nadir, the opposite of the zenith. See n. 15. As we shall see, Halifax will continue to implicitly use this part of Bradwardine's *Treatise*.

[22] "Mobile sequens umbram *a* corporis per totam horam continue movetur velocius per definitionem velocitatis et tarditatis quem dat Philosophus 4 *Physicorum*. Nam velocius est quod maius spatium in eodem tempore, vel aequale spatium in minori tempore, vel maius in minori tempore pertransit. Sed in qualibet parte illius horae et continue per totam horam *b* mobile sequens umbram *a* corporis pertransit plus de spatio, ergo velocius movetur quod autem plus pertransit de spatio", BNF, Lat. 15880, fol. 21va. Cf. Aristotle, *Physics* 4.10 [218b15–18]. See also Clagett's discussion of related Aristotelian definitions and the nature of the continuum: Marshall Clagett, *The Science of Mechanics in the Middle Ages* (Madison, WI: The University of Wisconsin Press, 1959), 176-179, esp. 178.

> an altogether equal space, and yet one <mobile> moved for the whole time in every part of it faster than the other.[23]

This passage identifies continuously increasing motion as having a specific relationship to time and space: this kind of motion extends space and leaves time unchanged. The proof itself proceeds barely from definitions and linguistic construct (i.e., from a sophism), which means that it stands in the tradition of the Oxford Calculators, and in the mathematical tradition more generally.

Replies to the argument and other arguments

In further arguments of question 1, Halifax concentrates on the ethical implications of his optical experience. While drawing on mathematics and astronomy, he makes remarks mainly concerning the moral agents. In one of these remarks, he alludes to a common principle:

> And yet by the end of the time, <the two moral agents> will be equal in merit, which seems impossible and against the common principle, evident per se to every intellect that if you add unequals to equals, the things that result shall be unequal, which is per se known.[24]

The principle of unequals added to equals was used by the English mathematician and astronomer, Johannes de Sacro Bosco, in the context of the equinoxes in the thirteenth century. As we shall immediately see, equinoxes can also play a role in Halifax's experiment.

[23] "... semper post primum instans illius temporis umbra *a* corporis fit brevior, et per consequens in omni instanti minus distabat conus illius a termino ad quem et magis a termino a quo quam ille conus alterius umbre, et per consequens mobile existens in cono alterius. Et tamen in fine temporis est aequale spatium pertransitum ab eis, quia in eodem instanti finientur illae umbrae, scilicet in ultimo instanti illius horae quando corpora luminosa sunt in punctis directe supra ista corpora opaca, ergo tunc utrumque mobile erint in loco ubi erat corpus opacum. Et habetur intentum quod in fine est aequale spatium omnino pertransitum ab eis, et tamen unum in toto tempore movebatur velocius alio et in qualibet parte illius", BNF, Lat. 15880, fol. 21va. The definition of motion with the *terminus a quo-terminus ad quem* pair singularly recalls Roger Bacon's definition of motion, on which see Irène Rosier-Catach, "Roger Bacon and Grammar", in *Roger Bacon and the Sciences: Commemorative Essays*, edited by J. Hackett (Leiden: Brill, 1997), 67-102.

[24] "Et tamen in fine temporis sunt omnino aequales in merito quod videtur esse impossibile et contra commune principium omni intellectui per se notum, quod si aequalibus inaequalia addas que resultant, erunt inaequalia, quod est per se notum", BNF, Lat. 15880, fol. 21^{vb}. For the principle about equinoxes, see Johannes de Sacro Bosco, *De sphaera mundi* (Paris: Jean Petit, 1495), fol. 52^{vb}. The nature of imaginary experience makes Halifax's argument to match several concrete physical cases.

Halifax expands on these mathematical considerations while introducing two new elements into his argument. (1) He emphasizes that there are contraries involved in the first motion, not only acceleration, but deceleration too:

> Concerning this argument, I say that the mobile body following the shadow of body *a* moves for one part of the time faster than the mobile following the shadow of the other body, and for the other part <of time> slower than before, because first, it moves much faster until a given point in space and a given instant in time, and from that instant, it moves slower until the end of the time. The cause of this is the different approximation of the shadow to the opaque body, which causes the shadow.[25]

(2) He encourages readers to consult the *Perspectiva* to find out the moment of change from slower to quicker in the case of mobile *b*: "But the point, at which the one, which first moved slower, starts to move faster, is to be found in a conclusion of the *Perspectiva*."[26] It is remarkable that Halifax only hints at the *Perspectiva* without giving a precise reference. Fortunately, contemporary Oxford works and their sources allow for a plausible identification, since only one point in space was singled out in concerns about the zenith, namely the already mentioned mean degree at 45°.

The trigonometrical approach in optics allowed for two types of shadows: the *umbra recta* stood for the horizontal shadow, and the *umbra iacens* for the vertical shadow. From sunrise until 45° elevation of the sun, the *umbra recta* decreased, while the *umbra iacens* increased. When 45° was reached, the pair of shadows, *umbra recta* and *umbra iacens*, were equal in size, and corresponded to the height of the object casting the shadow. After the sun has passed the 45° altitude, the former proportions of the shadows were inversed: The *umbra iacens* was longer than the *umbra recta*.[27] It seems that Halifax's mobile bodies obey these rules: Their motion changes, when the luminous

[25] "Ad istud argumentum dico quod mobile sequens umbram corporis *a* in aliqua parte temporis movetur velocius quam mobile sequens umbram alterius corporis, et in aliqua parte tardius, quia primo movetur multo <velocius> usque ad determinatum punctum in spatio et determinatum instans in tempore, et ab illo instanti movetur tardius usque ad finem temporis. Et causa est diversa appropinquatio umbrae ad corpus opacum ex quo causatur umbra", BNF, Lat. 15880, fol. 21^{vb}.

[26] "Sed in quo puncto illud quod prius tardius movebatur, incipiat velocius moveri, hoc potest haberi ex alia conclusione Perspectiva", BNF, Lat. 15880, 22ra. Halifax is possibly mentioning the (pseudo-)Bradwardinian treatise *Perspectiva cum sit una*; other treatises that include the inverse proportionality in the two kinds of shadows alluded to here as inverse motion are quoted in Lička, "Shadows in Medieval Optics", 209-210.

[27] Lička's transcription from a *Liber de umbris* gives the principle as follows: "Et sciendum umbram rectam sole oriente infinitam esse, iacente vero nullius quantitatis. Sole vero ascendente recta descrescit, iacens vero crescit. Si vero sol pervenerit usque ad altitudinem 45 graduum, erunt umbre equales. Si vero ascenderit ultra 45, fiet iacens maior recta. Et nota hec incrementa et decrementa umbrarum proporcionaliter esse; ut cum altera fuerit medietas sue mensure fixe, altera erit dupla sue mensure fixe.", Lička, "Shadows in Medieval Optics", 210, n. 91. Cf. the "mean motion" as "an angular distance measured from some base direction" in astronomy: North, *Stars, Minds and Fate*, 314.

bodies traverse the 45° altitude. The second period in time that starts then represents the following change in the motion of the mobile following opaque body *a*: "... First, it moves much faster until a given point in space and a given instant in time, and from that [point and instant], it moves slower until the end of the time."[28] While it moved fast with the *umbra recta* between 0° and 45°, it moves slower after the 45° were passed, when the *umbra recta* gets smaller, and vice versa.

With this inversion of the motion, Halifax significantly enriched his theorem, which in its first formulation read:

> Two moving bodies move precisely at the same time through two equal magnitudes, and one of them moves continuously quicker than the other for the whole time, and yet, by the end of that time, an altogether equal space will have been traversed by each of them.[29]

The second formulation gives a theorem, in which an arithmetical proportion of gain and loss in velocity beyond the mean degree allows for affirming the overall equality of velocity.[30] At this point, one can fully appreciate the dependence of Halifax's argument on both the new Oxford tradition about motion, and the old tradition, on which Bradwardine still relied, namely Gerard of Brussels's *Book on Motion*. Considerations of geometrically perfect, three-dimensional objects in motion, as well as their velocity at the midpoint are aspects that appear in both Gerard and Halifax, while they are absent from Bradwardine.[31] In the rest of the argument, and especially in the inferences that follow, Halifax repeatedly insists on the arithmetical nature of the proportions he established. With this, he stands in line with the optical tradition as it appears in the Oxford treatise called *Perspectiva cum sit una*, but underlines his

[28] "... primo movetur multo <velocius> usque ad determinatum punctum in spatio et determinatum instans in tempore, et ab illo movetur tardius usque ad finem temporis", BNF, Lat. 15880, fol. 21^{vb}; see n. 25.

[29] "Duo mobilia in eodem tempore praecise moventur per duas magnitudines aequales, et unum illorum continue per totum tempus movetur velocius alio, et tamen in fine temporis ab utroque illorum est aequale spatium omnino pertransitum", BNF, Lat. 15880, fol. 21ra; see n. 21.

[30] According to M. Clagett, this principle is at the core of the theorem of uniform acceleration. See Clagett, *The Science of Mechanics*, 262-266.

[31] Halifax also considers, as Gerard does, the problem related to the circulation of a circular surface in its own plane. See BNF, Lat. 15880, fol. 21^{vb}. A closer comparison of Halifax's and Gerard's texts will be necessary to understand the nature of their interdependence. Also, as Murdoch and Sylla note, "Gerard's work consistently appears in medieval manuscripts together with other works on mathematics, statics, and optics, and not with questions or treatises in natural philosophy, something that was characteristic of fourteenth-century works on motion, even those were most mathematical in character", Murdoch and Sylla, "The Science of Motion", 222-223. Halifax's argument evidently tightens the link between Gerard and the Oxford Calculators.

difference toward Bradwardine, whose theorem of motion concerned geometrical proportions.[32]

As he discusses the inversion of proportions, Halifax switches to the causal explanation of the different motions in the shadows. This is an important issue because it returns to the beginning of the argument, and highlights the very reason of its complex setting, namely, the two shadows being part of the same shadow-cone: "If there were only one cause for the shortening of body *a*'s shadow, it would be shortened equally with the other shadow, but there are here two causes, equal to each other, for the diminishing of body *a*'s shadow, each of which is equal to the cause of the diminishing of the other body's shadow."[33] Halifax closes this issue with the diversity of proportions following the diversity of motions: "I say that these two causes of that one diminishing of the whole shadow do not make for a quicker diminishing of the whole shadow, only for a diversity of the proportions."[34] Bradwardine referred this principle to Averroes in his *Treatise on Proportions*, after he stated his theorem mentioned earlier:

> This is what Averroes intends when he says, in comment 71 on *Physics* 4: "...If, therefore, there are two movers and the things which they respectively move are equal, then the two motions are of equal speed. If the proportion is varied, the motion is also varied in that proportion.... The difference between motions with respect to slowness and fastness varies in accordance with the proportion between the two powers (namely, motive and resistive)."[35]

We recall that Halifax's proof of his argument relied on Aristotle's *Physics* 4; here, it ends with Averroes's commentary on the same passage.

After these considerations, Halifax calculates and discusses the implications the diverse mathematical proportions have for the moral agents.[36] This constitutes a

[32] For the prevalence of arithmetical proportions in optics, see Lička, "Shadows in Medieval Optics", 207, 210. For Bradwardine's geometrical proportions, see Bradwardine, *His Tractatus*, 113.

[33] "Si non esset nisi una causa breviationis umbrae corporis *a,* aequaliter abbreviaretur cum umbra altera, sed iam sunt duae causae aequales inter se abbreviationis umbrae *a* corporis, quarum utraque est aequalis causa abbreviationis umbrae corporis *a*", Vat. Lat. 1111, fol. 14ra.

[34] "Dico quod istae duae causae respectu abbreviationis unius umbrae non faciunt ad velocius abbreviationem totius umbrae, sed solum ad diversitatem proportionis", Vat. Lat. 1111, fol. 14^{rb}.

[35] Bradwardine, *His Tractatus*, 111.

[36] Here, I will give one example: "Et sic consimiliter respondetur ad illud argumentum de merito quod *a* plus meretur in aliqua parte *c* temporis quam *b* quia in prima parte proportionali. Sed *b* in omni parte post primam partem plus mereatur quam *a*, quia *b* acquisivit tantum de merito in tertia parte proportionali quam *a* acquisivit in secunda parte de novo. Sed tertia pars in duplo est brevior quam secunda pars, ergo *b* intensius meruit in secunda parte. Et sequitur propositum quod *a* per totum tempus non meretur intensius quam *b*. Antecedens probatur per casum, quia *a* habuit tantum de merito in fine primae partis quantum *b* habiturus fuit in fine secundae partis, et *a* habuit tantum in fine secundae partis quantum *b* fuit habiturus in fine tertio ut *b* 8. Si mensura meriti *a* in fine partis primae designata per 4 tantum habiturus est *b* in fine

definite turning point in his argument, for he introduces the infinite into the proportions. The infinite is mentioned only one time in Bradwardine's *Treatise on Proportions*.[37] Yet, Halifax informs it with a notion from Bradwardine's *Treatise*, namely composite bodies:

> Now a human being can commit a venial sin, for which he does not make satisfaction, and the same human being can commit a mortal sin, of which he does not repent. The same person then has a venial and a mortal sin. Let the mortal sin be *a* and the venial *b*, and I give the name *c* to both at the same time, likewise we give the name *knife* to signify the handle and the steel together. I do not want it to be united with the infinite otherwise than *per accidens*, as the Philosopher says in *Metaphysics* 5; not as if they would be something unified per se. ... If I posit them proportionally as before, *c* exceeds *a* with regard to the gravity of the sin, and thus one having *b* and *a*, which constitute *c*, it ascends heavier than if it had only *a*. This is evident per se.[38]

Halifax is concerned here with the commensuration or proportionality between the infinite and the finite. He posits two principles. One principle denies that the infinite can enter a substantial union with the finite. The other principle allows the finite entity to remain an element of the composite body one has to account for when

secundae partis, et sic mensura meriti *a* in fine partis secundae tantum habiturus est *b* in fine tertiae partis, ergo sicut *a* acquisivit in tertia. Et cum tertia pars est in duplo brevior quam secunda, ergo intensius meruit *b* in tertia quam *a*. Et sic potest argui de omnibus sequentibus", BNF, Lat. 15880, fol. 22ra.

[37] In the *Treatise*, Bradwardine mentions the following case from Aristotle's *On Heavens* 1: "In the chapter on the "infinite", where the following two theorems are proved: (1) that the infinite cannot be moved by the finite, and (2) that the infinite cannot move the finite", Bradwardine, *His Tractatus*, 119. Halifax proposes an argument on this section in Bradwardine, which cannot be presented here, but see n. 13 and 44. Yet, Bradwardine calculates with the infinite in his *Sentences* commentary, questions 1 and 9: Jean-François Genest, "Les premiers écrits théologiques de Bradwardine: textes inédits et découvertes récentes", in *Mediaeval Commentaries on the Sentences of Peter Lombard*, edited by G. Evans (Leiden: Brill, 2002), 395-421, 397-398, and 408-409; and in *De causa Dei*: Lukács, "Calculations in Thomas Bradwardine's *De causa Dei*, Book I", 115-122. In none of these theological writings is Bradwardine's presentation as analytical as Halifax's.

[38] "Nam unus homo potest committere unum peccatum veniale pro quo non satisfacit, et idem homo potest comittere peccatum mortale de quo non penitet. Idem habet tunc peccatum veniale et mortale. Et sit mortale *a* et veniale *b*, et inpono hoc nomen *c* ad significandum utrumque simul sicut inponitur hoc nomen *cultellus* ad significandum manubrium et ferrum simul iuncta. Nec volo aliter quod sint agregata infinita quam unum per accidens ut loquitur Philosophus 5 *Metaphysicae*, non ut sint per se aliquod unum... Et hoc posito proportionaliter sicut prius, *c* excedit *a* in gravitate peccati et sic habens *b* et *a* quae sunt *c*, gravius ascendit quam habens *a* solum. Illud est per se notum", BNF, Lat. 15880, fol. 22$^{rb\text{-}va}$. Here and in the quotes below in n. 39, 42, and 43, *a* stands for a mortal sin, *b* for a venial sin, and *c* for the composite entity uniting *a* mortal and *b* venial sin. For Thomas Aquinas, a knife was not a non-composite artificial object. Richard Kilvington referred to it in his *Sophismata* in discussing composites, as Halifax does, but without defining its nature. See *The Sophismata of Richard Kilvington*, edited by N. Kretzmann and B. E. Kretzmann (Oxford: Oxford University Press, 1990), 56.

calculating the motion of the composite body. The finite is neither annihilated, nor overwhelmed by the infinite. As for the relationship of the infinite to the composite body, Halifax describes it in using a peculiar vocabulary:

> *C* exceeds *a* with a proportion of greater inequality, and yet it is less than a proportion of greater inequality denominated by a given number, since it is neither double, nor triple, nor quadruple, nor sesquialternate, etc.; and yet, it is greater than a proportion of equality and less than every proportion of greater inequality denominated by a given number. In the same way, there can be a proportion less than a proportion of equality, and yet greater than every proportion of lesser inequality denominated by a given number.[39]

This passage relies on chapter 2 of Bradwardine's *Treatise on Proportions* in which the language and properties of proportions are presented and defined. Halifax does not only adopt Bradwardine's language, but his approach too. Bradwardine extended the role of denomination to proportions between incommensurables, which are according to him "not immediately, but mediately denominated by a given number, for they are immediately denominated by a given proportion, which is, in turn, immediately denominated by a number."[40] Thus, to a certain extent, mathematics admitted the commensuration we defined according to Bradwardine in introducing Halifax's question of the finite and the infinite.

Yet, "from these two inferences follow many others that appear surprising to many people."[41] Halifax introduces with these words a series of nine inferences closing question 1. I would like to point out only two of these inferences, which explain the infinite in terms of mathematical excess. While Halifax used Aristotle and Averroes approvingly until now with regard to the calculation of excess, in the second inference, he explicitly rejects Averroes's approach:

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[39] "*C* excedit *a* proportione maioris inaequalitatis et tamen minor proportione maioris inaequalitatis designabili per numerum quia nec est dupla, nec tripla, nec quadrupla, nec sexquialtera et sic de aliis; et tamen est maior proportione aequalitatis et minor omni proportione maiori inaequalitatis [corrected from *aequalitatis*] designabili per numerum. Et eodem modo potest esse proportio minor proportione aequalitatis et tamen maior omni proportione minoris inaequalitatis designabili per numerum", BNF, Lat. 15880, fol. 22va. On these proportions, see Thomas Bradwardine, *Traité des rapports entre les rapidités dans les mouvements*, translated by S. Rommevaux (Paris: Les Belles Lettres, 2010), xxviii–xxxi.

[40] Quoted in John E. Murdoch, "The Medieval Language of Proportions: Elements of the Interaction with Greek Foundations and the Development of New Mathematical Techniques", in *Scientific Change: Historical Studies in the Intellectual, Social, and Technical Conditions for Scientific Discovery and Technical Invention, from Antiquity to the Present*, edited by A. C. Crombie (New York: Basic Books, 1963), 237-271 and 258-259.

[41] "Ex istis duabus conclusionibus sequuntur multae aliae quae apparent multis mirabiles", BNF, Lat. 15880, fol. 22va. Bradwardine also uses the same adjective in talking about motion caused by magnets. See Bradwardine, *His Tractatus*, 123.

> The second inference is that not every <motion> exceeding another is divisible into an equal and an excess, which is against the Commentator in *Physics* 4, comment 74. The consequence is proved, since a mortal sin that is bigger than *c* would be smaller than *a*. Yet *c* is not divisible into an equal to *c* and into what exceeds *c*, since what would equal *c* is greater than *a*, since *c* is greater than *a*, and thus, it could be divided into an equal *a* and into what exceeds it; and thus, that by which it exceeds it would equal *b*, and thereby, the mortal part would be equal to the venial, the opposite of which has been said.[42]

This inference explains the infinite in terms of a composite mover through division, as we saw in the example of the knife. Another inference glosses the same relationship also in terms of excess, but this time through additions. This argument does not posit the infinite as negative, but in positive terms:

> The sixth inference is that any sin exceeds sin *a* only finitely, since not in its double proportion, and yet, through the finite addition of equal parts or the imperfect addition of unequal parts, it cannot be equal to itself. This is proved, since a mortal sin exceeds *a* only in a double proportion, and yet, *a* with the addition of one venial sin cannot be equal to itself, nor through the addition of two, three, or four equal parts, and so forth infinitely. Therefore, it cannot be equal to itself through the addition of equal, infinite other parts, as a syncategorematic infinite is created.[43]

Halifax again makes a significant contribution in applying the theorem and language of proportions Bradwardine presented in his *Treatise* to the syncategorematic infinite and in characterizing it as an ever-increasing series of venial sins. The fact that

[42] "Secunda conclusio est quod non omne excedens aliud est divisibile in aequale et excessum quod est contra Commentatorem, 4 *Physicorum*, commento 74. Et consequentia probatur quia peccatum mortale maius *c* esset minus *a*. *C* tamen non est divisibile in aequale *c* et in illud per quod excedit *c*, quia illud quod esset aequale *c*, esset maius *a*, cum *c* sit maius *a*, et tunc illud posset dividi in equale *a* et in illud per quod excedit. Et tunc illud per quod excederet, esset equale *b*, et ita pars mortalis esset aequale veniali, cuius oppositum dictum", BNF, Lat. 15880, fol. 22va. The fifth inference bespeaks the excess between different species, a topic that refers motion and proportions to their metaphysical background. On this background, see Sylvain Roudaut, *La mesure de l'être: Le problème de la quantification des formes au Moyen Âge (ca. 1250-1370)* (Leiden: Brill, 2022), 142-143.

[43] "Sexta conclusio est quod aliquod peccatum excedit *a* peccatum solum finite, quia nonnisi in duplo, et tamen per finitam additionem partium aequalium vel imperfectam additionem partium inaequalium non potest sibi aequari. Probatur, quia aliquod <peccatum> mortale excedit *a* solum in duplo, et tamen *a* cum additione unius venialis non potest sibi aequari, nec cum additione duorum aequalium, nec trium, nec quattuor, et sic in infinitum, ergo per infinitarum aliarum partium additionem aequalium non potest sibi aequari accidendo infinitum syncategorematice", BNF, Lat. 15880, fol. 22^{vb}. Halifax is said to have followed a contemporary Oxford theologian, Richard FitzRalph on the infinite, while some aspects of Gregory of Rimini's approval of the actual infinite fit Halifax's approach outlined here. See North, *Stars, Minds and Fate*, 243; and *De la théologie aux mathématiques. L'infini au XIV^{e} siècle*, edited by J. Biard and J. Celeyrette (Paris: Les Belles Lettres, 2005), 197-219.

the infinite in question is part of a specific theological case that human acting—and not divine existence—implies, is a further aspect of the complexity the Oxford Calculators had to deal with when thinking and calculating motion.

Conclusions

It is not easy to sort out the most significant novelty that Robert Halifax's argument provides. The experiment with shadows Halifax presents is the only optical experiment we know to apply the new Oxford method of calculating motion. The double setting of luminous and opaque bodies with shadow cones allows for the commensuration of different motions and the calculation of their velocity. Halifax applies the demonstration further to show that the proportional calculation of motion applies to Christian ethics, or, more simply, to the moral evolution of human beings. The preoccupation with the zenith, the change in the shadow's size at 45° altitude as a trigonometric premise and the applicability of this astronomical setting to a theological argument attest to the far-reaching context and implications that an optical experiment can have. In the same argument, Halifax provides inferences about the infinite. In these, he likewise uses proportional calculation, and emphasizes the theological and mathematical reality of the syncategorematic infinite.

From the first novelty, there is a rather simple, but significant historiographical conclusion to be posited. When, from the experiment with shadow cones, Halifax makes two inferences, the first concerns the philosophy of nature. In another section of his *Sentences* commentary, Halifax introduces another experiment, with the same pattern, intended to prove another theorem in Bradwardine's *Treatise on Proportions*.[44] Another experiment with the same pattern of shadow cones and decreasing bodies appears in one of the difficulties discussed in the treatise *De sex inconvenientibus* amid other theories of the Oxford Calculators.[45] Because at least two arguments about shadows, heavily indebted to the Franciscan optical tradition, were penned by Robert Halifax in his commentary on the *Sentences* and no one else, we shall assume that Robert Halifax was their author. If we define the Oxford Calculators as thinkers having contributed to or developed the method and theorems Bradwardine posited in the *Treatise on Proportions*, then we shall conclude that Robert Halifax was one of the Oxford Calculators.

Yet the greatest novelty Robert Halifax's argument implies concerns optics. In the growing series of aims medieval optics is said to have been tasked with– astronomy,

[44] See n. 13 and 37.

[45] On this treatise, see Clagett, *The Science of Mechanics*, 216, 262, 263-265, and S. Rommevaux-Tani's works and her contribution to this issue. The argument the treatise *De sex inconvenientibus* refers to is not by Richard Kilvington, cf. Elżbieta Jung and Robert Podkoński, *Towards the Modern Theory of Motion: Oxford Calculators and the New Interpretation of Aristotle* (Łódź: Łódź University Press, 2020), 95.

practical geometry, and ethics–[46], Halifax adds a rather unexpected aim. With his argument, medieval optics accounted for quantitative change and proportional calculation of motion, thereby demonstrating theorems in mathematics and physics. This is a forceful, new approach we barely started considering.

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[46] For the first two see Lička, "Shadows in Medieval Optics", 217-223 and the literature quoted there; on the last, there is ample literature.

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THE PARADOXES PRODUCED BY THE DIFFERENT WAYS OF DETERMINING THE RAPIDITY OF MOTION IN THE ANONYMOUS TREATISE *DE SEX INCONVENIENTIBUS*

LAS PARADOJAS CAUSADAS POR LAS DIFERENTES FORMAS DE DETERMINAR LA VELOCIDAD DEL MOVIMIENTO EN EL TRATADO ANÓNIMO *DE SEX INCONVENIENTIBUS*

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Abstract

The anonymous treatise *De sex inconvenientibus* is a good example of the *calculatores*' approach when dealing with motion. It is organized around four main questions relating to the determination of rapidity in four kinds of changes, i.e. in the generation of substantial forms, in alteration, in increase, and in local motion. In some arguments the author points out the paradoxes to which the two ways of determining the rapidity of a motion can lead: rapidity is determined by the effect produced (the degree of quality generated, the space covered, etc.) or it results from the ratio between the moving power and the resistance of the mobile or patient. While this twofold approach to determining rapidity appears in the majority of calculator texts, the two points of view – the analysis according to its effects and the analysis according to its causes – have rarely been confronted.

Keywords

Natural philosophy; Motion; Rapidity; 14th Century

Resumen

El tratado anónimo *De sex inconvenientibus* es un buen ejemplo del enfoque de los calculadores al tratar el movimiento. Está organizado en torno a cuatro cuestiones principales relativas a la determinación de la velocidad en los cuatro tipos de cambios, es decir, en la generación de formas sustanciales, en la alteración, en el aumento y en el movimiento local. En algunos argumentos, el autor señala las paradojas a las que pueden conducir las dos formas de determinar la velocidad

de un movimiento: la velocidad se mide por el efecto producido (el grado de calidad generado, el espacio cubierto, etc.) o resulta de la relación entre la potencia del movimiento y la resistencia del móvil o del paciente. Aunque este doble enfoque de la determinación de la velocidad aparece en la mayoría de los textos de cálculo, los dos puntos de vista – el análisis según sus efectos y el análisis según sus causas – rara vez se han confrontado.

Palabras clave

Filosofía natural; movimiento; velocidad; siglo XIV

Introduction

In the 14th century, several masters at Oxford University, known as the *Calculatores*, introduced mathematical tools, notably the theory of proportions, mixed with logic, to study motion in the framework of Aristotelian physics (the most famous are Thomas Bradwardine, Richard Kilvington, William Heytesbury, John Dumbleton, and Richard Swineshead, and after them, many scholars in all European universities are taking up their ideas).[1] Aristotle, in *Physics* VII (250a 4-6), explained that if a motor moves a mobile with a certain rapidity, a motor of double power moves a mobile with double resistance with the same rapidity. It is tempting to deduce that velocity follows immediately from the ratio of the power to the resistance, but Aristotle himself shows what paradoxes such an identification leads to: for example, any motor can move a mobile of any resistance, however great it may be, or a man could move a boat that twenty men move, even if it is twenty times slower, while experience proves that he would not be able to move it (Aristotle, *Physics*, VII, v, 250 a 10-18).

Referring to Aristotle and seeking to determine velocity from the ratio between the power of the motor and the resistance of the mobile, Thomas Bradwardine sets out, in his famous treatise *De proportionibus velocitatum in motibus*, an alternative rule, which was generally accepted until the 17th century:[2]

> The ratio between the rapidities of motions derives from the ratio between motive powers and resistive powers, and conversely,
>
> or
>
> The ratios between motive powers and resistive powers and the rapidities of motions are proportional in the same order, and conversely.[3]

[1] There are many studies on these authors. See in particular John E. Murdoch, "The Science of Motion", in *Science in the Middle Ages*, edited by D. C. Lindberg (Chicago: The University of Chicago Press, 1978), 206-264.

[2] See for example Marshall Clagett, *The Science of Mechanics in the Middle Ages* (Madison, Milwaukee and London: The University of Wisconsin Press, 1959), ch. 7.

[3] H. Lamar Crosby, *Thomas of Bradwardine. His* Tractatus de Proportionibus. *Its Significance for the Development of Mathematical Physics* (Madison: The University of Wisconsin Press, 1961), 112:

According to this rule, the rapidities are proportional to the ratios between powers and resistances. I will not discuss here the mathematical problems posed by this formulation, which will be resolved by Nicole Oresme.[4] I notice that in the introduction to his treatise, Bradwardine says that he felt it necessary to present in a first chapter the little-known theory of proportions, which he uses for the study of motion, pointing out, following Boethius, that "whoever omits mathematical studies has destroyed the whole of philosophic knowledge."[5]

In this same treatise, Bradwardine explains that the rapidity of any local motion is also determined by the greatest distance traveled in a given time, or that the rapidity of a locally moved body is determined by the rapidity of the fastest moving point or the fastest moving points in that body.[6]

Unlike Bradwardine, who only studies local motion, William Heytesbury discusses, in the *Regule solvendi sophismata*, the three kinds of changes established by Aristotle: local motion, alteration, and increase or diminution.[7] Heytesbury takes up Bradwardine's rule of motion,[8] but he also explains, for each of the three kinds of changes, how to determine the rapidity from the space covered for local motion, from the latitude of the form acquired for alteration (e.g. the heat acquired during heating), from the quantity acquired for increase.[9] He then introduces the expressions "*quo ad*

"Proportio velocitatum in motibus sequitur proportionem potentiarum moventium ad potentias resistivas, et etiam econtrario" or "Proportiones potentiarum moventium ad potentias resistivas, et velocitates in motibus, eodem ordine proportionales existunt, et similiter econtrario"; the English translation is mine.

[4] See Sabine Rommevaux-Tani, *Les nouvelles théories des rapports mathématiques du XIV^e^ au XVI^e^ siècle* (Turnhout: Brepols, 2014), 15-34.

[5] Crosby, *Thomas of Bradwardine. His* Tractatus de Proportionibus, 64: "quisquis scientias mathematicales praetermiserit, constat eum omnem philosophiae periddisse doctrinam"; English translation, 65.

[6] Crosby, *Thomas of Bradwardine. His* Tractatus de Proportionibus, 130: "Cuiuslibet motus localis, velocitas secundum maximum spatium lineale ab aliquo puncto sui moti descriptum accipitur"; "Ideo videtur magis rationabiliter dici quod velocitas motus localis attenditur penes velocitatem puncti velocissime moti in corpore moto localiter".

[7] William Heytesbury, *Regule solvendi sophismata* (Venice: Bonetus Locatelllus, 1494), see the sixth chapter "De tribus predicamentis", fols. 37ra-52rb.

[8] Heytesbury, *Regule solvendi sophismata*, fol. 44vb: "(...) secundum proportionem potentie motoris ad potentiam resistivam generaliter attenditur velocitas in quocumque motu (...)".

[9] Heytesbury, *Regule solvendi sophismata*, fol. 38vb: "In motu autem locali difformi in quocumque instanti attenditur velocitas penes lineam quam describeret punctus velocissime motus si per tempus moveretur uniformiter illo gradu velocitatis: quo movetur in eodem instanti: quocumque instanti dato"; fol. 45ra: "Ideo sequitur tertia positio quam inter alias in ista materia reputo veriorem scilicet quod universaliter omnis velocitas talis motus attenditur penes proportionem quantitatis de novo uniformiter acquirende in tanto tempore vel in tanto ad quantitatem prius habitam (...)"; fol. 51ra:"Ideo sequitur tertia positio et ultima quam magis probabiliter meo iudicio poterit sustineri: videlicet quod omnis velocitas in alteratione attenditur penes maximam latitudinem talis

effectum", to qualify the determination of rapidity from the space covered, the heat or the quantity acquired, and "*quo ad causam*" to qualify the determination of rapidity from the ratio of power to resistance in the case of local motion.[10] It is indeed necessary that the power of the motor or the agent be greater than the resistance of the mobile or the patient for there to be motion, and the action of the motor or agent on the mobile or patient causes the change. Thus, Nicole Oresme, in his treatise *De proportionibus proportionum*, speaks of the ratio from which rapidity arises ("*proportio a qua venit velocitas*"[11]) and of the rapidity that comes from such a ratio ("*velocitas que a tali proportione oriatur*"[12]). Moreover, the effect produced is either the space covered, for local motion, or the form acquired, for alteration, or the quantity acquired, for increase.

In most of the treatises of the *Calculatores* tradition to which Bradwardine and Heytesbury belong,[13] where the question of determining rapidity for the different kinds of change is raised, the two ways of understanding rapidity, from the effect or from the cause, are treated separately.[14]

Several remarks are called for at this point:

– It is anachronistic to identify these two ways of studying rapidity with the division between dynamics and kinematics in modern physics; I agree with Daniel A. Di Liscia, who has explained this point perfectly.[15]

– To express the dependency between rapidity and cause or the ratio between power and resistance, Bradwardine uses the verb "*sequitur*", which Crosby translates as "varies in accordance with";[16] and to express the dependency between rapidity and

forme sue qualitatis que uniformiter acquiretur alicui subiecto maiori seu minori in tanto tempore vel in tanto correspondenter."

[10] He ends the chapter on local motion with these words (Heytesbury, *Regule solvendi sophismata*, fol. 44rb): "Ideo viso iam generaliter penes quid tamquam quo ad effectum attendatur velocitas in motu locali: quia secundum proportionem potentie motoris ad potentiam resistitivam generaliter attenditur velocitas in quocumque motu tanquam quo ad eius causam sequitur secunda pars huius capituli in qua perscrutabit penes quid quo ad effectum attendatur velocitas in augmentatione et diminutione, communiter dictis que rarefactio et condensatio appellantur."

[11] Nicole Oresme, *De proportionibus proportionibus* and *Ad pauca respicientes*, edited with Introductions, English Translations and Critical Notes by E. Grant (Madison: University of Wisconsin Press, 1966), 288, l. 357.

[12] Nicole Oresme, *De proportionibus proportionibus* and *Ad pauca respicientes*, 290, l. 374.

[13] There are many works on this tradition. See for example: Edith Dudley Sylla, "The Oxford calculators", in *The Cambridge History of Later Medieval Philosophy. Vol. 1: From the Rediscovery of Aristotle to the Disintegration of Scholasticism 1100–1600*, edited by N. Kretzmann, A. Kenny, J. Pinborg and E. Stump (Cambridge: Cambridge University Press, 1982), 540-563.

[14] See Daniel A. Di Liscia, "Velocidad *quo ad effectus* y velocidad *quo ad causas*: la tradición de los calculadores y la metodología aristotélica", in *Method and Order in Renaissance Philosophy of Nature. The Aristotle Commentary Tradition*, edited by D. A. Di Liscia, E. Kessler and Ch. Methuen (Aldershot: Ashgate, 1997), 143-176.

[15] Di Liscia, "Velocidad *quo ad effectus* y velocidad *quo ad causas*", 173-176.

[16] Crosby, *Thomas of Bradwardine. His* Tractatus de Proportionibus, 112 and 113.

distance traveled, Bradwardine uses the expression "*attenditur penes*" translated by Crosby as "is to be determined by". Grant, in his edition of Nicole Oresme's *De configurationibus qualitatum et motuum*, translates "*attenditur penes*" as "is a function of" in most cases[17] or "is measured by"[18] or sometimes "is attended", specifying in the latter case "i.e. is measured by".[19] I note that in his treatise *De configurationibus qualitatum et motuum*, Nicole Oresme uses the verb "*mensuratur*" only in the case of determining the rapidity from the space traveled in the local motion.[20] Further study of these expressions and their uses in the *Calculatores* treatises would be necessary to determine their exact meanings; in particular, it would be necessary to see whether the term "*mensura*" is usually used in this context.

– I note that Bradwardine's rule and the rules which express rapidity in terms of space covered, form or quantity acquired, are rarely used in these texts in order to calculate rapidity (even though Bradwardine's rule is a mathematical statement). These rules are generally used, in the comparison of two motions, to explain that one is faster than the other, or to decide whether a motion is uniform or uniformly difform, for example. Thus, if the ratio of power to resistance for one change is greater than the ratio of the same type for the other change, the former is said to be faster than the latter. And if, during a change, the ratio of power to resistance remains unchanged, the change is said to be uniform; it is uniformly difform if this ratio increases or decreases continuously. Moreover, if more space is covered by the first mobile than by the second in the same time, the first will be said to be faster than the second. All these considerations are qualitative.

– To my knowledge, the link is never made by Bradwardine or Heytesbury between these two approaches to determining rapidity, *quo ad effectum* and *quo ad causam*. And this seems to be the case for the other members of the *Calculatores* tradition,[21] with the exception of the author of *De sex inconvenientibus*, as we shall now see.

The anonymous treatise *De sex inconvenientibus*

In a treatise entitled *De sex inconvenientibus*, written between 1335 and 1339, the anonymous author, who is perfectly familiar with the works of Bradwardine,

[17] Marshall Clagett, *Nicole Oresme and the Medieval Geometry of Qualities and Motions. A Treatise an the Uniformity and Difformity of Intensities known as* Tractatus de configurationibus qualitatum et motuum (Madison, Milwaukee and London: University of Wisconsin Press, 1968), 169, 221, 223, 225, 245.

[18] Clagett, *Nicole Oresme and the Medieval Geometry of Qualities and Motions*, 215, 277.

[19] Clagett, *Nicole Oresme and the Medieval Geometry of Qualities and Motions*, 279.

[20] Clagett, *Nicole Oresme and the Medieval Geometry of Qualities and Motions*, 168, l. 9-11: "Item sicut velocitas in motu locali secundum longitudinem spatii mensuratur, ita in alteratione velocitas attenditur penes intensionem."

[21] See Daniel A. Di Liscia, "Velocidad *quo ad effectus* y velocidad *quo ad causas*...".

Heytesbury, whom he quotes, and undoubtedly Kilvington, even though he does not quote him, raises the question of determining the rapidity for the three usual kinds of changes, i.e., alteration, increase and local motion; but the author adds to these the generation of substantial forms.[22] The treatise thus consists of four main questions, to which are attached secondary questions or articles (three per main question).[23] The treatise is thus composed of *Questiones*. In this type of text, the *quod non* or *quod sic* arguments that open the *Questio* are not very developed, the most important part being the *determinatio,* in which the author develops his answer to the question asked.[24] This is not the case in *De sex inconvenientibus*. The *determinationes* are reduced; for the most part, the author simply says which opinion he agrees with, with a few exceptions (for example, for the article concerning the theorem of the middle degree, he gives several demonstrations of this theorem[25]). On the other hand, he presents three opinions for each main question and produces for each of them a set of six *inconvenientes* or difficulties that would result from the acceptance of these opinions, even for the one (the third) that he finally accepts. And for each article, he produces six difficulties that would result from a positive or negative answer (as the case may be) to the question posed. Hence the title of the treatise is *De sex inconvenientibus* (About six difficulties). It is several of these *inconvenientes* that we will examine here, those in which the author confronts the points of view on the case treated.

Contradiction between the two ways of determining rapidity

The first main question of the treatise asks whether the rapidity of generation of substantial forms can be determined. The cases considered in this question are of two kinds: a hot body *a* warms another less hot or a cold body *b*, introducing its form of heat until *b* becomes as hot as *a*; a body becomes hotter by the destruction of its internal coldness by its internal heat. These are thus processes of alteration, but described as the generation of heat from other heat or by the destruction of cold.

The author records three positions regarding the determination of the rapidity of these processes. He rejects the first two and accepts the third, but presents six

[22] See J. Papiernik, "How to measure different movements? The 14th-century treatise *De sex inconvenientibus*", *Przegląd Tomistyczny* 25 (2019): 445-460.

[23] See Sabine Rommevaux-Tani, *"De sex inconvenientibus". Un traité anonyme de philosophie naturelle au XIV^e siècle* (Paris: Vrin, 2022); this book contains the critical edition of the *De sex inconvenientibus* and a doctrinal analysis of the treatise.

[24] For the genre of the Questio see, for example: Olga Weijers, *La 'disputatio' dans les facultés des arts au moyen âge* (Turnhout: Brepols, 2002) and more recently Olga Weijers, *In Search of the Truth. A History or Disputation Techniques from Antiquity to Early Modern Times* (Turnhout: Brepols, 2013).

[25] See Sabine Rommevaux-Tani, "The influence of the Oxford Calculatores on the Understanding or Local Motion: The Example of the *Tractatus de sex inconvenientibus*", in *Quantifying Aristotle. The Impact, Spread and Decline of the Calculatores Tradition*, edited by D. A. Di Liscia and E. Sylla (Leiden: Brill, 2022), 153-185.

difficulties raised by each of these three positions. According to the first position, the rapidity of such a kind of generation would depend on the form or quality introduced by what generates it.[26] And the explanation that follows the statement of this position is the following:

> (...) in heating, for example, where a more intense form of fire is introduced, the motion by which that form was introduced is faster than another motion in which a weaker form is introduced.[27]

Then the author considers the case of an extreme heat *a* (a fire) approximated by a less hot body *b*.[28] He assumes that *b* is uniformly difformly hot, i.e. he considers a linear body whose heat is continuously distributed from one end to the other, from degree 0, or non-degree of heat, to an extreme degree, and he further assumes that the hottest end is of extreme heat exclusively (it has a degree of heat lower than the extreme degree by an indivisible).

On the one hand, the author notes that, since the heat of *b* increases due to the action of *a* on *b*, the resistance of *b* to heating by *a* diminishes continuously. Thus, the ratio between the power of *a* and the resistance of *b* increases continuously during the whole heating process. And since, according to Bradwardine´s rule, the rapidity depends on the ratio of the power of *a* to the resistance of *b*, then the rapidity increases; the motion is uniformly accelerated or uniformly difform.

But on the other hand, it may be noticed that *a* introduces during the whole period of the motion an extreme constant heat. Since the rapidity is, according to this first opinion, determined by the degree of heat introduced, the rapidity is constant; the motion is uniform.

Then the following difficulty arises, which leads the author to reject this first: "*a*, which generates, will continuously generate with a greater and greater ratio, and yet, continuously, it will generate uniformly."[29] The motion is uniform if the rapidity is determined by the generated form, i.e. by the effect produced, but the motion is uniformly difform if we consider it from the point of view of the cause, that is, the ratio between power and resistance (even if the author of *De sex inconvenientibus* does not use the terms 'effect' and 'cause' in this treatise).

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[26] Rommevaux-Tani, "*De sex inconvenientibus*", 136: "secundum sectam positionis prime sequitur quod talis velocitas attenditur penes formam inductam vel inducendam a generante."

[27] Rommevaux-Tani, "*De sex inconvenientibus*", 135: "quando generans inducit vel incipit inducere formam suam, verbi gratia in calefactione, ubicumque inducitur forma ignis intensior, motus iste, quo inducitur, est velocior aliquo alio motu, quo forma remissior inducitur."

[28] See the second difficulty raised by this position: Rommevaux-Tani, "*De sex inconvenientibus*", 138.

[29] Rommevaux-Tani, "*De sex inconvenientibus*", 136: "*a* generans continue generabit a proportione maiori et maiori, et tamen ipsum continue uniformiter generabit."

The paradoxes caused by the two ways of determining rapidity are also at the heart of the difficulties raised by the second position presented by the author regarding the determination of the rapidity of generation:

> such rapidity would depend on the latitude of the form to be acquired and on the quantity in which the latitude of this form to be acquired is extended.[30]

The term "latitude" refers to the variation in intensity of forms, qualities, quantities, rapidities, etc., during a change in a subject.[31] We also find in *De sex inconvenientibus* the term "degree", referring to the latitude. Thus, when a body is heated, its heat increases from degree *a* to degree *b*, passing through all intermediate degrees; all these degrees constitute the latitude *ab*.

Moreover, the statement should be understood as follows: the rapidity is determined by the quantity of the altered subject when equal forms are introduced, and it is determined by the latitude of the form introduced in equal subjects. The author never considers the case where latitudes of different forms are introduced in subjects of different quantities.

We are not going to examine all the difficulties arising from this second opinion, in which, as has been stated, the author compares the two modes of determining rapidity. Let us look at the fifth.[32] The author presents the case of two heats, *a* and *b,* acting respectively on *c* and *d*, introducing equal latitudes of heat. It is assumed that *a* is one hundred times hotter than *b* and that *c* and *d* are of equal quantities.

The two heats act with equal rapidities, since the rapidity is, according to this second opinion, determined from the latitudes introduced in equal subjects, and it was assumed that *a* and *b* introduced equal forms in their patients.

Furthermore, it was assumed that *a* has a power to act one hundred times greater than *b*, and the patients *c* and *d* have equal resistances, so that *a* alters *c* one hundred times faster than *b* alters *d*.

In conclusion: "*a* and *b*, things that generate, alter their patients equally, and yet *a* does so a hundred times faster."[33] Again, equal effects imply equal rapidities, but unequal ratios lead to the conclusion that the changes are unequal.

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[30] Rommevaux-Tani, "*De sex inconvenientibus*", 142: "talis velocitas attenderetur penes latitudinem forme acquirende et penes quantitatem per quam extenditur ista latitudo istius forme acquirende, sicut ponit seconda positio."

[31] For this notion see: Edith Sylla, "Medieval concepts of the latitude of forms. The Oxford calculators", *Archives doctrinales et littéraire du Moyen Age* 40 (1973) : 223-283, in particular 251-257.

[32] Rommevaux-Tani, "De sex inconvenientibus", 145.

[33] *Ibid.*, 143: "*a* et *b* generantia equaliter alterant sua passa, *a* tamen in centuplo velocius."

It should be noted in this case that the numerical value "one hundred" is of no importance in the reasoning here. The only thing that matters is that *a* acts more strongly than *b*.

Let us now consider one of the arguments that the author opposes to the second opinion concerning the determination of the rapidity of alteration. According to this opinion, the rapidity would depend on the quantity or the extension of the subject in which the alteration takes place.

The author then considers the case of a fire *a* heating water *b* in such a way that *a* continuously introduces as much heat into any part of *b* during the process. The alteration is thus assumed to be uniform, according to this opinion. But the author notes that the resistance of *b* to the action of *a* decreases as *b* becomes hotter and hotter. So, the ratio increases between the power of *a*, which is constant, and the resistance of b, which decreases. Hence the difficulty that "something that alters will continually alter with an ever-increasing ratio and yet it will continually alter uniformly."[34] Here again, the author rejects this opinion because of this contradiction.

Distinction between "being moved or changed by faster motion or change" and "being moved or changed more quickly"

Let us return to the first opinion, considered in relation to the determination of the rapidity of generation: the rapidity would depend on the form or quality introduced. Let us consider the same case as above: the generation of heat produced by an extreme heat *a* in a uniformly difformly hot body *b*, the most intense end of which is in the extreme form of heat exclusively. Now compare it with the generation of heat produced by *c,* half as hot as *a,* on a uniformly difformly hot body *d*, similar to *b* but half as hot.[35] The heat introduced by *c* is twice as low, therefore, according to this first opinion, as *a* generates; the time taken for the action of *a* in *b* is half the time taken for the action of *c* in *d*.

It may be observed, moreover, that the ratio of the power of *a* to the resistance of *b* is the same as the ratio of the power of *c* to the resistance of *d*. The author does not explicitly make this last remark, but it can be deduced from what he says: "*a* and *c* will generate their forms precisely as quickly ('*eque cito*'). Indeed, each of them immediately after that will introduce its form into the patient that resists it, and only by a motion of generation."[36]

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[34] *Ibid*, 208: " aliquod alterans alterabit continue a maiori proportione et maiori, et tamen continue uniformiter alterabit"; proof on page 209.

[35] See the fifth *inconveniens*: Rommevaux-Tani, "*De sex inconvenientibus*", 140-141.

[36] Rommevaux-Tani, "*De sex inconvenientibus*", 141: "eque cito precise generabunt *a* et *c* formas suas, quia utrumque istorum immediate post hoc inducet formam suam in passum sibi resistens, et solum motu generationis."

The difficulty is summarized as follows: "*a* and *c* are two things that generate similar forms in patients *b* and *d*, and *a* will generate its form in half the time of *c* and they begin to generate at the same time, yet *c* generates its form precisely as fast as *a*, all other things being equal."[37] So, the motion is accelerated, if we consider the effect produced, but it is uniform if we consider the cause, i.e. the ratio of power to resistance.

Note that in this argument, the author uses two different terminologies: he speaks of a motion that is "faster" ("*velocior*") than another on the one hand, and on the other hand, he talks about mobiles that reach the final heat "as quickly" ("*eque cito*"); the first notion, "faster", refers to the determination of rapidity from the effect produced, and "as quickly" to the ratios between power and resistance, which are equal here.

Note, moreover, that for the reasoning to be valid, the author could have said that *c* is less hot than *a*, and *b* is less hot than *d* according to the same ratio, without specifying what ratio. And he would have come to the paradoxical conclusion that *a* and *c* are two things which generate similar forms in patients *b* and *d*, and *a* will generate its form in less time than *c*, and yet *c* generates its form precisely as quickly as *a*. That *a* will generate its form in half the time of *c* in the case under consideration is anecdotal.

Still, with regard to the generation, the author agrees with the third position, according to which the rapidity depends only on the latitude of the form to be acquired, without taking into consideration the extension of the subject of generation.[38] But here again, he proposes six difficulties that may arise if this position is accepted.

He thus considers two identical bodies, *a* and *b*, slightly hot. These two bodies are heated by the destruction of their intrinsic coldness by their intrinsic heat. And it is assumed that all the coldness is thus destroyed in *b*, so that the whole of *b* becomes extremely hot; in *a*, however, one half remains unchanged, while the other half becomes extremely hot by the destruction of the coldness in it.[39]

The altered subjects are *b* and half of *a*. Since *b* and *a* have been assumed to be identical, the altered subjects are in a double ratio. And the same extreme heat is acquired by both. It is deduced that the alteration by which *b* is changed is twice as fast as that by which *a* is changed. But the author notes also that the alterations in *a* and *b* begin and cease at the same time (the two halves of *b* begin and cease to heat up at the same time as the half of *a*).

[37] Rommevaux-Tani, "*De sex inconvenientibus*", 137: "*a* et *c* sunt duo generantia que generabunt ex *b* et *d* passis formas illis consimiles, et *a* in duplo minori tempore generabit formam suam quam *c*, et simul incipiunt generare, et tamen eque cito precise generabit *c* formam suam sicut *a* formam suam, ceteris paribus".

[38] Rommevaux-Tani, "*De sex inconvenientibus*", 147: "si in generatione formarum sit certa ponenda velocitas, igitur talis velocitas attenderetur solum penes latitudinem forme acquirende, sicut ponit tertia positio et tenet tota scola oxoniensis."

[39] Rommevaux-Tani, "*De sex inconvenientibus*", 151.

Thus we have the following difficulty (the fifth):

> "in the intrinsic generation of an element, two uniform slightly hot things, of equal quantities and heats, are altered during precisely the same time, until each of them becomes extremely hot, in such a way that they begin to be altered as quickly and cease to be altered as quickly, and yet the entire alteration by which *b* will be continuously altered will be continuously twice as rapid as the alteration by which *a* will be continuously altered."[40]

The author must respond to the argument because he accepts this opinion.[41] He rejects, of course, the argument that *b* moves twice as fast as *a* because the subject in which the alteration in *b* takes place is double that in which the alteration in *a* takes place. Indeed, according to this position, only the latitude of the acquired form is to be taken into consideration and not the extension of the subject where the alteration takes place.

But he also takes advantage of this case to distinguish between "be altered by faster motion" ("*velociori motu alteratur*") and being "altered more quickly" ("*velocius alteratur*): *a* is altered by a motion twice as fast, when the ratio of power to resistance is twice as great, and *a* is said to be altered twice as fast, if the latitude acquired by *a* is double. And the author accepts that an alteration can be said to be twice as fast, while the thing altered is not twice as fast. He therefore rejects the following implication: "*b* is altered by a motion twice as fast as the motion by which *a* is altered, so *b* is altered twice as fast as *a*." He thus acknowledges that the two ways of determining rapidity can lead to different conclusions, at least for this type of alteration.

Note again that the fact that *b* is altered precisely twice as fast as *a* is unnecessary; the paradox is that *b* is altered faster than *a*.

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[40] Rommevaux-Tani, "*De sex inconvenientibus*", 147: "QUINTO, quod in generatione intrinseca elementi, aliqua sunt duo calida remissa uniformia equalis quantitatis et eque calida, que alterabuntur per idem tempus precise, quousque utrumque istorum fuerit calidum in summo, ita quod eque cito incipiunt alterari et eque cito desinent alterari, et tamen tota alteratio qua *b* continue alterabitur erit continue in duplo velocior quam alteratio qua *a* continue alterabitur."

[41] Rommevaux-Tani, "*De sex inconvenientibus*", 201: "AD QUINTUM ET SEXTUM, que in modico discrepant, dicitur concedendo illas conclusiones contra, quarum primam arguitur sic: « *a* et *b* iam sunt per omnia similia et utrumque alterabitur uniformiter, quousque ipsum fuerit summum; et *b* continue alterabitur in duplo velocius; igitur *b* erit citius summum quam *a* », conceditur consequentia et negatur antecedens pro ista parte: « *b* continue alterabitur in duplo velocius *a* ». Sed contra: « duplo velociori motu alteratur *b* quam *a* », conceditur. « Igitur in duplo velocius alteratur *b* quam *a* », non sequitur. Et si adhuc arguitur: « a maiori proportione alteratur *b* quam *a*, igitur velocius alteratur *b* quam *a* », adhuc non sequitur. Sed illud sequitur quod velociori motu alteratur *b* quam *a*, quoniam motus sequitur proportionem, ipsum autem velocius, tardius vel equaliter sequitur magnitudinem spatii in eodem tempore vel equali descripti, sicut clarius patebit in questione de augmentatione."

This distinction between "having a faster motion" and "being moved more quickly" can be found in the third main question concerning increase in the arguments against the third opinion, which is the one accepted by the author. According to this opinion, the rapidity of the increase results from the ratio between the latitudes of rarity (i.e. the quantities of bodies at the beginning and at the end of the increase), and one increase is faster if the linear space described by the fastest moving point or points is longer in the same time.[42] In the case of increase, in the absence of an identified agent, rapidity cannot result from the ratio of the power of the agent to the resistance of the patient. The difficulties raised relate to the apparent contradiction that may arise between the two ways of determining rapidity stated by this position.

Difficulties may arise in particular from comparing the increase of a finite body *a* and an infinitesimally small body *b*, for example, an infinitesimally small part of *a* (one can imagine that *a* and *b* are linear quantities). Since the body *b* is infinitesimally small, it begins to move infinitely slowly, because the distance covered by its fastest moving point is infinitesimally small. This statement is justified as follows: if one body begins to rarefy along a certain distance with a certain rapidity, another body would begin to rarefy along half that distance with half the rapidity, and another along a third of that distance with three times the rapidity, etc., because the ratio between the rapidities depends on the ratio between the distances travelled by the fastest moving point. So, since *b* has been assumed to be infinitesimally small, it starts to become infinitely rarefied. If, on the other hand, it is assumed that the finite body *a* begins to rarefy with the same degree of rapidity, i.e., with the same ratio between the latitude of final rarity and the latitude of initial rarity, we have the first difficulty: "*a* and *b* begin rarefied with the same ratio, and yet *b* begins rarefied infinitely more slowly than *a*."[43]

Moreover, it follows from the same case that, whatever the degree of rapidity with which this same continuous *a* becomes rarefied (i.e. whatever the ratio between the latitudes of rarity), it begins to become rarefied infinitely slowly. Indeed, it is supposed that *a* is continuously rarefied, therefore part by part. Now, given a part of *a*, it is always possible to find one that is infinitely smaller than it. And according to the previous case, this infinitely small part will increase infinitely slowly. So, *a* will start to increase infinitely slowly. Thus, we have the second difficulty: "whatever ratio *a* begins to rarefy, it begins to rarefy infinitely slowly."[44]

[42] Rommevaux-Tani, "*De sex inconvenientibus*", 267: "velocitas in tali motu augmentationis attendetur penes proportionem latitudinum raritatis, et ipsum velocius penes proportionem quantitatum linealium a puncto velocissime moto vel a punctis velocissime motis in tanto vel in tanto tempore descriptarum."

[43] Rommevaux-Tani, "*De sex inconvenientibus*", 267: "*a* et *b* ab eadem proportione incipiunt rarefieri, et tamen in infinitum tardius incipit *b* rarefieri quam *a*."; proof on pages 267-268.

[44] Rommevaux-Tani, "*De sex inconvenientibus*", 267: "quecumque fuerit proportio a qua *a* incipit rarefieri, in infinitum tarde ipsum incipit rarefieri."; proof on page 268.

To these two difficulties the author responds by admitting the conclusions, and he adds: "as far as I can see, they have been clearly demonstrated and are not in contradiction with the rules of the ratios."[45] He then explains that the rapidity or slowness of an increase results from the ratio between the latitudes of rarity, and whether one increase is faster or slower than another depends on the ratio between the distances travelled by the fastest moving point or points in the bodies, in the same time.

He thus distinguishes two ways of qualifying the increase, which can lead to different conclusions, without this being a difficulty. And he adds that, in so doing, augmentation is distinguished from local motion:

> And although, perhaps, this is against the rules of ratios for local motion, it is not against these demonstrative rules for the rarefaction and increase, since these motions differ specifically from local motion.[46]

Conclusion

The author of the *De sex inconvenientibus* is well aware that there are different ways of determining the rapidity of a motion or change. In particular, rapidity can be determined by the effect produced, and any motion or change is more or less rapid according to the ratio between the power of the agent or motor and the resistance of the mobile or patient. The author makes evident this double way of considering rapidity by using different expressions to qualify them. He distinguishes between "having a faster motion or change" and "being moved or changing faster." The motion or change is said to be faster when the ratio of power to resistance is greater, and *a* is said to be moved or change faster than *b*, if the effect of the motion of change for *a* is more intense than for *b*. In the first case, the object considered is the motion or change which results from the ratio between power and resistance. In the second case, the object is the subject that is moved or changed, and the effect of the motion or the change on this subject tells us how quickly the subject is affected. The confrontation of these two points of view leads the author to reject certain opinions regarding generation, alteration, and increase.

Furthermore, we have noticed on several occasions that the numerical values present in the different cases are of no importance. The paradoxes raised arise from the fact that the rapidities are unequal, whereas the data of the problem should have led to

[45] Rommevaux-Tani, "*De sex inconvenientibus*", 295: "ET TUNC AD ARGUMENTA IN OPPOSITUM dico quod conclusiones adducte pro maiori parte sunt vere, videlicet prima, secunda, quarta et quinta, que, sicut mihi apparet, sunt clarius demonstrate, nec ille sunt contra regulas proportionum, quoniam, licet motus et ipsa velocitas et tarditas proportionem sequantur, ipsum tamen velocius et tardius sequitur proportionem spaciarum linealium in eodem tempore descriptarum."

[46] Rommevaux-Tani, "*De sex inconvenientibus*", 295: "Et licet forte hoc foret contra regulas proportionum de motu locali, non tamen foret hoc contra regulas demonstrativas in motu rarefactionis et augmentationis, cum illi motus specifice differant a motu locali."

the fact that they are equal, or vice versa. All these considerations in the *De sex inconvenientibus* are fundamentally qualitative.

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NICOLE ORESME ON MOTION AND THE ATOMIZATION OF THE CONTINUUM

NICOLE ORESME SOBRE EL MOVIMIENTO Y LA ATOMIZACIÓN DEL CONTINUUM

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Abstract

As Aristotle classically defined it, continuity is the property of being infinitely divisible into ever-divisible parts. How has this conception been affected by the process of mathematization of motion during the 14th century? This paper focuses on Nicole Oresme, who extensively commented on Aristotle's *Physics*, but also made decisive contributions to the mathematics of motion. Oresme's attitude about continuity seems ambivalent: on the one hand, he never really departs from Aristotle's conception, but on the other hand, he uses it in a completely new way in his mathematics, particularly in his *Questions on Euclidean geometry*, a tantamount way to an atomization of motion. If the *fluxus* theory of natural motion involves that continuity is an essential property of real motion, defined as a *res successiva*, the ontological and mathematical structure of this continuity implies that continuum is *in some way* "composed" of an infinite number of indivisibles. In fact, Oresme's analysis opened the path to a completely new kind of mathematical continuity.

Keywords

Continuity; Nicole Oresme; Mathematics; Motion; Fluxus Theory; Indivisibles; *res successiva*; Ontology; Infinitely Small

Resumen

De acuerdo con la definición clásica de Aristóteles, la continuidad es la pertenencia de ser infinitamente divisible dentro de las partes siempre divisibles. ¿Cómo ha afectado este concepto al proceso de matematización del movimiento durante el siglo XIV? Este artículo se centra en Nicole Oresme, quién ha extensamente comentado la *Física* de Aristóteles y, al mismo tiempo, llevó a cabo contribuciones decisivas relativas a las matemáticas del movimiento. La actitud de Oresme con respecto a la continuidad parece indecisa: por un lado, él nunca se aleja de la

concepción de Aristóteles; por otro lado, la utiliza de una manera completamente nueva en su matemática particularmente en sus *Cuestiones sobre la Geometría de Euclides,* una manera que es equivalente a una atomización del movimiento. Si teoría del *fluxus* del movimiento natural implica que la continuidad es una propiedad esencial del movimiento real, definida como una *res succesiva,* la estructura ontológica y matemática de esta continuidad insinúa que esta continuidad está de alguna manera "compuesta" de un número infinito de indivisibles. De hecho, el análisis de Oresme abrió el paso a una nueva forma total de continuidad matemática.

Palabras clave

Continuidad; Nicole Oresme; matemáticas; movimiento; teoría del fluxus; indivisibles; *res successiva*; ontología; infinitamente pequeño

Introduction

By teaching how to represent motion by geometrical diagrams in his *Tractatus de configurationibus qualitatum et motuum,*[1] Nicole Oresme[2] made a decisive contribution to the mathematization of motion.[3] Moreover, such a mathematization has ontological counterparts. Mathematizing motion requires us to identify it with a whole whose properties are determined by its very parts. The continuity of motion requires moreover that it is conceived as infinitely divisible in divisible parts, according to the classical

[1] Marshall Clagett, *Nicole Oresme and the Medieval Geometry of Qualities and Motions: a treatise on the uniformity and difformity of intensities known as Tractatus* De configurationibus qualitatum et motuum (Madison, Milwaukee and London: The University of Wisconsin Press, 1968). See also Marshall Clagett, *The science of mechanics in the Middle Ages* (Madison: University of Wisconsin Press, 1959); Peter Damerow, Gideon Freudenthal, Peter Mclaughlin and Jürgen Renn, *Exploring the limits of preclassical mechanics: a study of conceptual development in early modern science: free fall and compounded motion in the work of Descartes, Galileo, and Beeckman* (New York: Springer, 2004).

[2] On the life of Nicole Oresme, see Max Lejbowicz, "Nicole Oresme 'spectateur engagé'", in *Nicole Oresme philosophe: Philosophie de la nature et philosophie de la connaissance à Paris au XIVe siècle*, edited by J. Celeyrette and Ch. Grellard (Turnout: Brepols, 2014), 21-61.

[3] See the references in footnote 1. See also Philippe Debroise, *Mathématiques de l'intensité et Merveilles de la nature, Étude sur le* Tractatus de configurationibus qualitatum et motuum (Paris: Université Paris Diderot, Doctoral thesis, 2019); Pierre Duhem, *Études sur Léonard de Vinci*, 3 (Paris: Hermann, 1984 [1908]), 314-350; Pierre Duhem, *Le Système du monde. Histoire des doctrines de Platon à Copernic*, vol. 7 (Paris: Hermann, 1956), 462-633; Anneliese Maier, "La doctrine de Nicolas d'Oresme sur les 'configurationes intensionum'", *Revue des sciences philosophiques et théologiques* 32, 1/2 (1948): 52-67, also in Anneliese Maier, *Ausgehendes Mittelalter I: Gesammelte Aufsätze zur Geistesgeschichte des 14. Jahrhunderts* (Rome: Edizioni di Storia e Letteratura, 1964), 335-352; John E. Murdoch and Edith D. Sylla, "The Science of Motion", in *Science in the Middle Ages*, edited by D. C. Lindberg (Chicago and London: University of Chicago Press, 1978), 206-264; Pierre Souffrin and Jean-Pierre Weiss, "Le Traité des configurations des qualités et des mouvements. Remarques sur quelques problèmes d'interprétation et de traduction", in *Nicolas Oresme. Tradition et innovation chez un intellectuel du XIVe siècle*, edited by P. Souffrin and J.-P. Segonds (Paris: Les Belles Lettres, 1988), 125-134.

definition Aristotle gave of continuity in his *Physics.*[4] Could such an *understanding* of the continuum be maintained when applied to a mathematized motion? Superficially, Oresme never departs from this classical understanding of the continuum, particularly in his extended studies that are to be found in his *Questions on Physics.*[5] However, when one looks more precisely at his arguments and compares them to other, more mathematical works, like his *Questions on Euclidean geometry*,[6] one cannot fail to be struck by the completely original conception Oresme had of the continuum, and by the way he could turn those ontological views into strong mathematical techniques. In fact, those striking mathematical techniques are tantamount to an atomization of the continuum, an atomization that Oresme always *explicitly* refuses, but implicitly *practices*.[7] The goal of this paper is not to propose a general survey of Oresme's conception of the continuity of motion. More limited, its purpose is to present, compare, and comment on surprising texts that show how Oresme's understanding of the continuum was original, profound, and yet very ambivalent.[8] I shall first show that Oresme's *fluxus* theory, his identification of motion with a continuous motion, is in part due to the necessity of distinguishing real from apparent motion. However, we will then see that the ontology of real motion, identified with an absolutely successive being, retains some strong analogies with apparent motion, in particular its atomization. Finally, I will show how Oresme drew very paradoxical mathematical consequences of this kind of atomization, which allowed him to define a very fine-grained idea of an infinitely small increase.

[4] Aristotle, *Physics*, III.1, 200b18-20.

[5] Nicole Oresme, *Questiones super physicam. Books I-VII*, edited by S. Caroti, J. Celeyrette, S. Kirschner and E. Mazet (Leiden: Brill, 2013).

[6] Hubert L. L. Busard, *Nicole Oresme, Questiones super geometriam Euclidis* (Stuttgart: F. Steiner, 2010).

[7] This is the reason why Oresme's mathematics is relevant for the history of the calculus. See Carl B. Boyer, *The history of the calculus and its conceptual development* (New York: Dover Publications Inc, 1959), 61-95 (1st ed 1939); Adolf P. Youschkevitch, *Geschichte der Mathematik im Mittelalter* (Leipzig: Teubner, 1963); Charles Henry Edwards Jr., *The historical development of the calculus* (New York: Springer Verlag, 1979). One medieval studies following archimedean methods, see Marshall Clagett, *Archimedes in the Middle Ages*, 5 vols. (Madison and Philadelphia: University of Wisconsin Press and American Philosophical Society, 1964-1984).

[8] Oresme's deepness in mathematics is well established. His skill is mainly known for his doctrine of configurations and his theory of ratios of ratios. For a general survey, one can see on the first subject, see the bibliography in footnote 3. On the ratio of ratio, see Nicole Oresme, *De proportionibus proportionum and Ad pauca respicientes*, edited by E. Grant (Madison: University of Wisconsin Press, 1966); Sabine Rommevaux, *Les nouvelles théories des rapports mathématiques du XIVe au XVIe siècle* (Turnhout: Brepols, 2014).

1. Motion and continuity

1.1 Mathematical and ontological *fluxus*

Motion is a recurrent matter of concern in many of Oresme's works.[9] Oresme contributed to the development of a *mathematical* science of motion by defining a geometrical model for the study of the variation of motion, be it local or qualitative.[10] Variations of motion were only a special instance of the general theory of the latitude of forms, a science Oresme deepened in his *Questiones super geometriam euclidis* and synthetized in his *Tractatus de configurationibus qualitatum et motuum*. There, motion is mathematically assimilated to a kind of intensive quality, affecting a mobile whose specific intensity and velocity can vary according to space and time. The mathematical analysis of heating, for example, would distinguish two kinds of intensity at work: first, the intensity of heat, second, the intensity of "heating", of the motion itself, that is, the velocity of heating. Motion is called a "*fluxus*" more than one time,[11] and by such a *fluxus*, Oresme can indeed refer to concrete motions, or to mathematical and imaginary motions, like the *fluxus* of a line above another one, used to symbolize the simultaneous intensification of a whole subject.[12] Although never defined in Oresme's mathematical works, this notion of a *fluxus* is, on the contrary, the main concept of his ontological studies.

Indeed, Oresme also sought to understand more adequately the *essence* of motion, from a *gnoseological* and *ontological* point of view. This problem is mainly studied in his *Questiones super Physicam*, particularly in questions III.1 to 7.[13] In the first extended study of Oresme's commentary, III.1-7, Stefano Caroti acknowledged the originality of Oresme's position concerning the essence of motion, and the need for more analysis.[14]

In the background of this discussion, there is, in the Latin West, the classical distinction, due to Albert the Great, between two notions of motion: motion as a *forma*

[9] Stefan Kirschner, "Oresme's Theory of Motion", in *Nicole Oresme philosophe: Philosophie de la nature et philosophie de la connaissance à Paris au XIVe siècle*, Studia Artistarum 39, edited by J. Celeyrette and Ch. Grellard, (Turnhout: Brepols Publishers, 2014), 83-104; Johannes M. M. H. Thijssen, "The Debate Over the Nature of Motion: John Buridan, Nicole Oresme and Albert of Saxony. With an Edition of John Buridan's *Quaestiones Super Libros Physicorum, Secundum Ultimam Lecturam*, Book III, Q. 7", in *Evidence and Interpretation in Studies on Early Science and Medicine*, edited by E. Sylla and W. R. Newman, 14, 1-3 (2009): 186-210; Stefano Caroti, "La position de Nicole Oresme sur la nature du mouvement (*Questiones super Physicam* III, 1-8): problèmes gnoséologiques, ontologiques et sémantiques", *Archives d'histoire doctrinale et littéraire du Moyen Age* 61 (1994): 303-385; Stefano Caroti, "Oresme on Motion (*Questiones super Physicam* III, 2-7)", *Vivarium* 31, 1 (1993): 8-36.

[10] For a more extended presentation, see Debroise, *Mathématiques de l'intensité et Merveilles de la nature*.

[11] See for example Nicole Oresme, *De configurationibus*, II.4, 276.

[12] See for example Nicole Oresme, *De configurationibus*, II.4, 394.

[13] Nicole Oresme, *Questiones super Physicam*, 293-341.

[14] Caroti, "Oresme on Motion".

fluens, or as a *fluxus formae.*[15] It was usual to find a contradiction in Aristotle's work concerning the ontology of motion. From *Physics* III, it could be deduced that motion was not a specific category, but that each kind of motion belonged to the same category as what is gained by the motion, the *res acquisita*, as it appears in Oresme's text. But from the *Categories*, it could be deduced that motion belonged in general to the category of *passio* or affection. In his commentary, Averroès explained this contradiction by distinguishing two different approaches to motion: motion could be studied from a teleological point of view, according to the *terminus ad quem*, toward which the mobile goes (a site, a quality, a size), or from a processional point of view, according to the enduring process itself. In this second case only, motion belonged to a specific category of motion, distinct from the category of the reality being acquired. Those two aspects of motion became two different theories about its nature, the teleological one of motion as *forma fluens*, and the processional one of motion as *fluxus formae*.

As it is well known since Stefano Caroti's studies, Oresme's main conclusion is that motion is a *fluxus*, as it was for his Parisian contemporaries Buridan and Albert of Saxony. However, Oresme's conception of velocities strongly departs, though implicitly, from Buridan's position by adding that this *fluxus* must not be understood as an entity *added* to the mobile and *inherent* to it (a *res superaddita*): such a being would be essentially contradictory, just as *to be* is in contradiction with *to become.*[16] But in fact, even God cannot create such a contradiction: this *fluxus* is a way of being of the mobile, a *modus seu condicio* of the mobile.[17] Moreover, Oresme generalizes the *fluxus* theory to all kinds of motion, whether local or qualitative, when Buridan limits this idea to local motion. Therefore, one can say that in Oresme's works, the *fluxus* theory has an unprecedented extent.

One can guess that mathematical *fluxus* and ontological *fluxus* are related one way or another. Obviously, the geometrical figuration of motion, as distinct to the mobile, is a mathematical expression of the ontological reality of motion as such: motion can be easily represented only because motion is something in its own right, distinct from

[15] Anneliese Maier, "Die scholastische Wesensbestimmung der Bewegung als *forma fluens* oder *fluxus formae* und ihre Beziehung zu Albertus Magnus", *Angelicum* 21 (1944): 97-111. For the Arabic origin of this distinction, see John McGinnis, "A Medieval Arabic Analysis of Motion at an Instant: The Avicennian Sources to the *forma fluens/fluxus formae* Debate", *The British Journal for the History of Science* 39, 2 (2006): 189-205.

[16] "Nec est fluxus distinctus, quia tale haberet unam partem preteritam et aliam futuram, et ita non esset, nec esset subiectum in quo sue partes essent (...)", Nicole Oresme, *Questiones super Physicam*, 312.

[17] On the *condicio* theory, see: Stefano Caroti, "Nicole Oresme and Modi Rerum", *Noctua* 1, 1 (2014): 1-27. See also Stefan Kirschner, "Oresme on Intension and Remission of Qualities in His Commentary on Aristotle's 'Physics'", *Vivarium* 38, 2 (2000): 255-274; Stefano Caroti, "*Modi rerum and materialism*: a note on a quotation of a condemned articulus in some fourteenth-century Parisian *De anima* commentaries", *Traditio*, 55 (2000): 211-234; Stefan Kirschner, "A Possible Trace of Oresme's *Condicio*-Theory of Accidents in an Anonymous Commentary on Aristotle's Meteorology". *Vivarium*, 48, 3 (2010): 349-367.

the mobile and *res aquisita*, even if this reality is neither a substance added, nor an accident, but a new kind of ontological being, a *condicio* of the mobile. The configuration theory is a mathematical counterpart of Oresme's ontological stance: being symbolized by geometrical figures, uniform or difform motions become objects *per se* of a new mathematical science.[18]

This identification of motion to a *fluxus* in both mathematical and ontological contexts reflects Oresme's effort to mathematize *continuous* processes.

1.2 Discrete and continuous mathematics

It has been a matter of debate, and should still be, whether Oresme was a pure continuist, or whether he admitted, one way or another, the idea of an atomization of the continuum.

In Aristotle's *Physics*, the continuity of motion plays a key role.[19] As Barbara M. Sattler recalls, Aristotle gives two different definitions of continuity: first, two things are continuous whose limit at which they touch each other is one; secondly, one thing is continuous if it is divisible into ever-divisible parts.[20] However, continuity of motion is harder to understand than the continuity of a magnitude. A magnitude can be infinitely divided in infinitely divisible parts because it is a whole whose parts are all simultaneously given. Motion, on the contrary, is an ongoing process: to walk in a park has a beginning, and this motion is fulfilled only when it has come to an end. Thus, it cannot be conceived as a whole to be divided before it is accomplished, and when it is accomplished, the motion is already past: it is never a given whole. This is why Zeno could deny the very possibility of motion: if motion is to be understood as a continuous whole, it has to be on the one hand infinitely divisible, but on the other, generated one part after the other. Consequently, a mobile seems to span an *infinite* number of places in a *finite* time. For this reason, Aristotle's study of the continuity of motion analyzes

[18] However, Oresme's contribution to the science of latitudes of forms should not be limited to this geometrical symbolisation. Daniel A. Di Liscia has shown how Oresme could be ingenious even in the *calculatores* or rhetoric style of mathematics. See Daniel A. Di Liscia, "La conclusio pulchra, mirabilis et bona: una ingeniosa demostración atribuible a Nicole Oresme", *Mediaevalia. Textos e estudos* 37 (2018): 139-168. This important contribution should be added to any reflection on Oresme's mathematical style (See George Molland, "The Oresmian Style: Semi-Mathematical but Also Semi-Holistic in Oresme I", *Cahiers du Séminaire d'Epistémologie et d'Histoire des Sciences-Université de Nice* 18 (1985): 7-12; Edmond Mazet, "Richard Swineshead et Nicole Oresme : deux styles mathématiques", in *Nicole Oresme philosophe: philosophie de la nature et philosophie de la connaissance à Paris au XIVe siècle*, edited by J. Celeyrette and Ch. Grellard (Turnhout: Brepols, 2014), 105-137.

[19] Barbara M. Sattler, *The Concept of Motion in Ancient Greek Thought, Foundations in Logic, Method and Mathematics* (Cambridge: Cambridge University Press, 2020).

[20] Sattler, *The Concept of Motion*, 295. For the two definitions, see Aristotle, *Physics*, III.1, 200b18-20 and VI.1, 231a22.

the way the infinite number of parts of space are related with the infinite number of parts of time in one continuous motion.[21]

Obviously, Oresme uses geometrical and static continuity to mathematize the continuity of motion: to spread this processional being on a surface, to symbolize a *successive* or changing being by a permanent being is the basic idea of the second part of his *De configurationibus*. However, in a series of papers,[22] Stillman Drake argued that the medieval approach to motion, contrary to a Galilean one, required an atomization of it in discrete successive parts. He suggested, in particular, that philosophers of what is sometime called the "Parisian school" defending the impetus theory, Buridan or Albert of Saxony, were also defending a "quantum theory of free fall, with a succession of extremely short but increasing uniform speeds succeeding one another contiguously."[23] The case of Nicole Oresme is ambivalent: if Drake acknowledged that Oresme, thanks to his configurational doctrine, could think of a mathematically continuous motion, and could therefore be thought of as an "exception",[24] he still included Oresme in his general idea of "medieval writers". In any case, he suggested that, due to deficiencies in Campanus's translation of Eudox's continuous theory of proportionality, medieval mathematicians developed an arithmetical theory of proportion "brought by Oresme to a point almost equivalent to our own arithmetization of the continuum."[25]

Oresme's idea of *intensio velocitatis* could seem to be in favor of such an atomization of motion: this concept would seem to burst motion into an infinite number of successive instantaneous velocities. Of course, Oresme did not define anything like instantaneous velocity, a notion that would require the method of derivation of space through time.[26] But thanks to his geometrical theory of motion, he was able to analyze the mathematical behavior of instantaneous change, such as the beginning or the end of a motion, a maximum or a minimum, a continuous acceleration or deceleration. However, Georges Molland was right when objecting that Oresme's approach to motion

[21] Sattler, *The Concept of Motion*, 277-334.

[22] Stillman Drake, "Impetus Theory and Quanta of Speed before and after Galileo", *Physics* 16 (1974): 47-65; Stillman Drake, "Impetus Theory Reappraised", *Journal of the History of Ideas* 36 (1975): 27-46; Stillman Drake, "Free Fall from Albert of Saxony to Honoré Fabri", *Studies in History and Philosophy of Science* 5 (1975): 347-366; Stillman Drake, "A Further Reappraisal of Impetus Theory", *Studies in History and Philosophy of Science* 7 (1976): 319-336.

[23] Drake, "Free Fall from Albert of Saxony", 351.

[24] Drake, "Impetus Theory Reappraised", 38 n. 2.

[25] Drake, "Impetus Theory Reappraised", 41.

[26] Pierre Souffrin, "La quantification du mouvement chez les scolastiques. La vitesse instantanée chez Nicole Oresme", in *Autour de Nicole Oresme, Actes du colloque Oresme organisé à l'Université de Paris XII*, edited by J. Quillet (Paris: Vrin, 1990), 63-83.

is essentially continuous.[27] But he was undoubtedly wrong when he added that Oresme's continuity was "essentially Aristotelian".[28]

As Molland argues, for Oresme, when a body starts to move, as when a heavy body is dropped, it does not suddenly acquire a definite speed, however small: nothing in nature happens suddenly. Indeed, the acceleration of the body should be analyzed like this: for any given degree of speed of the mobile, there was a previous instant when the mobile had a lesser velocity.[29] As Oresme notes in his *Livre du Ciel et du Monde*, this is the way the technical formula "to begin *a non gradu*" should be analyzed.[30]

We could add to Molland's argument that points or instants, for Oresme, are only mathematical commodities. Thus, if a mathematical argument concludes demonstratively the existence of an instantaneous motion, as a mobile being at rest at any instant before an instant T, and at a finite and determinate speed at instant T, then the mathematical argument must be rejected as in contradiction with natural motion.[31] Thus, it is clear that for Oresme, motion is a continuous being. But what kind of continuity is it? How does Oresme understand this continuity of motion? We shall progressively see that Oresme's continuity is clearly not that of Aristotle's.[32]

[27] Georges A. Molland, "The Atomisation of Motion: A Facet of the Scientific Revolution", *Studies in History and Philosophy of Science* 13, 1 (1982): 31-54.

[28] "Oresme's view of continuity was essentially Aristotelian", Molland, "The Atomisation of Motion", 41.

[29] See for instance: "Et pour entendre les causes de ces choses, je di premièrement que tout mouvement de chose pesante ou legiere, quelcunque il soit, commence en enforçant telement que quelcunque degré de ysneleté donney ou signey en lui, il convient que il eust devant mendre ysneleté et mendre et mendre outre toute proporcion ; et est ce que l'en seult appeller commencier *a non gradu*", Nicole Oresme, *Le Livre du ciel et du monde*, edited by A. D. Menut (Madison: University of Wisconsin Press, 1968), 414.

[30] Nicole Oresme, *Le Livre du ciel et du monde*. And of course, the same thing can be said for the opposite, "to end *ad non gradum*". This is why "*non gradum*" cannot simply be translated by "zero", and why Oresme, even in his French work, kept the Latin formula without translation.

[31] See for example: "Also, since the former case of alteration of subject *AB* does not *seem to be* naturally impossible and yet it *is* naturally impossible for something to become suddenly hot in a maximum degree after being very cold in a maximum degree (and similarly for other cases), so an argument can be made for proving that a point is not something really indivisible, nor is a line or a surface something, although the imagination of these [entities] is convenient for better understanding the measures of things, as was noted in the first chapter of the first part", Nicole Oresme, *De Configurationibus*, 403.

[32] I don't mean to revive Drake's opinion. Drake's idea was based on the comparison between a "medieval approach" and a Galilean one. I am only concerned with Oresme's understanding of the continuity of motion.

1.3 Gnoseology and visual illusions

Oresme's understanding of the continuity of motion stems from his analysis of the perception of motion, which is to be found in Question 1 of the third book of his questions on Aristotle's *Physics.*[33] Indeed, an originality of Oresme's ontological study consists of starting from the standpoint of the perception of motion, in the perspectivist tradition. So his main goal, in question 1, is to prove that we don't have a direct vision of a motion: we only see successive states or relations that, by comparison, our inner sense or *virtus distinctiva* will use to judge what is really moving and what is not.

This is why he starts from the description of motion proposed by Witelo in his *Perspectiva*: "*moveri est aliter se habere nunc quam prius*."[34] In his commented translation in French of the *De Caelo*, Oresme keeps approximately the same description: "l'en ne apparçoit mouvement fors telement comme l'en apparçoit .i. corps soy avoir autrement ou resgart d'un autre."[35] But, as this last quote makes clear, this definition only applies to *apparent* motion: it does not allow to distinguish between apparent motion and real motion. In particular, if two mobiles are in a relative motion, one with the other, it isn't enough to decide which one is actually in motion. This is the main reason why, in question III.7, where Oresme definitely settles the ontological question of what a motion is, he also gives a new definition – or "description" as he says – of motion in terms of an internal reference mark: to be absolutely in motion, a mobile doesn't need the existence of another body relative to which it finds itself in a new state or position: it only has to be different from what it was previously.[36] But in fact, another understanding of motion is already at work in this first question. In a corollary, he specifies that, if "to move", for a body, means "to behave differently than before", "it means, moreover, a mutation of it (*significat ultra permutationem ipsius*)."[37] This addition expresses, in fact, what we mean by a *real* motion, as distinct from an apparent motion.

Absoluteness is only one aspect of this second definition. The other main aspect is *continuity*. Thus, when Oresme defines motion in the beginning of the ontological questions, in question III.3, he writes: "motion is a connotative name that is used for the sake of brevity in the place of a proposition, like this one or one similar: 'the mobile behaves continually differently than before, relative to something immobile'."[38] As we

[33] Nicole Oresme, *Questiones super Physicam*, 293-303.

[34] Nicole Oresme, *Questiones super Physicam*, 296. Same formula in Witelo, *Perspectiva*, IV, 110, *Opticae Thesaurus*, edited by F. Risner (Basel: Per Episcopios, 1572), 167.

[35] Nicole Oresme, *Le Livre du ciel et du monde*, 522.

[36] "Quinta est descriptio melior et vera <est> quod moveri est aliter se habere continue quam ipsum mobile prius se habebat respectu sui et non respectu cuiuscumque extrinseci", Nicole Oresme, *Questiones super Physicam*, 337. See also below.

[37] Nicole Oresme, *Questiones super Physicam*, 296.

[38] "'Motus' est nomen connotativum et quasi propter breviloquium ponitur loco unius orationis, sicut illius vel consimilis: 'mobile se habet continue aliter quam prius respectu cuiuslibet non moti';

see, this definition is still relative, but it adds the important specification of continuity. The reason for this is that the continuity of a motion can be illusory, as a better understanding of the perception of motion shows.

Jean Celeyrette has already described the gnoseological process that Oresme supported.[39] Oresme's main idea is that one does not *see* motion itself, as one immediately sees the color of a wall. First of all, to "see" a motion requires a capacity to compare the mutual states of two objects, one at rest and the other in motion, and two different periods, the present and the past. This comparative capacity goes beyond the external senses and needs to be fulfilled by the activity of an inner sense, the *virtus distinctiva*. However, because this comparison is not enough to judge which of the objects is actually moving, another operation is needed, which Oresme calls a *discursum*[40] of the intellect: a logical deduction which concludes from actual knowledge which body is actually moving. Thus, one only "perceives that things are not related as before (*solum sentitur aliter se habere quam prius*)":[41] real motion as a *permutatio* of the mobile is invisible.

Oresme is conscious that his analysis of the perception of motion goes beyond common opinion: don't I see someone running in front of me?[42] But in fact, what we see is that he is now in a place different from where he was earlier. Thus, we saw he has moved in a very near past, but cannot see him moving in the present: this would require us to see that the mobile will be in another place *later*. Otherwise, it could be presently at rest. To know that something is moving now, at the very moment of the perception itself, would require the ability to know the future: the continuity of motion links the past to the future.[43] Thus, the impossibility to see the future makes it impossible to see with obviousness that something is actually moving.

From this gnoseology, basic deceptions can be described. Deceptions due to relational illusion are simple: if something is moving relative to another, there is no certainty as to which one is moving, and which one is at rest. More interesting here are deceptions due to sequential illusions. For example, Oresme says, "it is possible that something be divided in a thousand instants, each imperceptible, and move in one, then rest in another alternatingly. From this, it follows moreover that, by imagination, it is

et hoc vel secundum qualitatem vel secundum locum, et sic de aliis", Nicole Oresme, *Questiones super Physicam*, 313.

[39] Jean Celeyrette, "Apparences et imaginations chez Nicole Oresme: Question III. 1 sur la Physique et question sur l'apparence d'une chose", *Revue d'histoire des sciences* 60, 1 (2007): 83-100.

[40] Nicole Oresme, *Questiones super Physicam*, 296.

[41] Nicole Oresme, *Questiones super Physicam*, 300.

[42] "Dubitatur contra illam conclusionem, quia experientia est quod ego video Sor currere, et hoc est moveri (...)", Nicole Oresme, *Questiones super Physicam*, 299.

[43] "Ad primum dico quod non video evidenter etc., sed quia tempus propinquum instanti presenti, scilicet preteritum, iudicatur quasi presens, ideo dicitur quasi esset de presenti quod video <Sor> moveri, licet non videam <nisi> quod immediate <ante> vel statim movebatur", Nicole Oresme, *Questiones super Physicam*, 300.

possible that a well-disposed vision judges something moving that never moves: if at each instant, something is instantaneously moved, the period between each being imperceptible."[44]

Therefore, there are two different cases described here. In the first one, a period is divided into a great number of imperceptible intervals, and the mobile alternatively moves and stops. In the second one, the mobile instantaneously jumps from one position to another, while the periods during which it is at rest are imperceptible. In the second case, vision will judge the mobile to be in motion, while it is not, and one can guess the same about the first case. Both rely on the important idea that vision requires time: there is no instantaneous vision. Thus, there is a *minimum sensibile* such that a discrete succession of positions or states can be mistaken for a continuous motion.

He goes back to a similar point a few lines later: "Third, it is obvious (...) that continuity, without which there is no motion, is not experimented. For this reason, by imagination or power of God, if something were instantaneously moved in instants – the time between those instants being imperceptible - and if it were not moving during those [imperceptible] times, the thing would not seem other than if the mobile were continuously moving. Thus, continuity is not known by experiment."[45] Jean Celeyrette, who commented on those cases in a different perspective, mentions similar arguments in another work attributed to Oresme, the *De apparentia dei.*[46]

Those examples are striking. They are similar but not identical to the most quoted illusion of the rotating spinning top described by Boethius in his *Institutio musicae*, and some other usual illusions of the same kind.[47] In those illusions, a moving point creates the illusion that it occupies continuously a static continuous line, a circle for example. But here, Oresme describes cartoon-like illusions, where the observer believes he sees a continuous motion, while in reality, there is only a very quick succession of discrete

[44] "Sequitur corollarie quod possibile est quod aliquid dividatur per mille instantia, quorum quodlibet sit imperceptibile, et moveatur in uno et quiescat in alio alternatim; ex quo etiam sequitur ultra quod per ymaginationem possibile est quod visus bene dispositus iudicet aliquid moveri quod numquam movetur, ut si per instantia aliquid subito transferretur, inter que esset tempus insensibile", Nicole Oresme, *Questiones super Physicam*, 297. This text is also commented by Jean Celeyrette in Celeyrette, "Apparences et imaginations chez Nicole Oresme".

[45] "Tertio, patet ex corollario quarte suppo<sitio>nis quod continuatio, sine qua non est motus, non experitur. Unde per ymaginationem aut per potentiam Dei, si aliquis transferretur subito per instantia inter que esset tempus insensibile, et non per tempus moveretur, non appareret aliter quam si continue moveretur, igitur continuatio non patet experiment", Nicole Oresme, *Questiones super Physicam*, 300.

[46] Celeyrette, "Apparences et imaginations chez Nicole Oresme".

[47] Boethius, *De institutione arithmetica libri duo, De institutione musica libri quinque. Accedit Geometria quae fertur Boetii* I, 3, edited by G. Friedlein (Leipzig: Teubner, 1867), 190, lines 11-21. Oresme refers to this deception in relation to the apparent continuity of a sound. See Nicole Oresme, *De Configurationibus*, 305.

phases of a motion. This really is the basic idea behind the phenakistiscope invented by Joseph Plateau in 1832, the illusion being due to the retinal persistence.

Thus, the gnoseological analysis of motion implies a strong distinction between apparent motion, and real motion. The first simply means that something behaves differently than before relatively to something else, but real motion goes beyond: it means a real *permutatio* that affects the mobile. But this means that motion is a kind of reality distinct to the mobile and to the thing acquired. The purpose of the ontological study that follows immediately is to establish the ontological necessity of the supposition of such a *permutatio*.

1.4 Ontology

Indeed, the first ontological problem raised about motion concerns its continuity. In the second question, III.2, where Oresme asks whether motion is something or not, the first argument *quod non* notes is that motion as a whole has two parts: a past one, which is not anymore, and a future one which is not yet.[48] One solution would be: to answer that motion is a successive being, and not a permanent being. It doesn't exist *tota simul*.[49] However, such an explanation is not enough, because even a successive being requires an *existing* part. Thus, he suggests to define a "present part (*pars presens*)", "composed of something past and something future."[50] This solution is not absolutely satisfactory, and Oresme will refine this answer as we will see later.[51] Anyway, it highlights the main problem: if motion is to be mathematized, it has to be understood as a whole composed of parts. How are those relations to be understood, since those parts cannot be simultaneous?

Although Oresme is a supporter of the *fluxus* theory, he first denies that motion is a *fluxus*. Indeed, there is only three possible opinions: first, motion could be the mobile, second, motion could be the thing acquired, and third, motion could be a *fluxus*.[52] But if he calls defenders of the *fluxus* theory his "adversaries",[53] it is only because they

[48] "Et arguitur primo quod non, quia pars preterita motus non est nec pars futura, ergo motus non est; consequentia tenet, quia totum non est aliud quam sue partes", Nicole Oresme, *Questiones super Physicam*, 304.

[49] On the distinction between *res permanentes* and *res successiva*, see the second part below.

[50] "Dico quod motus habet aliam partem quam medietatem preteritam et medietatem futuram, scilicet partem presentem, que componitur ex aliquo preterito et aliquo futuro", Nicole Oresme, *Questiones super Physicam*, 308.

[51] Caroti, "Oresme on Motion", 17.

[52] Nicole Oresme, *Questiones super Physicam*, 312. Oresme identifies five "rational opinions" about motion, the two first of which are quickly dismissed. See Nicole Oresme, *Questiones super Physicam*, 305.

[53] Nicole Oresme, *Questiones super Physicam*, 313.

understand this *fluxus* as "*disctinctus*",[54] a "*res superaddita*",[55] a being *added* to the mobile. Such an idea implies an ontological inflation. For example, if water becomes hot, it also becomes becoming-hot: it becomes in motion. Thus, it also becomes becoming-becoming-hot, and this one single situation of heating would imply an infinite number of beings.[56]

Why, then, does Oresme finally support the *fluxus* theory? His arguments to show that motion is a *fluxus* or, as he calls it, a "successive being absolutely distinct from permanent beings (*res successiva distincta simpliciter a permanentibus*)",[57] are primarily logical and concern the truth-makers of propositions involving a reference to motion: it is logically necessary to suppose such a being, in addition to the mobile and space spanned (in the case of local motion) to establish the truth of the proposition: "This is moving (*hoc movetur*)."[58] If motion is to be real, "*in re*", and not only the appearance corresponding to the observational fact that things are now related otherwise than they were before, it has to be a *fluxus*. Ontologically, if something is moving, it has to be "*aliter et aliter*", successively one thing and another, and this very mode of being is precisely the ontological aspect of the general situation of a moving body that Oresme calls its *fluxus*: even God cannot create a motion without this additional being-other-and-other – this way of being that is characteristic to motion.[59]

Now, this *fluxus* theory is not to be confused, as I said earlier, with Buridan's theory: the *fluxus* is not a *being* added to the mobile, but a mode of being of the mobile itself. This idea is definitely established as the most probable in question III.7, where Oresme exposes his own opinion. To do so, he needs to fix, once again, the definition of motion: none of the previously given definitions, neither the one inspired by Witelo (III.1) nor the one specifying the continuity of motion (III.3) were suitable enough to describe real motion as absolute. For this reason, Oresme introduces the new kind of definition mentioned above, involving what Stefano Caroti calls an "internal reference mark:"[60] "To move is to behave continuously differently from how the mobile itself behaved

[54] Nicole Oresme, *Questiones super Physicam*, 331.

[55] Nicole Oresme, *Questiones super Physicam*, 312.

[56] "Contra: sit *a* mobile, et *b* sit ille fluxus; tunc sic: prius est verum quod *b* non est in *a* et postea quod *b* est in *a*, ergo *a* est mutatum ad ipsum *b*, ergo per suppositionem secundam hoc est per mutationem distinctam a subiecto et termino, quia propter aliud non ponitur <talis fluxus>, ergo motus erit motus, et sic proceditur in infnitum, quod est contra Aristotelem septimo *huius*", Nicole Oresme, *Questiones super Physicam*, 313.

[57] Nicole Oresme, *Questiones super Physicam*, 334.

[58] "Et probatur, <quia>, quando due res non sufficiunt ad hoc quod aliqua propositio sit vera, oportet ponere aliam rem vel saltem alium modum rei; patet statim, quia, si sufficiebat ante, iam fuisset vera, sed posito mobili et spatio non sufficit ad hoc quod hec sit vera: 'hoc movetur', ergo, quando fuit vera, aliud ponitur", Nicole Oresme, *Questiones super Physicam*, 334.

[59] "Sicut Deus non potest facere quod aqua calefieret successive quin haberet se aliter et aliter, ita nec potest tollere illum modum se habendi in casu posito", Nicole Oresme, *Questiones super Physicam*, 335.

[60] Caroti, "Oresme on Motion", 28.

before relative to itself and not to anything extrinsic (*moveri est aliter se habere continue quam ipsum mobile prius se habebat respectu sui et non respectu cuiuscumque extrinseci*)."[61] Then, he is able to conclude that motion is indeed a *fluxus*: "motion is some mutation distinct from permanent beings, a mutation that is successive, supposing 'successive' as before (*motus est quedam mutatio preter res permanentes, que est successiva, exponendo 'successivum' sicut prius*)."[62] Both points, the new description and the *fluxus* theory, are based on the same kind of argument, the one-body argument which can also be found in Buridan's studies on motion.[63]

Indeed, if we suppose only one body in the world, that is the world itself. It could happen that this body would be rotating around its own axis. Thus, the meaning of this "motion" cannot be a varying relation of the mobile with something else: "motion" must mean an *internal* change or mutation. The motive of this distinction is obviously to distinguish real motion, an internal mutation, from apparent motion, a varying relation. But one must also observe that this new description makes the *continuity* an essential aspect of what we call a real motion.

The semantical question left aside, the one-body argument is also required to establish ontologically that motion is a *fluxus*: let's now suppose this body to be in motion for one hour, then at rest for the next hour, and again indefinitely moving and resting successively. There is no thing nor "place" to which it could be compared to define this motion. In the same way, all its parts are always in the same relation to one another. Thus, the body has two different behaviors: motion and rest, but nothing extrinsic relative to which this difference could be defined. Therefore, motion cannot be anything else than an internal "*condicio*", a way of being, a mutation which affects the body when it is moving, and not when it is at rest.[64]

The *condicio* theory of motion has another consequence. Oresme doesn't absolutely reject the identification of motion with a mobile. Of course, motion is not the mobile of which it is a way of being. But there is another sense in which motion is, in a way, a mobile: motion can be itself in motion, as it is in the case of acceleration and deceleration. This is the meaning of the argument *quod sic* of question III.3: "some motion behaves continually differently than before due to its own mutation. Thus, this motion is moved, and consequently it is something moved or a mobile."[65] Indeed,

[61] Nicole Oresme, *Questiones super Physicam*, 337.

[62] Nicole Oresme, *Questiones super Physicam*, 338. For the meaning of "successive" here, see below.

[63] Thijssen, "The Debate Over the Nature of Motion".

[64] "Hiis positis arguendo ad conclusionem, ymaginetur in mundo unum corpus solum et sit *a*, et moveatur in una hora, et in alia quiescat, et sic alternatim; tunc *a* movetur in prima hora et non in secunda, et postea in tertia, nec partes eius nec ipsum ad aliud se habet aliter quam prius, ergo in se ipso habet aliquam condicionem, que non erat ante; et hoc vocatur 'motus', et quando non habet quiescit. Patet statim per suppositions", Nicole Oresme, *Questiones super Physicam*, 338.

[65] "Aliquis motus continue se habet aliter quam prius per sui mutationem, igitur ille motus movetur, et per consequens est res mota seu mobile", Nicole Oresme, *Questiones super Physicam*, 311.

acceleration is a variation of the motion, a motion of the motion or, as he calls it in his *De configurationibus*, a kind of "succession in motion (*successio in motu*)."[66] Another case of "succession in motion", extensively studied in this last treatise, is the motion of the "beginning (*incipit*)" of the motion, a notion tantamount to the variation of the derivative of velocity with respect to space $\frac{dv}{dx}$.[67] Because motion is not a being, the ontological inflation I mentioned earlier is not to be feared anymore: acceleration could be in turn in motion, and so on indefinitely. Once again, this *condicio* theory legitimizes mathematical techniques: in fact, his mathematical doctrine typically authorizes an inflation of graphs or geometrical figures. But one should not believe naïvely that there is a being corresponding to each graph. Thus, Oresme does not reject absolutely this identification of motion to a mobile: he only rejects it in the ontological sense used in the question asked. Indeed, for the motion to be in motion in this sense, it would have to be, according to the definition of the motion, different from what it was: it would have to retain the *same being*. But on the contrary, an accelerated motion is a successive being never identical to itself, "because one part would be faster and the other slower."[68] Motion cannot be a "mobile", something that retains a permanent being while moving and changing.

Thus, Oresme's ontological study aims at separating apparent and real motion. *Continuity* is an essential property of real motion as distinct to apparent motion. An infinite succession of states can look like a continuous motion if *leaps* are imperceivable. And the leaps are imperceivable if the time between two different states is imperceivable. This *apparent* continuity based on the imperceptibility of leaps should be different from *real* continuity, supposedly a process without any leaps. But as we are now going to see, this is not absolutely the case: the "continuity" that characterizes real motion is absolutely not what we would expect.

2. The problem of unity and multiplicity of a *res successiva*

To be a continuous *fluxus*, for Oresme, is the same as to be a *res successiva*, a successive being.[69] Although he uses the expression frequently, as opposed to *subita* and to *permanens*, he doesn't give any precise definition of it before question III.6. Thus, when Oresme faces the real continuity of motion, he has to tackle the classic distinction between *permanent* beings and *successive* beings. A permanent being is a whole whose parts all exist simultaneously. A successive being is a whole whose parts exist one after the other, like a word: it never exists as a whole, but only one syllable after the other.

[66] Nicole Oresme, *De configurationibus*, II.V, 280.

[67] Nicole Oresme, *De configurationibus*, II.V, 280. See also Debroise, *Mathématiques de l'intensité et Merveilles de la nature*, 515.

[68] Nicole Oresme, *Questiones super Physicam*, 318.

[69] See the title of question III.6: "Utrum motus sit res successiva sive *fluxus* distinctus a rebus permanentibus", Nicole Oresme, *Questiones super Physicam*, 331.

A successive being is an ongoing whole. Originally meant to grasp the contrast between the instability of the creature and the stability of the Creator, this pair of concepts had a fixed meaning by the end of the 13th century. However, Robert Pasnau noted the originality of Oresme's understanding of those concepts. In particular, for a being to be permanent, Oresme required not only the simultaneity of existence of all the parts, but also that this existence last for a time, excluding any instantaneous being.[70]

Oresme not only asserts that motion is a successive being; he also wants to show that it is an *absolutely* successive being. For Aristotle, any change requires something unchanged, a *substratum*. This is the paradox of change he insists on in *Physics*: "What comes to be must do so either from Being or from non-Being, and both are impossible. For Being cannot come to being, since it already is, and nothing can come to be from non-Being, since something must be underlying."[71] On the contrary, Oresme is looking for a highly paradoxical concept: an *absolutely* successive being, a succession without any permanent part or counterpart. I shall insist here on the mathematical implications of such an idea, and on its paradoxical nature acknowledged by Oresme himself.

As we saw, continuity is essential to motion, Oresme insists.[72] But continuity of motion is in fact the same thing as its unity.[73] Or should we add, the mixture of alterity and unity. Thus, a motion can be more or less one: "a regular motion is more one than an irregular one."[74] An irregular motion is a motion whose velocity varies. Although Oresme follows Averroès on this remark, he insists: "However, I say that variation in velocity doesn't destroy the unity of motion",[75] precisely because it doesn't destroy its continuity. Thus, the reality of motion as a successive being introduces an important metaphysical problem: how can a successive being keep its unity? Doesn't its successive multiplicity destroy its unity? Oresme tackles this question in an overwhelming ontological chapter, the only one of the sort, of his *De configurationibus qualitatum et motuum*. A treatise, one should recall, structured by the distinction between permanent beings (part I) and the successive beings (part II), of which motion is the main example, but not the only one.

Here, Oresme notes that "certain things are so successive that they cannot last in any way, such as time and motion."[76] Anyway, this *absolute* successivity of motion does

[70] Robert Pasnau, *Metaphysical themes: 1274-1671* (Oxford: Clarendon Press, 2011), 378-379.

[71] Aristotle, *Physics*, 191a28-31. See Sattler, *The Concept of Motion*, 281.

[72] "(...) continuitas est intrinseca motui, ut dicitur tertio *huius*, quia apparet ex descriptione motus", Nicole Oresme, *Questiones super Physicam*, V.10, 636.

[73] "Tertio, pono illam descriptionem quod motum esse unum vel aliquid moveri uno motu non est nisi aliquid moveri continue", Nicole Oresme, *Questiones super Physicam*, V.10, 633.

[74] "Sexta conclusio est quod motus regularis magis est unus quam motus irregularis", Nicole Oresme, *Questiones super Physicam*, V.10, 636.

[75] "Dico tamen incidenter quod diversitas in velocitate non tollit unitatem motus", Nicole Oresme, *Questiones super Physicam*, V.10, 636.

[76] "Rerum quedam sunt ita successive quod non possunt aliquo modo permanere, sicut tempus et motus", Nicole Oresme, *De Configurationibus*, 298. Clagett's translation slightly modified.

not prevent this motion from keeping its unity. In particular, the intension and remission of velocity never destroys unity, as we can guess from Oresme's examples of the unity of varying curvature or rarity: "For just as in the intensity of curvature or rarity, there is continually different curvature or different rarity while in the whole time it consists of one successive curvature or rarity, and similarly in the cases of augmenting a ratio or a dissimilarity, so I imagine it to be in the case of the intension of any intensible quality such as heat or whiteness, and similarly for the case of the remission of the same quality."[77] Thus, the *identity* of the whole is nothing else than its *continuity*. Still, the case of motion is more complicated than that of those intensive qualities, because it can *in no way* be a *permanent* being.

We thus see that it was a major concern for Oresme to understand how motion could keep its unity while being "made of" multiplicity: this is the issue of the nature of absolute succession, an issue Oresme addresses more precisely in two major texts: *Quaestiones super de generatione et corruptione*, I.13 ; *Questiones super Physicam*, III.6. In both, the question is the same: are successive beings distinct from permanent beings, or can they be reduced to such beings? His answer is very similar in both, but overall more precise in the first one.

2.1 *Questiones super Physicam III.6*[78]

The question asked is whether motion is a successive being or a *fluxus* distinct from permanent beings, that is the mobile and the being acquired during the process.[79]

Oresme starts his study on successivity by determining what it means to be "successive", and suggests three different meanings: the first is *improper*, and simply names a permanent being, always equal to itself, but changing location. The second is *less improper*, and names a thing of which one part exists already, and of which another part is being acquired, as is some heat being acquired. In this sense, one could speak of succession of a river as compared to the permanence of the riverbed: it is a succession *secundum quid*, the whole entity being divided between permanent parts which guarantee unity, and other successive parts. None of these two kinds of succession is really problematic.

The difficulty starts with the third kind of succession, the succession *simpliciter* or *absolute* succession: "Third, [succession can be said] for this which never behaves in

[77] "Sicut enim in intensione curvitatis vel raritatis est continue alia et alia curvitas vel alia et alia raritas et in toto tempore illo est una curvitas vel raritas successiva et conformiter in augmento proportionis vel dissimilitudinis, ita ymaginor in intensione cuiuscunque qualitatis intensibilis, sicut caliditatis vel albedinis, et similiter in eiusdem qualitatis remissione", Nicole Oresme, *De Configurationibus*, 300.

[78] Nicole Oresme, *De Configurationibus*, 331-335.

[79] "Utrum motus sit res successiva sive *fluxus* distinctus a rebus permanentibus, cuiusmodi sunt mobile et res acquisita, ad quam est motus", Nicole Oresme, *Questiones super Physicam*, 331.

such way that what was in the first part is in the second part, but for any given period, in any part of it, there is something of this successive being, and in another part of it, there is a completely other thing."[80] Time is an example of such an absolute successive being, and for this reason it is said to be in "*continuous fluxus*". Indeed, one must distinguish between a locative way to flow (*fluere secundum locum*), as a river does, and an ontological way (*fluere secundum esse*): if something flows ontologically, "during the whole period, it does not have the same *esse*."[81]

The four conclusions are not of equal values. After defining successivity, Oresme wants to prove that there are indeed such things as successive beings. The reality of successive being *secundum quid* is unproblematic. But Oresme insists on the fact that these kinds of beings are those referred to by Plato in the *Timeo*.[82] The same reference is made in his *Questiones super generationem et corruptionem*, in the same context.[83] Implicitly, Oresme is suggesting that when Plato asserted that everything is in a continuous flow of change, he was only thinking of this relative kind of succession: he didn't know the reality of *absolutely* successive being, a reality asserted in the second conclusion, with *motion* as a first example.[84] Indeed, the mobile is obviously "continually in one place and another", and is "continuously in one state and in another." This is why Plato thought that one cannot say, about a successive being, "this" or "that": its unity and identity, as Oresme concludes in his questions on the *De generatione*, is only improper.[85]

[80] "Et tertio pro eo quod in nullo tempore sic se habet quod illud quod fuit in prima parte est in secunda parte, sed quolibet tempore accepto in una parte illius est aliquod tale illius successivi, et <in> alia totaliter aliud; sic ymaginatur de tempore, quia prima pars non est quando secunda est, ideo tale dicitur non permanens, sed in continuo fluxu et transitu. Verbi gratia, illud dicitur fluere secundum locum, quod in aliquo eodem loco proprio non est per tempus; ita dicitur aliquid fluere secundum esse, quod in aliquo toto tempore non habet idem esse; et propter hoc dicitur tempus preterit more fluentis aque. Et permanens per oppositum dicitur, quando est aliquod tempus, et in pluribus eius est idem et totum simul in aliquo instanti et usque ad aliud instans", Nicole Oresme, *Questiones super Physicam*, 331-332.

[81] See the note above.

[82] "Et ideo de talibus dicit Plato in *Timeo* quod sunt in continuo fluxu nec expectant demonstrationem, que sit per illa pronomina 'hoc' vel 'illud', quia continue est aliud et aliud", Nicole Oresme, *Questiones super Physicam*, 332.

[83] "Et similiter intelligitur dictum Platonis in Timeo ubi dicit quod propter talem successionem non potest idem bis demonstrari in talibus que continue transmutantur", Nicole Oresme, *Quaestiones super de generatione et corruptione*, edited by S. Caroti (München: Bayerische Akademie der Wissenschaften and C. H. Beck, 1996), 116.

[84] "Secunda conclusio est de successivo simpliciter, quod est aliqua condicio simpliciter successiva. Probatur primo de motu, et est manifestum in motu locali quod mobile continue est in alio et alio loco, et quod continue se habet aliter et aliter; et similiter de tempore", Nicole Oresme, *Questiones super Physicam*, 332.

[85] In the case of inanimated beings, Oresme concludes: "non manet idem proprie et simpliciter (...), tamen, si maior pars maneat, potest dici idem (...)". In the case of animated beings, he concludes: "quod in animalibus in quibus quedam partes fluunt etc. Adhuc magis proprie manet idem totum

The very problematic nature of the kind of succession Oresme has in mind is even more obvious with the other conclusions. Let's examine first the fourth one: "It does not imply any contradiction nor is it absolutely impossible that a substance be absolutely successive."[86] Of course, Plato had already said in the *Timeo* that substances were always changing, so every man is, indeed, a successive being, with his hairs and nails always growing. But once again, this is not what Oresme has in mind, and what he calls a "successive man (*homo successivus*)"[87] is something only God could create thanks to His absolute power.[88] *Natural* men are successive, but not absolutely successive beings.

The argument goes like this: if A, which is double of B, successively decreases, it is not contradictory that God would create one substance or a man who would exist precisely when A will be double, thus for only one instant, and in the same way when A is sesquialtera (in ratio 3:2), and thus continually for the other ratios. And here, maybe Oresme means *rational* ratios. Now the *sum* "composed" of all those instantaneous men would be *one* absolutely successive man, an absolutely successive substance. Nothing of it which would have existed in any part of time would still exist in the future.[89] What kind of man is this cartoon-like man, created like an apparent motion whose illusion emerges from successive flapping papers, or the rotation of a phenakistiscope? God would be creating a man just like a geometer would draw a line point by point. And indeed, the comparison is Oresme's: an *instantaneous* man would be to the *aggregate*, the single absolute successive man, just "as a point is to a line", or "an instant to time".[90] When commenting on this passage, Stefano Caroti admitted that it was "difficult to see how this aggregation could be considered a single man, as the text seems to suggest."[91] We cannot but agree, except for the fact that Oresme doesn't mean that this heavenly creation is an ordinary man: it is something never seen, an absolutely successive man, whose existence is continuous, although created one phase after the other.

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quam in rebus inanimatis, licet non sit idem simpliciter", Nicole Oresme, *Questiones super Physicam*, 116.

[86] "non implicat contradictionem nec <est> simpliciter impossibile quod sit aliqua substantia simpliciter successive", Nicole Oresme, *Questiones super Physicam*, 333.

[87] Nicole Oresme, *Questiones super Physicam*, 333.

[88] This doesn't mean, of course, that such an absolute successive being is a mere fiction that can be thought without contradiction: if God were to create such a successive man, it would be a *real* being, not a *chimera*.

[89] "Verbi gratia: si *a*, quod est duplum ad *b*, diminuatur successive, non est contradictio quod Deus creet unam substantiam vel hominem, qui precise durabit quamdiu *a* erit duplum, scilicet per solum instans, et similiter quando erit sesquialterum, et sic de qualibet alia proportione; igitur tale aggregatum ex omnibus istis esset homo vel substantia successiva, cuius nihil quod erat in aliqua parte temporis fuerit in sequenti. Et dico corollarie quod in talibus illud quod est solum per instans, non est pars illius successivi, sed se habet ad illud sicut punctus ad lineam et instans ad tempus", Nicole Oresme, *Questiones super Physicam*, 333-334.

[90] Nicole Oresme, *Questiones super Physicam*, 333-334.

[91] Caroti, "Oresme on Motion", 26.

We should halt a moment on the expression "*aggregatum*". It is a common way to designate an arithmetical sum.[92] It expresses a specific relation between "parts" and wholes. As we see, Oresme defines instantaneous beings, and then collects this infinity of beings as an aggregate to "compose", in a way, a successive man. Strictly speaking, the instantaneous men are not parts of the aggregated successive man, just like points are not parts of a line. In his *De configurationibus*, he also uses the same expression to express the relation between a long sound such as a cantilena and partial sounds separated by perceivable sensible pauses, as when the singer is breathing. Both sounds have unity, but the latter has a unity of the second mode (only cut by imperceptible pauses), when the former has a unity of the third mode, improper and "*ex aggregatione*".[93]

Other examples express this higher mode of unity formed by unities of a lesser mode. In the second conclusion, after having given motion as a first example of an absolutely successive thing, and then time, Oresme gives a very abstract and mathematical example: ratios. Let there be a greater quantity A, he says, and a lesser one B, and let A decreases successively.[94] Then, in any instant, A and B will have a ratio, *always other and other*, and so the "total ratio (*totalis proportio*)", that is concerning the whole time, is called "successive".[95] Thus, this *total* ratio is composed of an infinite succession of *instantaneous* ratios, a continuous succession: this is quite exactly what we would call a *varying* ratio.

Totalis proportio is a surprising formula, analogous to the *aggregatum* mentioned before. Studying the first two questions on Geometry, Edmont Mazet noticed that Oresme is the first to call "a total" the sum of an infinite series, that is, geometrically speaking, the sum of the infinite number of parts in which a magnitude could be divided into a finite duration.[96] This notion is tantamount to a practical use of actual infinite, even though, when Oresme addresses the philosophical question of the possibility of such an actual infinite few questions later, he rejects it.[97] It is very important to have in

[92] For example: "square numbers are always the result of the sum of odd numbers (*ex* (...) *aggregatione numerorum imparium semper resultant numeri quadrati*)", Nicole Oresme, *Questiones super geometriam Euclidis*, 153.

[93] Nicole Oresme, *De Configurationibus*, 306.

[94] "Secundo, sit *a* quantitas maior et *b* minor, et diminuatur *a* successive; tunc in quolibet instanti *a* ad *b* habet aliam et aliam proportionem, ergo totalis proportio, que est per totum tempus, dicitur successiva et quidam modus <se> habendi successivus, et in nulla parte temporis habet taliter esse qualiter se habet in sequenti, ergo est simpliciter successivum, iuxta expositionem prius positam etc." Nicole Oresme, *Questiones super Physicam*, 333.

[95] See the preceding note.

[96] "Oresme introduit, sous le nom de 'tout', la notion même de somme de la série, et cela non seulement dans le cas d'une série convergente, mais aussi – et c'est là qu'intervient le dépassement du point de vue physique d'Aristote – dans le cas d'une série divergente", Edmond Mazet, "La théorie des séries de Nicole Oresme dans sa perspective aristotélicienne. 'Questions 1 et 2 sur la Géométrie d'Euclide'", *Revue d'histoire des mathématiques* 9, 1 (2003): 77.

[97] "Actu et categorematice nihil est infinitum", Nicole Oresme, *Questiones super Physicam*, 361.

mind, when we read those ontological arguments, that Oresme is probably the first to propose a general "theory of series", that he taught general a general method to calculate infinite series, and that he is probably the first to demonstrate the divergence of the harmonic series.[98]

Lastly, the third conclusion concerns the reality of absolutely successive *qualities*.[99] The image in a mirror, *species* and light, and finally sound. These cases are neither possible creations of God, nor mathematical beings, but physical and quite ordinary things. But the unity of each has to be understood as the result of a kind of aggregation of instantaneous units: if an object is moving, its "total image (*totalis ymago*)"[100] in a mirror is a continuous being, but in a way made of an infinite number of instantaneous images, because "at each instant, there is a new image."[101] Another example: if a coin, a *denarium*, is deep in a flowing river, there will be continually new *species* or "images" of the coin in the river. Finally, if a sound is intensified and goes continuously higher and higher, nothing remains of the lower degrees, otherwise the same sound would produce continually concord and discord, which is never the case.[102]

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[98] John E. Murdoch, "Review of Nicole Oresme's 'Quaestiones super geometriam Euclidis', edited by H.L.L. Busard", *Scripta Mathematica* 27 (1964): 67-91.

[99] "Tertia conclusio est quod est aliqua qualitas simpliciter successiva. Probatur primo, si ymago sit aliquid in speculo, tunc, si obiectum moveatur, faciliter potest ostendi quod in quolibet instanti est nova ymago secundum se et quo<d>libet sui propter novum motum vel continuam mutationem situs obiecti ad speculum, ergo totalis ymago, que est per tempus, est res successiva. Secundo, si conceditur quod species est in medio et medium continue moveatur, sicut <si> denarius sit in fundo aque currentis, tunc per idem probaretur quod continue in illa aqua, que sup<er>ponitur denario, est nova species. Eodem modo est de lumine secundum aliquos: bene lumen intenditur, <et> dicunt quod est continue novum secundum quodlibet sui, et ita dicunt de caliditate. Tertio, arguitur fortius de sono, quia conceditur quod est quedam qualitas sensibilis distincta a medio vel subiecto. Sed tunc arguitur: sonus consequitur motum, ut patet in secundo *De anima* et etiam in *Musica* Boethii, ergo sonus est successivus eo modo sicut motus. Etiam patet quod una syllaba non est, sed iam transit quando venit alia, et ita de partibus syllabe; et propter hoc sonus mensuratur aliter tempore et duratione quam alie qualitates <scilicet> permanentes. Etiam si aliquis sonus continue intendatur, tunc, si aliqua pars permaneat, tunc grave et acutum esse<n>t simul, et sic ex uno sono proveniret dissonantia vel consonantia, quod est contra Boethium in *Musica* sua", Nicole Oresme, *Questiones super Physicam*, 333.

[100] See the footnote above.

[101] See the footnote above.

[102] See the footnote above. This case should be compared to Oresme's solution to the ontology of intensive variation. As it is well-known, Oresme admits an intensive quality to be *composed* of (simultaneous) degrees only by mathematical imagination. In reality, when a substance is becoming whiter, it is not composed of simultaneous degrees successively added one to the other, but has continuously another being-white: "ideo quando subiectum dicitur intendi vel fieri magis album, continue habet aliud et aliud esse album. Unde totaliter est aliud esse album intense <et> aliud est esse album remisse, nec unum componitur ex alio", Nicole Oresme, *Questiones super Physicam*, 42. Thus, concerning the ontology of degrees, Oresme adopts the *successive* theory, and admits the *additive* theory only by mathematical imagination and for mathematical sake. This shows that the adverbial-indivisibles *succeeding* one another concerns the *ontology* of the *res successiva*, not their

Oresme is perfectly aware of the difficulty: isn't he *composing* the continuum as a totality generated by the succession of an infinite number of indivisibles? This is in part the meaning of the sixth objection: if motion is a *res successiva* as defined, then "in a small period, there will be an infinite number of things, like [an infinite number] of being-changed (*in parvo tempore fierent infinita, sicut infinita mutata esse*)."[103] And Oresme *concedes* this objection: "it is not a difficulty (*non est inconveniens*)."[104] Indeed, this infinite number of "being-changed" is not an infinite number of *entities*, but an infinite number of *modifications*. The *condicio* theory enables Oresme to atomize the continuum in an infinite number of indivisibles, because those indivisibles are not *beings*, but *modes* of beings. This is why there is no paradoxes in the fact that the *totalis proportio* we saw above is really "composed" of an infinite number of ratios. This must be kept in mind when coming to Oresme's study of continuity in book VI, as we shall see below.

2.2 *Quaestiones super de generatione et corruptione, I.13*[105]

The same kind of discussion is to be found in Oresme's *Questiones de generatione et corruptione*, question I.13: "Does the thing increased remain the same in the beginning of the increase and in the end? And the same question for the case of decreasing."[106] As before, Oresme is thus asking how a successive being can have some unity and keep its identity during time. If the study has a general perspective, Oresme focuses himself on the case of a substance continuously gaining or loosing parts, as would a living animal.

Oresme suggests two ways to solve the problem, and then his own. The second is very simple and simply states that a successive thing has an identity because it keeps a permanent and essential part.[107] Oresme doesn't even discuss this answer, obviously because it doesn't solve the problem of *absolutely* successive beings. Indeed, immediately after the formulation of this solution, which Oresme dismisses, he distinguishes between three ways to understand the words "*unum*" and "*idem*": for totally permanent things, for absolutely successive things, and for mixed things. He goes on to say that the unity of an absolutely successive being, such as the motion of

mathematical *imagination*. See also Kirschner, "Oresme on intension and remission of qualities"; Debroise, *Mathématiques de l'intensité et Merveilles de la nature*, 305-327.

[103] Nicole Oresme, *Questiones super Physicam*, 335.

[104] Nicole Oresme, *Questiones super Physicam*, 335.

[105] Nicole Oresme, *Quaestiones super de generatione et corruptione*, 111-118.

[106] "Queritur tertiodecimo utrum augmentatum maneat idem in principio augmentations et in fine ipsius, et similiter de diminution", Nicole Oresme, *Quaestiones super de generatione et corruptione*, 111.

[107] "Alia via est quod in composito, saltem animate, quedam sunt partes necessario per se requisite ad esse illius compositi, et animal est proprie tales partes, et ille non fluunt et refluunt; sed alie sunt partes que non requiruntur per se sed dicuntur accidentales, sicut accidit homini habere digitum et posset esse et abesse, et tunc hoc totum non est tales partes nisi per accidens", Nicole Oresme, *Quaestiones super de generatione et corruptione*, 115.

heaven, is due to "its successive continuity."[108] The Parisian river Seine is a case of an absolute *fluxus*: the water of the Seine is not today the same as it was two years ago.[109] Anyway, the Seine is the same Seine, and this is only due to continuity: "the whole is one continuum (*totum est unum continuum*)."[110] Thus, once again, his own solution is really to make the continuity the real cause of the unity of a successive being.

However, the first *via* Oresme suggests is most interesting, and most impressive. Oresme dismisses it, but only because it lacks generality and could be used to prove paradoxes. He carefully deduces difficult conclusions from this solution, as if one of Oresme's purposes in this question was precisely to demonstrate his skill in manipulating the logical and quasi mathematical concepts involved.

This first *via* has a theological stance, and rests upon the general principle: "one being is many beings (*una res est plures res*)."[111] For permanent beings, the mixture of unity and multiplicity is due to the "divisibility at the same time."[112] But in the same way, "one being is many successive beings (*una res est plures successiva*)."[113] What Oresme is talking about is not absolutely clear, but he immediately adds: the first case is possible only "*supernaturaliter et in divinis*", but the second case is true *naturaliter*. Stefano Caroti supposes in his commentary[114] that Oresme is referring to the mystery of Trinity.[115] Thus, what Oresme is suggesting here is that successive things, particularly motion, could be some kind of temporal images of the trinity, just as *impossible* to rationally understand as the mystery of religion.

The case he uses to illustrate this natural unity is odd at first glance: Socrates "is [now] some parts, and then other parts will be, while he is the same, and himself before was other parts." That is, a man "who now is body and soul, and after death will be only soul."[116] From this case, Oresme will now suggest rules to solve paradoxes of identity of

[108] Nicole Oresme, *Quaestiones super de generatione et corruptione*, 115.

[109] "Non est eadem aqua Secane nunc, que erat quod sunt duo anni", Nicole Oresme, *Quaestiones super de generatione et corruptione*, 116.

[110] Nicole Oresme, *Quaestiones super de generatione et corruptione*, 116.

[111] "Nunc pro solutione difficultatum multi sunt modi dicendi. Unus est quod sicut una res est plures res divisim simul tempore, sic etiam una res est plures successive. Primum tamen est possibile solum supernaturaliter et in divinis, sed secundum est verum naturaliter. Et idéo Sortes, qui modo est aliqua partes, postea erunt alie partes ipse idem, et ipse ante fuit alie, sicut aliqui dicunt quod homo, qui nunc est corpus et anima, post mortem erit sola anima", Nicole Oresme, *Quaestiones super de generatione et corruptione*, 113.

[112] "Divisim simul tempore" Nicole Oresme, *Quaestiones super de generatione et corruptione*, 113.

[113] Nicole Oresme, *Quaestiones super de generatione et corruptione*, 113.

[114] Nicole Oresme, *Quaestiones super de generatione et corruptione*, 112*-118*.

[115] "Im ersten Fall bewahrt man die Einheit Gottes innerhalb der Dreifaltigkeit; im zweiten die Identität der natürlichen Dinge, die der zeitlichen Veränderung unterworfen sind", Nicole Oresme, *Quaestiones super de generatione et corruptione*, 114*.

[116] "Et ideo Sortes, qui modo est alique partes, postea erunt alie partes ipse idem, et ipse ante fuit alie, sicut aliqui dicunt quod homo, qui nunc est corpus et anima, post mortem erit sola anima", Nicole Oresme, *Quaestiones super de generatione et corruptione*, 113.

a general form. Thus, if a totality composed of two parts, A and B, loses one part, say B, then, two composed totalities will successively exist, first *A and B*, and then *only A*. But those two realities are in fact only one and the same reality: when Socrates is dead, he is a soul deprived of its body, but he remains the same being, Socrates. The paradox emerges from the confrontation between this unity and the succession of time: "This whole will be tomorrow, this whole is A and B, thus A and B will be tomorrow; and let's suppose that B is a part to be suppressed. We answer by conceding that A and B will be tomorrow, but it doesn't follow that B will be tomorrow, because A and B will be B."[117]

Oresme's solution to the paradoxes relies on the logical operation called "exchange of names (*communicatio ydiomatis*)", an operation Oresme explained in a theological treatise named *De communicatione ydiomatum*: if there is an identity between two realities, the properties of one can be stated of the other.[118] For example, if the man Jesus is God, as Jesus is mortal, God is mortal, and as God is immortal, Jesus is immortal. The contradiction of such a statement doesn't destroy the argument, but only expresses the mystery of Incarnation and the incapacity of human reason to understand it. What is important to note is that the nature of the paradoxes Oresme studies in this theological treatise is exactly the same as the seven cases Oresme analyzes in this section of question 1.13.

Even if this first *via* is not Oresme's final answer, it illustrates the perplexities Oresme had to face when studying the unity of an absolutely successive being such as motion: the logical techniques he uses are the same as those he needed to analyze paradoxes of the theological mystery of Incarnation, as if the continuity of motion was just as difficult to understand as the unity of God.

Thus, Oresme's analysis is paradoxical: on the one hand, he has distinguished real motion from apparent one by its essential continuity: motion is a *continuous flux*. But on the other hand, this continuous flux can be analyzed as a whole "composed" of an infinite number of indivisibles. It is not a composition properly speaking, because those indivisibles are not the *parts* of the continuum: no part of motion is instantaneous. But for any two given successive parts, however small, there is no instant in the first part when the motion is in the same "state" as in any instant of the second. Fundamentally, the structure of continuity is not only defined by a whole/part relationship, but a whole/part/point relationship. The ontological paradoxes involved in the idea of a composition of the continuum by an infinite number of indivisibles are avoided thanks to the *condicio* theory. However, as we saw, Oresme judged this continuity sufficiently

[117] "Arguitur primo sic: hoc totum erit cras, hoc totum est a et b, ergo a et b erunt cras; et sit ita quod b sit pars resolvenda. Responditur concedendo quod a et b erunt cras nec ex hoc sequitur quod b erit cras, quia a et b erunt cras a", Nicole Oresme, *Quaestiones super de generatione et corruptione*, 113.

[118] Ernst Borchert, *Der Einfluss des Nominalismus auf die Christologie der Spätscholastik: nach dem Traktat De communicatione idiomatum des Nicolaus Oresme* (Münster: Aschendorff, 1940).

paradoxical to be compared to the mysteries of Religion. But in fact, he also deduced from this notion astonishing mathematical corollaries, as we shall now see.

3. A new kind of mathematical continuity

Any scholastic discussion about continuity and atomism rests upon Aristotle's classical rejection of the idea that a continuous magnitude is composed of *indivisibles* parts.[119] As John Murdoch has extensively shown, in the 14th century, atomism was revived in Western universities by philosophers such as Henry of Harclay, Walter Chatton, Gerard of Odon, or Nicholas Autrecourt.[120] This intellectual movement incited defenders of the continuum to renew their argument, as we can see with Thomas Bradwardine's treatise *De continuo* where he conscientiously refutes the idea that the continuum would be composed of *extensionless* indivisibles, whether finite in number *or infinite*. Murdoch has insisted on the fact that the critics against this new kind of atomism went "beyond Aristotle", "providing *new* conceptions and *new* arguments for their cause."[121] It is not the goal of this paper to reevaluate the relation between Oresme and contemporary atomism.[122] However, this global renewal implied for Oresme a real deepening of what continuum is.

Oresme studies continuity directly in two main works: the first three questions on book VI of Aristotle's *Physics,*[123] and the eighth question on Euclid's Geometry.[124] There are strong analogies between those two difficult studies, and I think that his analysis in *Physics* is better understood in the light of the questions on Euclid's geometry.

At first sight, Oresme's conclusions about continuity are not original at all. He first denies that the continuum is composed of indivisibles, whether this continuity concerns spatial and permanent entities (VI.1) or successive entities (VI.2). In the same way, the immediate conclusion of the next question (VI.3) is expected: a continuum, he says, is always divisible in divisible things (*divisibilia*). However, the arguments he uses

[119] On medieval atomism, see Bernhard Pabst, *Atomentheorien des lateinischen Mittelalters* (Darmstadt: Wissenschaftliche Buchgesellschaft, 1994); Andrew Pyle, *Atomism and its Critics. problem areas associated with the development of the atomic theory of matter from Democritus to Newton* (Bristol: Toemmes Press, 1995); Christophe Grellard and Aurélien Robert, *Atomism in Late Medieval Philosophy and Theology* (Leiden and Boston: Brill, 2009).

[120] John E. Murdoch, "Beyond Aristotle: Indivisibles and Infinite Divisibility in the Later Middle Ages", in *Atomism in Late Medieval Philosophy and Theology*, edited by Ch. Grellard and A. Robert (Leiden and Boston: Brill, 2009), 15-38.

[121] Murdoch, "Beyond Aristotle: Indivisibles and Infinite Divisibility", 17.

[122] For Oresme's relation to atomism, one should start with Stefano Caroti "Configuratio, ymaginatio, atomisme et modi rerum dans quelques écrits de Nicole Oresme", in *Méthodes et statuts des sciences à la fin du Moyen Âge*, edited by Ch. Grellard (Villeneuve d'Ascq: Presse universitaire du Septentrion, 2004), 127-140.

[123] Nicole Oresme, *Questiones super Physicam*, 658-677.

[124] Nicole Oresme, *Questiones super geometriam Euclidis*, 125-128.

are much more surprising, and reveal a truly original and profound understanding of the nature of the *continuum*. Before examining those arguments, I shall first present the content of the first two questions.

3.1 *Questiones super Physicam VI.1* and *2*

At the beginning of question VI.1, Oresme gives a very traditional definition of continuity: "Something is continuous whose parts are joined to one another and make one (*continuum est cuius partes copulantur ad aliquem terminum et faciunt unum*)."[125] He then distinguishes different kinds of continuity: the continuity *primo divisibile*, meaning the *quantitas extensa*, and the continuity *secundario divisibile*, meaning intensively divisible. This intensive continuity is thought of by analogy with "distance", extensive continuity. Finally, he distinguishes *continuum permanens* and *continuum successivum*, the continuity of a whole whose parts are not simultaneous.[126]

The first two questions only concern the supposition of a composition of a *finite* number of indivisibles. The first one is limited to extensive quantities and gives a very general conclusion: "no continuum is composed of indivisibles (*nullum continuum est ex indivisibilibus*)."[127] His general arguments rely heavily on Aristotle and the impossibility for indivisible things to be mutually in contact. Then Oresme specifies this general conclusion to the case of straight lines, circular lines, surfaces and bodies, using geometrical arguments. For example, the composition *ex indivisibilis* would not be compatible with continuous divisibility or incommensurability. It would also imply that the smaller magnitude would be equal to the greater, because both would be composed of the same quantity of points.

In the second question, Oresme studies the case of successive continuity, such as time, motion, and consequences of motion, like sound. Obviously, such a continuity cannot be defined by the mutual contact of its parts, because for a successive being, parts only exist one after the other: a being cannot be in contact with a nonbeing. However, Oresme gives a new understanding of continuity only in his final answers to preliminary arguments. Instants, he says, are concerned with continuity only *syncategorematice*, because after one instant, there is another instant "*sine intermissione.*"[128] Indeed, in the course of this second question, he implicitly identifies successive continuity with the negation of any quantitative instantaneous "leaps".[129]

[125] Nicole Oresme, *Questiones super Physicam*, 659.
[126] Nicole Oresme, *Questiones super Physicam*, 659.
[127] Nicole Oresme, *Questiones super Physicam*, 659.
[128] Nicole Oresme, *Questiones super Physicam*, 669.
[129] For example: "Tertia conclusio est quod nec motus intensionis, ut intensio albedinis, componitur ex indivisibilibus, sicut aliqui ymaginantur gradus indivisibiles. Probatur, quia sequitur quod talis intensio non esset continua; patet consequentia, quia indivisibile non aquirit<ur> nisi in

This raises questions about his analysis of the continuity of time. Indeed, his first conclusion states without ambiguity that time is not composed of a finite number of instants, just like a line is not composed of points.[130] Moreover, if time was composed of instants, and if a mobile was in motion during a period composed of three instants, A, B, and C, then the mobile would not be in motion in any instant: motion is a successive being, with *prior* and *posterior* as Oresme says, but if an instant is indivisible, there cannot be *prior* and *posterior* in it. Therefore, there would be no motion. Still, he concedes at the end of the question that "there will continually be an instant after an instant (*continue post instans erit instans*)."[131] In particular, he concedes that, for a duration A, all the instants that "endure (*continuant*)" during A are immediate to the term or last instant of A.[132] Doesn't that imply that time is composed of instants? At least, it doesn't imply, Oresme adds, that there are two instants immediately successive one after the other: the set of all instants before the last instant is an infinite set *without a last term.*[133] This argument introduces the

<instanti>, ergo non fieret intensio nisi per instantia, ex quibus non componitur tempus per primam conclusionem", Nicole Oresme, *Questiones super Physicam*, 667.

[130] "Prima est quod tempus non componitur ex instantibus, saltim finitis", Nicole Oresme, *Questiones super Physicam*, 666.

[131] "Secundo: si non ita est, sit ergo tempus *a b c* compositum ex tribus instantibus, tunc moveatur aliquid <in> illo tempore; tunc in nullo instanti movetur, ergo in tempore non movetur. Tenet consequentia, quia quod non movetur in aliqua parte temporis non movetur primo in illo tempore; et patet antecedens, quia in instanti non est prius aut posterius, quia iam esset divisibile; ergo in instanti non est motus qui est successivus", Nicole Oresme, *Questiones super Physicam*, 669.

[132] These are the arguments *quod sic* opening the question and arguing that instants are continuous: "Secundo, instantia sunt continua in tempore, ergo tempus componitur ex illis. Tenet consequentia, quia ex eis non fit aliud quam tempus, et si sint continua faciunt unum continuum. Probatur antecedens tripliciter: primo, quia continue et semper est instans in tempore, ergo illa <que> sic sibi succedunt in tempore sunt continua. Secundo, confirmatur auctoritate: inter omnia instantia que continuant horam et instans terminans est aliquod medium aut nullum. <Si aliquod>, sic dicendo similiter <hoc medium erit> tempus, et in illo sunt instantia, ergo non essent <omnia> alia assumpta. Si nullum, ergo omnia illa et instans terminans sunt immediata. Tertio, confirmatur: inter *a* instans et non esse illius nullum est medium, sed non esse illius terminatur aliquo instanti, ergo illud est immediatum *a*", Nicole Oresme, *Questiones super Physicam*, 664, and here is Oresme's final answer to these arguments: "Ad secundam, negatur antecedens, scilicet quod instantia sint continua. Et cum dicitur quod sunt continue, distinguendum est, quia potest intelligi quod se habeant continue, ita quod unum sit alteri continuum; et tunc est negandum. Alio modo quod ly 'continue' tenetur syncategorematice et valeat tantum sicut: 'sine intermissione post instans est instans'; et tunc conceditur quod continue post instans erit instans, et tamen nullum instans continue sequitur post hoc instans nec ex hoc sequitur quod aliqua sunt immediata vel continua etc. Et quando confirmatur ultra: 'inter omnia continuantia et terminans etc.', dico quod si ly 'omnia' potest teneri collective pro infinitis, tunc concedo quod terminans et omnia alia sunt immediata. Et ex hoc non sequitur quod aliqua duo sunt immediata, quia inter illa continuantia non est dare aliquod ultimum. Ad aliam cofirmationem, cum dicitur: 'inter *a* instans et suum non esse etc.', verum est secundum <quod> suum non esse non habet primum instans, immo in quocumque instanti non erit prius non fuerit", Nicole Oresme, *Questiones super Physicam*, 669.

[133] "Et ex hoc non sequitur quod aliqua duo sunt immediata, quia inter illa continuantia non est dare aliquod ultimum", Nicole Oresme, *Questiones super Physicam*, 669.

hypothesis of an infinite number of indivisibles, and thus goes beyond the purpose of this second question: we will go back to it when we shall study the third one. Anyhow, we see that continuity is not understood as a *relation* between *two parts* anymore, but as a *propriety* of a *whole*, an *infinite* whole.

Let's go back to the other successive continuities. Local motion, as one expects now, is not composed of "*mutatis esse indivisibilibus*" (second conclusion).[134] The same conclusion is repeated for the *motus intensionis*, the intensive motion (third conclusion).[135] Then, the fourth conclusion concerns the successive things which are consequences of motion, such as sound, proportion, sickness, intension, velocity, "*et similia*".[136] Once again, the same conclusion is drawn, with an interesting corollary about which I will say more below. Oresme finally goes back to permanent qualities, asserting that they are not composed of finite indivisible degrees either.[137]

Except for the corollary I just mentioned, those first conclusions do not seem very original. However, we already know from III.6 that in fact, Oresme considers it unproblematic to atomize local motion in an infinite number of indivisible *mutata esse*, provided that those indivisibles are not understood as beings, but as modes of beings: clearly, Oresme doesn't tell us the whole story here. For this reason, we should not be surprised that his argumentation gets more complicated in the next question.

3.2 *Questiones super Physicam VI.3*[138]

The question that is now raised is surprising. He asks whether a continuum is divisible into ever-divisible "things" (*divisibilia*).[139] In fact, he divides this question in two topics: first, he asks whether the continuum is divisible into ever-divisible things;

[134] "Secunda conclusio est quod nec motus localis vel extensionis componitur ex mutatis esse indivisibilibus. Probo, quia motus dividitur ad divisionem temporis a quo habet successionem per notabile prius dictum; ergo in tot dividitur sicut tempus, quod non componitur ex talibus per primam conclusionem", Nicole Oresme, *Questiones super Physicam*, 666.

[135] "Tertia conclusio est quod nec motus intensionis, ut intensio albedinis, componitur ex indivisibilibus, sicut aliqui ymaginantur gradus indivisibiles. Probatur, quia sequitur quod talis intensio non esset continua; patet consequentia, quia indivisibile non aquirit<ur> nisi in <instanti>, ergo non fieret intensio nisi per instantia, ex quibus non componitur tempus per primam conclusionem", Nicole Oresme, *Questiones super Physicam*, 667.

[136] "Quarta conclusio est quod nullum successivum sequens motum componitur ex indivisibilibus", Nicole Oresme, *Questiones super Physicam*, 666 and 667.

[137] Nicole Oresme, *Questiones super Physicam*, 668.

[138] "Quinta conclusio est quod <n>ulla qualitas permanens, si est, componitur ex indivisibilibus intensive, supposito quod habeat partes secundum intensionem, sicut calor vel albedo, quia tunc motus intensionis componeretur ex indivisibilibus, quod est contra tertiam conclusionem", Nicole Oresme, *Questiones super Physicam*, 671-677.

[139] "Consequenter queritur utrum continuum Sit divisibile in semper divisibilia, intelligendo quod dividatur in aliqua et illa in alia, et sic semper", Nicole Oresme, *Questiones super Physicam*, 671.

second, he studies whether it is composed of *infinite* indivisibles. Therefore, the main difference with the two former questions is that the number of indivisibles is now supposed to be infinite. However, the question of infinite divisibility might seem to have been already settled: obviously if a continuum is not composed of indivisibles, should it not be thought of as always divisible in divisible parts? But Oresme's purpose is different, and his main conclusions are much more complicated. There is a neat contrast between the apparent classical general conclusions he draws and the complexity of the corollaries he adds very allusively.

The first general conclusion concerns the first topic, and is quite expected: a continuum is indeed divisible into ever-divisible parts (*continuum est divisibile in semper divisibilia*), at least "by signations of parts", although no actual separation of the parts could occur.[140] The arguments do not teach the reader anything new: first, a part of a continuum is not indivisible, and conversely a point is not part of the continuum; secondly, the signature process used in arithmetic or astronomy is infinite; third, and more originally I think, the musical tonus cannot be divided in two equal halves.

Now, this general conclusion is immediately followed by two very surprising series of corollaries. But before turning to them, I shall comment on the general conclusions of the second topic.

Of the three general conclusions he comes to, the last one is the most disturbing:

- Continuum is not composed of an infinite number of indivisibles;[141]
- There are no such indivisibles in a continuum;[142]
- But: "the being of indivisibles must not be denied, taking 'being' in a large and equivocal meaning (*non est negandum indivisibilia esse, large et equivoque capiendo 'esse'*)."[143]

Thus, we immediately see that Oresme's conclusion is ambivalent: on the one hand, he completes Aristotle's doctrine by extending his rejection of the composition of the

[140] "De primo est conclusio quod continuum est divisibile in semper divisibilia per signationem partium, quamvis non sit separatio actualis", Nicole Oresme, *Questiones super Physicam*, 672.

[141] "Prima conclusio est quod continuum non componitur ex indivisibilibus infinitis", Nicole Oresme, *Questiones super Physicam*, 675.

[142] "Secunda conclusio est quod non sunt talia indivisibilia in continuo, quia non substantia, ut probatum est, nec accidens, nec tales forme, quia tunc quere<re>tur de subiecto. Et secundo, videtur quod aggregatum ex omnibus illis esset continuum, et quod componeretur ex illis", Nicole Oresme, *Questiones super Physicam*, 675.

[143] "Tertia conclusio est quod non est negandum indivisibilia esse, large et equivoce capiendo 'esse', et ymaginando aliter quam mathematicus ymaginatur, quia talia sunt significabilia aut complexe aut similitudinarie", Nicole Oresme, *Questiones super Physicam*, 675. It is interesting to note that the being of indivisibles must be "imagined", but not in the way mathematician do. The common distinction between reality and mathematical imagination is not enough: there is room for an imagination which is not mathematical, that is to say which is not, in that case, merely fictional.

continuum to the case of an infinite number of indivisibles. He even adds that those indivisibles don't exist in the continuum. But, on the other hand, he justifies the logical and mathematical use of indivisibles by clarifying their meanings. A natural philosopher cannot avoid points, surfaces, or instants, but he must exactly understand the meaning of these words. Indeed, what Oresme means by this "*large et equivoce*" meaning of *esse* is that a point must be understood as "here in-an-indivisible-manner (*hic indivisibiliter*)", an instant as "now in-an-indivisible-manner (*nunc indivisibilter*)", so that indivisibles are not beings, or *res*, but modes of beings more adequately named by adverbs.[144] As we see, Oresme doesn't dismiss the reality of indivisibles as mere mathematical fictions: the *esse* of indivisibles *must not be denied*. However, indivisibles are not what the mathematician thinks they are, that is to say: *beings*.

His answers to objections in favor of the composition of the continuum are very significant. The fourth argument *quod non* states that if a sphere tangent to a surface moves on it, the motion will describe a line on this surface, so that "a line is composed of points, but infinite in number."[145] Oresme's answer is straightforward: "I concede the whole case."[146] But one must not think that there is indeed a point where the sphere touches the surface, "as mathematician imagines (*sicut mathematicus ymaginatur*)": what is true is that the sphere touches the surface "somewhere in an indivisible manner (*indivisibiliter alicubi*)."[147] The use of indivisibles, even when a continuum is mathematically *imagined* as composed of such indivisibles, is mathematically legitimate. Yet, the way the mathematician imagines things does not reflect reality.

Again, he objects to himself the possibility to imagine a body composed of an infinite number of indivisible surfaces. Doesn't that mean that a quantity can be composed of an infinite number of *non quanta* ?[148] Indeed, answers Oresme, but only in

[144] Nicole Oresme, *Questiones super Physicam*, 675. This propositional analysis is related to the *condicio* theory. See the bibliography above (note 18). See also Laurent Cesalli, "Ontologie 'nominale' et 'adverbiale' chez Nicole Oresme", in *Nicole Oresme philosophe: Philosophie de la nature et philosophie de la connaissance à Paris au XIVe siècle*, edited by J. Celeyrette and Ch. Grellard (Turnout: Brepols, 2014), 163-183.

[145] "Quarto, unumquodque dividitur in ea ex quibus componitur, sed non componitur ex semper divisibilibus, immo indivisibilibus, quod patet si sphera super planum moveatur, que tangit planum in puncto, et continue punctus talis est supra <punctum> spatii, et tamen describit lineam tali motu, et cum in fine fuerit super totam, et non nisi super puncta, videtur quod linea sit composita ex punctis, saltem infinitis", Nicole Oresme, *Questiones super Physicam*, 671.

[146] "Ad quartam, de sphera mota super planum, conceditur totus casus. Nec est ibi punctus aliquis secundum quem tangat, sicut mathematicus ymaginatur, sed tangit indivisibiliter alicubi, ideo non oportet, nec etiam describit lineam, igitur etc.", Nicole Oresme, *Questiones super Physicam*, 677.

[147] See the footnote above.

[148] "Ad ymaginationem superficies finita lata pedalis componitur ex infinitis superficiebus indivisibiliter latis, ergo non est impossibile quod quantum componatur ex infinitis non quantis. Antecedens patet in figura supra *a b c d*", Nicole Oresme, *Questiones super Physicam*, 676.

imagination, not *secundum rem*.[149] And he adds: "(...) anyway, this is a beautiful argument (*pulchra persuasio*) for those who defend the opposite."[150] But the identification of a body with an infinite number of surfaces is just the kind of mathematical method Oresme uses with high skill, for example in his *De visione stellarum,* where he assimilates an atmospheric volume to an infinite set of thin refractive layers.[151] We thus have the feeling that, if Oresme denies the reality of composition of the continuum, it is mainly to *justify* its mathematical use *secundum ymaginationem* in new mathematical techniques invented by Oresme himself.

3.3 The first series of corollaries of question VI.3

This skill is in fact suggested in the two series of corollaries in question VI.3 mentioned before. Here is the first series:[152]

- (1.1) the past being considered in the divisive sense, it is possible that if the world was eternal, any part of a continuum would have been divided.
- (1.2) the continuum cannot be divided in every manner in all [indivisibles] in which it can be divided.
- (1.3) the past being considered in the divisive sense, this is possible: if the world had been eternal, any part of a continuum would have been divided and no part would remain undivided, meaning a part which was previously not divided, although parts would still be joined.
- (1.4) there are an infinite number of points on this continuum, where there never was a division, but that can be divided in an infinite number of other ways.

Oresme is very allusive, but obviously, those corollaries are not at all expected as the general conclusions we saw before.

The first corollary projects the division of a continuum in an eternal past: it rests on the logic of time. If it is supposed that the world had not been created and was eternal, then it is possible that a continuum *was* divided in the past in such a way that

[149] "Ad secundam, conceditur antecedens ad ymaginationem; tamen non propter hoc tales superficies secundum rem sunt <partes> indivisibiliter late. Et ideo non est omnino simile, licet esset pulchra persuasio tenentibus oppositum", Nicole Oresme, *Questiones super Physicam*, 676.

[150] See the footnote above.

[151] Dan Burton, *Nicole Oresme's "De visione stellarum (On seeing the stars)": A Critical Edition of Oresme's Treatise on Optics and Atmospheric Refraction* (Leiden and Boston: Brill, 2007), 158-160.

[152] "De preteritis in sensu diviso hoc est possibilis, si mundus fuit eternus quelibet pars continui fuit divisa"; "non potest esse divisum omnimode in omnia in que est divisibile"; "de preteritis in sensu diviso hec est possibilis: si mundus fuit eternus, quelibet pars huius continui fuit divisa et nulla remanet indivisa, hoc est que prius non fuerit divisa, quamvis iterum partes sint unite"; "infinita sunt puncta in isto, ubi numquam fuit divisio, et quod infinitis aliis modis potest dividi, ergo", Nicole Oresme, *Questiones super Physicam*, 672-673.

each part of it *had been* divided. The proposition is true only "*de preteritis de sensu diviso*", and not *composito*: in the composite sense of the past, the proposition would mean that there *was* an instant in the past when all the parts of the continuum *were* actually divided. In the divisive sense, it means that for each part of continuum, there *was* an instant when this part *was* divided, while some other parts still remained undivided.[153] In particular, if A is such a divided part, it was divided in parts B and C still left undivided. However, there was also an instant when B was divided, and another for C.

Because of the past tense of the proposition, the reader is left with the quite strange idea that a continuum *is actually wholly* divided. The third corollary is very clear, specifying that "no part remains undivided (*nulla [pars] remanet indivisa*)."[154] At first sight, such an idea is absolutely in contradiction with what we usually understand by the infinite divisibility of the continuum: precisely, we mean that *there is always something left to be divided*.[155] Indeed, the meaning of this proposition is that there is no instant when the division leads to such small quantities that they cannot in turn be divided. Now, if the division is supposed to have been done in the past, it should be thought of as *fully accomplished* in the present. And of course, we have difficulties to understand in what kind of state could be a *wholly* divided continuum!

This paradoxical idea is not unusual in Oresme's work. In fact, this is the basis of a new kind of exhaustion principle Oresme used and probably invented, a principle I called a "complete exhaustion along proportional parts of time."[156] If a continuous magnitude is continually divided in proportional parts, for example in a ratio of 2: 1, but in such a way that the division process is done in one hour, the first half being divided in the first half of the hour, then a quarter in the next quarter of the hour, and thus continually for each proportional parts of the hour, then the division should be thought of as *complete* at the end of the hour: nothing is left to be divided. As Edmond Mazet showed, this mathematical method, which Oresme presents in the first question of his *Questiones super geometriam Euclidis*, is very important to calculate the sum of infinite series of determinate ratio, a major topic in Oresme's mathematical accomplishments.[157]

The two other corollaries, the second and the fourth, are much harder to understand. What does it mean, that the continuum cannot be divided "in any manner in anything where it is divisible (*omnimode in omnia que est divisibile*)"? Why is it

[153] This interpretation of mine is based on Curtis Wilson, *William heytesbury. Medieval Logic and the Rise of Mathematical Physics* (Madison: University of Wisconsin Press, 1960), 17.

[154] Nicole Oresme, *Questiones super Physicam*, 672-673.

[155] Mazet, "La théorie des séries de Nicole Oresme".

[156] Debroise, *Mathématiques de l'intensité et Merveilles de la nature*, 595-616.

[157] About the originality of this kind of exhaustion, Edmont Mazet notices: "Sur ce point, Oresme opère un renversement complet, qui ne consiste en rien de moins qu'à passer du point de vue strictement aristotélicien d'un processus se poursuivant indéfiniment à celui d'un processus actuellement poussé à l'infini", Mazet, "La théorie des séries de Nicole Oresme", 58.

important to notice that there was an infinite number of points where no division occurred? I think the key is to be found in the analogous arguments, and slightly more precisely, that one can find the eighth question of his questions on Euclidean geometry.

3.4 Question 8 on Euclidean Geometry

In question 8,[158] Oresme asks a seemingly harmless question: is the diagonal of a square commensurable to its side?[159] Having argued that it is not, he concludes two corollaries and, as he says, two "difficulties".[160] The two difficulties are thus formulated:

(1) It could be proved that a magnitude A, yet of the same kind as any line between C and D, and smaller, could become greater than any of these lines by a continuous increase, and never would be equal to any of them.[161]

(2) From this, it could be proven that it is possible that a *continuum* be composed of an infinite number of indivisibles.[162]

As usual in those questions, Oresme doesn't justify those two statements. Of course, they are startling: the second one just states the contrary to what we would expect. Moreover, as we shall see, the arguments are very similar to those we can find in VI.3 of his *Questions on Physics*. The first one will be fully explained below, but we can already notice that it is supposed to conceptualize a "continuous increase (*continua augmentatio*)".[163]

Both difficulties are necessary consequences of the two imaginations he had proposed as corollaries, of which the first is:

(1) "Any continuum, as a line, can be divided in two incommensurable [parts]. From this, it follows that if a line were so divided, that one part is to the other like the diagonal to the side of a square, and once again those two parts divided in the same way, and so on infinitely, and if this line had been divided along all those imagined points, on which such a division can be done, then there would remain something to be divided, and there would be an infinite number of points on which no division would have been performed. Indeed, the

[158] Nicole Oresme, *Questiones super geometriam Euclidis*, 125-128.

[159] "Utrum dyameter sit commensurabilis coste", Nicole Oresme, *Questiones super geometriam Euclidis*, 125.

[160] Nicole Oresme, *Questiones super geometriam Euclidis*, 128.

[161] "(...) poterit probari, quod a, quod est eiusdem rationis cum qualibet linea, que est inter c et d, et minus, fiet maius qualibet illarum et hoc per continuam augmentationem et nulli earum fiet equale", Nicole Oresme, *Questiones super geometriam Euclidis*, 128.

[162] "(...) ex hoc probatur, quod possibile est, quod continuum componeretur ex indivisibilis infinitis", Nicole Oresme, *Questiones super geometriam Euclidis*, 128.

[163] Nicole Oresme, *Questiones super geometriam Euclidis*, 128, l.78.

> division would have fallen on no point dividing the line into two commensurable parts."[164]

For the argument to be well understood, it must be noticed that the infinite process of division is supposed to be achieved. Implicitly, Oresme is asking to measure the process of division of time, for example, one hour, to divide the whole hour according to a continuous proportion, and to consider the state of the divided line at the end of the hour. This is a case of the complete exhaustion along proportional parts of time I mentioned above.

We recognize the same kind of conclusion we found very allusively in his *Questions on Physics*: if we continually divide a magnitude according to an irrational ratio, on the one hand the division is infinite and there will always remain something to be divided. But what if the division is supposed to be fully achieved? Would there be any remainder to be divided? In a sense, there would, but it is a *new* sense: all parts would have been divided, but all the rational *points* would remain undivided. Thus, the focus has shifted from undivided *parts* to undivided *points*, or, as one could say more exactly, *uncut* points.

This sheds a new light on the initial question of VI.3: if Oresme, quite traditionally, agrees with the fact that the continuum is "divisible in always divisible things", he doesn't understand it in the traditional way. If the process of division is fully achieved, as it is when projected in the past, there is no remaining *part* to be divided. Once again, his first corollary states clearly: "any part of the continuum has been divided (*quelibet pars continui fuit divisa*)." However, there is an infinite number of *points* where no division is ever felt: this is why, even in this strange case, something still remains "*undivided*", uncut. But this corresponds to a totally new understanding of the continuum, a novelty confirmed by the other corollaries.

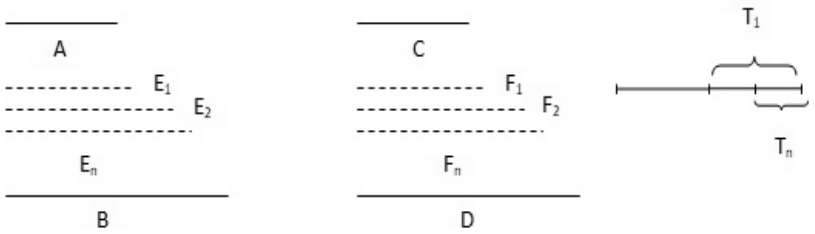
Indeed, Oresme immediately draws a strange conclusion from this first imagination: "From this it follows that, if a portion of prime matter is given – a portion that, according to Aristotle, has existed since eternity –, then it was so divided that no part remains undivided, and yet, in the future, it can be divided in an infinite number

[164] "Primum est, quod quodlibet continuum, verbi gratia linea, potest dividi in duo incommensurabilia et ex isto sequitur quod, si aliqua linea sit divisa in duo talia, quorum unum sit sicut dyameter et reliquum sicut costa, et iterum quelibet istarum partium in duo talia et sic in infinitum, et si ista linea fuisset divisa secundum omnia ista puncta ymaginata (super que potest fieri divisio talis isto modo), quod adhuc remansisset dividendum et cum hoc fuissent infinita puncta, super que non fuisset divisio, quia super nullum punctum dividens eam in duo commensurabilia cecidisset divisio, et hoc patet. Iterum ex isto sequitur, quod demonstrata una portions materie prime, que fuit ab eterno secundum Aristotelem, quod ipsa fuit taliter divisa, quod nulla pars remanet indivisa, et tamen infinitis poterit dividi aliter quam umquam fuerit divisa prius", Nicole Oresme, *Questiones super geometriam Euclidis*, 127.

of ways different from those by which it has been already divided."[165] Two very different ideas about the continuum are clearly distinguished here: the first, in terms of *parts*, the second, in terms of *points*.

The second imagination confirms this analysis and demonstrates once more how profound Oresme was about mathematical continuity. Here, Oresme states:

(2) "I suppose one line A and one another B double to A, and a line C equal to A and D equal to B. Then between A and B let us imagine a line incommensurable



to both, then between any of the other lines and this [last] one, another line incommensurable to both, and so on infinitely. And in the same way, let there be between C and D commensurable lines and so on, infinitely. In the same way, let's imagine an hour divided in instants in two equal parts, and similarly those equal parts in two and so on infinitely."[166]

Oresme doesn't go any further, but now we can guess what he was talking about when speaking of a "continuous increase" of magnitude A. Let's call E_n and F_n any magnitude respectively greater than A and smaller than B, and greater than C and smaller than D. Let's also divide proportionally one hour and call T_n any part of it. The set of all magnitudes between A and B is a scale along which a variable magnitude could increase from A to B taking *continually* the value of a magnitude incommensurable to both A and B. Therefore, the increase is *continuous* in the sense that for any increase from A to, say, E_1 however small, during a small period T_1, there is a smaller increase from A to an incommensurable line E_2 smaller than E_1 during a period T_2 smaller than

[165] "(...) demonstrata una portione materie prime, que fuit ab eterno secundum Aristotelem, quod ipsa fuit taliter divisa, quod nulla pars remanet indivisa, et tamen infinitis poterit dividi aliter quam umquam fuerit divisa prius", Nicole Oresme, *Questiones super geometriam Euclidis*, 127.

[166] "Pono, quod *a* sit una linea et *b* sit una alia dupla ad illam et sit *c* una alia equalis *a* et *d* equalis *b*, tunc inter *a* et *b* ymaginetur una linea utrique incommensurabilis, deinde inter quamlibet aliarum et istam linea utrique incommensurabilis et sic in infinitum. Et sic eodem modo fiant linee inter *c* et *d* que sunt commensurabiles et sic in infinitum. Item ymaginetur hora dividi per instans in duas medietates et iterum quelibet medietas in duas et sic in infinitum", Nicole Oresme, *Questiones super geometriam Euclidis*, 127-128.

T_1. Therefore, there are no leaps during the increase from A to B. However, the situation is very paradoxical.

The paradox stems from the unification of the two sets: the one with incommensurable and the other with commensurable values. Both are *continuous* sets between the *same* terms, the magnitudes A and B (or C and D equal to them), but no element of any of them is an element of the other. The magnitude A will become greater than F_n by a *continuous* increase, without being ever equal to F_n, and in the same way the magnitude C will become greater than E_n by a *continuous* increase, without ever being equal to E_n. Each magnitude passes through holes without ever jumping...

Finally, we can try to understand the conclusions I mentioned.

If we consider the three sets, the rational values, the irrational values, and time, we have three continually divisible sets; the set of rational values and the set of irrational values are thus constituted such that there is no interval so small that it is not divisible into divisible parts. Therefore, if the magnitude has a rational value, there was an instant when it had a smaller value. And the same thing can be said of irrational values. Thus, we have a strange situation, because both increases are continuous, yet "in a certain way", they skip values. The irrational set skips the rational values, the rational set skips the irrational ones. But if we consider separately each set, no value is skipped: there is no "instantaneous" motion. This is probably the reason why Oresme feels authorized to conclude that it *could* be argued that a continuous being *be composed* of infinite indivisibles.

3.5 Back to question VI.3: the second series of corollaries

We can now go back to the second series of corollaries in *Physics*, VI.3.[167] The same kind of arguments is also to be found here. Just like in the question 8 on Euclid's geometry, Oresme first asserts that a continuum can be divided in two parts either commensurable or incommensurable.[168] He then adds that a rational ratio can become irrational, and conversely, by adding or subtracting an "infinitely small quantity (*infinitum modicum*)".[169] He does not really explain here what he has in mind, but the proposition II.4 of his *De commensurabilitate* gives us some hints.[170] There, he

[167] Nicole Oresme, *Questiones super Physicam*, 674.

[168] "Primum est quod secundum quamlibet proportionem et qualitercumque potest dividi continuum in duo media vel etiam in partes commensurabiles <vel incommensurabiles>, Nicole Oresme, *Questiones super Physicam*, 674.

[169] "Qualibet proportione rationali data per infinitum modicum fieret irrationalis, aut e converso, addendo vel diminuendo", Nicole Oresme, *Questiones super Physicam*, 674.

[170] "Conclusio quarta. Nulla est circuli tam parva portio in qua talia duo mobilia non coniungantur in posterum et in qua non fuerint [in preterito] aliquando coniuncta", Nicole Oresme,

suggests applying the side of a square on its diagonal as many times as necessary for it to exceed it.[171] Obviously, the excess of added sides upon the diagonal is smaller than the diagonal. If we now apply again this excess to the diagonal as many times as necessary for it to exceed once again the diagonal, we will obtain a new smaller excess. Oresme concludes: "Proceeding thus infinitely, the excess by which the diagonal is divided would be diminished infinitely (*in infinitum diminueretur*) so that, in the whole time, no part of the diagonal would remain undivided (*nulla pars remanet toto tempore indivisa*)."[172]

Therefore, the excess is understood as a *variable* magnitude, continuously decreasing one division after the other, in such a way that no part remains undivided, and thus "tending" to *non quantum*. What Oresme is asking in the corollary of VI.3 is the reverse process: this "infinitely small quantity" is now *added* to any magnitude. For example, added to the diagonal of a square, it makes a very small increase from a magnitude incommensurable with the side to a commensurable one: an irrational ratio has become rational by what one could call an *infinitesimal increase*. Once again, this reversal of a subtracting process to an additive process is no exception in Oresme's works.[173]

We can now examine the most astonishing corollary of those two series, obviously meant to be spectacular. Oresme now wants to prove that during the time of the increase (of a magnitude), two contradictory propositions will be continuously (*continue*) true: "These are commensurable", and "These are not commensurable."[174] Going back to the case given above, an increase from A to B through incommensurable values will be continuous, as we saw, just like an increase from C to D through commensurable values. Now, if we "mix" those two increases by considering a growing

Tractatus de commensurabilitate vel incommensurabilitate motuum celi, edited by E. Grant (Madison: University of Wisconsin Press, 1971), 252.

[171] "Ergo nulla pars circuli restabit quin aliquando ad ymaginationem sit divisa per hunc modum sicut qui replicaret costam quadrati super dyametrum quousque excederet, et iterum abscinderet ilium excessum secundum et replicaret ut prius et acciperet tertium excessum, et sic procederet in infinitum. Tunc in infinitum diminueretur ille excessus secundum cuius quantitatem semper divideretur dyameter, igitur nulla pars dyametri remanet toto tempore indivisa; et ita est quodammodo in proposito", Nicole Oresme, *Tractatus de commensurabilitate*, 254.

[172] See the footnote above.

[173] Question 2 of his Questions on the geometry of Euclid is another very important case. Nicole Oresme, *Questiones super geometriam*, 103-106. See also: Mazet, "La théorie des séries de Nicole Oresme".

[174] "Ex quo sequitur tertio quod continue per illud tempus augmenti utrumque contradictoriorum erit verum continue, id est sine intermissione temporis, supposito quod instans sit aliquid verum, et contradictoria sunt illa: hec sunt commensurabilia, hec non sunt commensurabilia. Ex hoc possunt haberi multe ymaginationes de mixtione et aliis, convertendo ymaginationem de successivo ad permanens. Et ita etiam si *a* sit unisonus et *b* sonus continue intendatur, tunc continue erit concordia et continue erit discordia, et sic de aliis", Nicole Oresme, *Questiones super Physicam*, 674.

line taking *all* the values, commensurable and incommensurable, thus allowing for those infinitely small increases defined above between the commensurable and the incommensurable, we obtain the paradoxical situation where, on the one hand, the magnitude is commensurable continuously and without interruption, and at the same time continuously incommensurable. Of course, at any instant, the growing line is either commensurable or incommensurable to the given and static lines. But if one considers the *whole* period of increasing, the growing line is *continuously* commensurable *and* incommensurable: truth is now in the state of Schrödinger's cat.[175]

Oresme has thus defined a continuity of higher order: an increase is continuous in a "first order" continuity, or "*sine intermissione*", when it is the reverse process of the classical geometrical infinite division. But it is of a "second order" continuity when the set of all possible increases includes the "infinitely small" increase defined above between commensurable and incommensurable magnitudes. The Schrödinger-like state induced can even be heard: if a sound is *continuously* intensified – with a second-order continuity – then it will be *at the same time* but *continuously* in concord *and* discord with another given sound...[176]

3.6 Oresme's solution to Zeno's paradox

In question VI.3, the first two *argumenta quod non* are explicitly Zeno's paradoxes.[177] According to the second one, if continuity was composed of continually divisible parts, then the quicker mobile would not reach the slower one. The continuity of magnitude seems in contradiction to the continuity of motion. After his long and profound study on continuity, and his new understanding of a continuous increase and decrease, Oresme can answer this objection in a very straightforward way.[178]

[175] Oresme's reasoning could be compared to the Dirichlet function, where $f(x)$ equals 1 if x is a rational number and 0 if x is not rational.

[176] Nicole Oresme, *Questiones super Physicam*, 674.

[177] "Et arguitur quod non, quia sequitur quod nulla magnitudo finita posset pertransiri tempore finito. Patet statim, quia pertransiretur medietas, deinde medietas residui, deinde medietas secundi residui; et sic semper, <si> quodlibet residuum sit divisibile. Secundo, sequitur quod mobile velox non possit atti<n>gere mobile tardum. Verbi gratia: sit *a* velox, *b* tardum precedens; tunc, quando *a* venerit in puncto *c* ubi nunc est *b*, adhuc non erit coniunctum *b*, quia *b* erit ulterius motum propter hoc quod movetur continue; et tunc iterum, quando *a* venit in *d* ubi nunc est *b*, adhuc non attingeret *b*, quia *b* excedit *d*. Et sic argueretur semper, si quelibet pars spatii est divisibilis; ergo *a* nunquam attingeret *b*. Et ille sunt due rationes Zenonis; et una prius fuit facta et quattuor habent parvam apparentiam", Nicole Oresme, *Questiones super Physicam*, 671.

[178] "Ad secundam, dicitur quod mobile velox attingit mobile tardum, sed numquam dum dista<n>t, sed in primo instanti in quo non distabunt. Immo bene probat ratio quod non est ultimum instans in quo distant, sed quandocumque distant, adhuc distabunt semper; et sic in infinitum. Tamen quia hoc est semper diminuendo, totum pertransitur isto tempore habente etiam infinitas partes", Nicole Oresme, *Questiones super Physicam*, 677.

He distinguishes two relations between the mobiles: to be mutually distant, and not to be mutually distant. The argument proves that there is no last instant when the two mobiles are distant, because of the infinite divisibility. However, he adds, "because this is always diminishing, the total will be passed through during this period having also an infinite number of parts."[179] The "period" he is talking about is the one during which the two mobiles are mutually distant. This period does not have a last instant, but is, however, limited by the first instant when the two mobiles *are not* mutually distant. Thus, if we suppose D to be the initial distance between the two mobiles at the beginning of the motion, Oresme is stating that during this period, D will decrease until it vanishes: "the total is passed through (*totum pertransitur*)." This requires the new mathematical methods Oresme has just introduced, in particular, the *complete* exhaustion. It doesn't immediately require what I called the second order continuum, but the formalization of the idea an "infinitely small increase" between the commensurable and incommensurable, a quasi-punctual increase (or decreasing) really gives a mathematical feeling of what the continuity of motion is.

Thus, we see that, although he remains traditional is his general conclusions, Oresme totally renews the meaning of them by distinguishing *undivided parts* and *uncut points*. He never advocates the atomization of the continuum, but his fine-grained mathematical analysis of the continuum is really tantamount to such an atomization. The geometrical demonstrations that end the D*e Configurationibus* illustrate the way those logical and ontological reflections beg imperceivable et effective mathematical techniques. In particular, proposition III.11 really is a mathematical variation on a Zenonian theme, turning the logical paradox into an ability to measure mathematically the finite space spanned by a mobile during a never-ending motion whose velocity is continuously decreasing.[180]

Conclusion

As we saw, Oresme's understanding of the continuity of motion is very ambivalent: he has a tendency to assert vigorously the continuity of motion, but another tendency to atomize this continuity. On the one hand, he defines continuity as an *essential* property of real motion by contrast with apparent motion. His analysis of cartoon-like discrepancies even reveals his psychological subtlety. But on the other hand, the way he understands this continuity, ontologically and mathematically, is tantamount to a very original kind of atomization of the continuum: Oresme's notion of an *absolutely* successive being makes it possible for him to understand motion as a continuous whole "composed" of or "generated" by an infinite number of atoms of motion, just like a continuous line that would be generated by an infinite number of indivisible points. This does not mean, of course, that the continuum really is *composed* of indivisibles,

[179] See the preceeding note.
[180] Nicole Oresme, *De Configurationibus*, 424-426.

since as Oresme repeatedly asserts, indivisibles are not beings, as the mathematician wrongly imagines. In the case of motion, the ontological paradoxes implied by such a "being" could be solved thanks to the *condicio* theory. The mathematical counterpart of this ontological analysis is Oresme's original method of complete exhaustion, and his ability to calculate the summation of different series. To the infinite divisibility of the continuum, he adds a new kind of property: the existence, for any division of the continuum, of an infinite number of uncut points. Consequently, a line being given, the set of rational points and the set of irrational points are both continuous, and the union of the two sets is a continuum of higher order. In such a way, a growing line taking successively all these values passes through infinitely smaller increases, the increase from a rational/irrational value to an irrational/rational one. Thus, we can see how subtle Oresme was when analyzing the continuity of motion, and why, in the course of those analyses, he had the feeling of meeting difficulties only comparable to the mysteries of his religion.

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NICOLE ORESME ON THE MOVEMENTS OF JAVELIN THROWERS: A PERIPATETIC READING OF *DE CONFIGURATIONIBUS* II, 37

NICOLE ORESME SOBRE LOS MOVIMIENTOS DE LOS LANZADORES DE JABALINA: UNA LECTURA PERIPATÉTICA DEL *DE CONFIGURATIONIBUS* II, 37

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Abstract

In this contribution, I analyze a text by Oresme which gives a rather original explanation of the process of throwing a javelin and, more generally, of the actions of people who seem to have a kind of natural ability to succeed in their actions (*De Configurationibus* II, 37). In highlighting some sources that appear to have been present on the author's mind although they were hitherto neglected in Oresmian studies, I would like to show that his presentation of this specific kind of motion is deeply rooted in the scholastic theological tradition and that this tradition makes this chapter seem much less strange and much more coherent than it might seem at first glance.

Keywords

Good Fortune; Oresme's Ballistic and Doctrine of Configuration; Aristoteles Latinus; *Liber de bona fortuna*; Peripatetic Tradition in the Middle Ages

Resumen

En esta contribución analizo un texto de Oresme que ofrece una explicación singular del proceso de lanzamiento de una jabalina y, más en general, de las acciones de personas que parecen poseer una especie de habilidad natural para tener éxito en sus acciones (*De configurationibus* II, 37). Poniendo de relieve algunas fuentes que parecen haber estado presentes en la mente del autor pero que hasta ahora han sido ignoradas en los estudios oresmianos, quisiera mostrar que la presentación de este tipo específico de movimiento está profundamente arraigada en la tradición teológica escolástica. Visto a la luz de esta tradición de ideas, el capítulo en cuestión resulta mucho menos extraño y mucho más coherente de lo que pueda parecer a primera vista.

Palabras clave

buena fortuna; balística y doctrina de la configuración en Oresme; Aristoteles Latinus; *Liber de bona fortuna*; tradición peripatética en la Edad Media

Introduction*

In this contribution, I analyze a late text by Oresme which gives a rather original explanation of the process of throwing a javelin and, more generally, of the actions of people who seem to have a kind of natural ability to succeed in their actions (*De Configurationibus* II, 37). In highlighting some sources that appear to have been present on the author's mind although they were hitherto neglected in Oresmian studies, I would like to show that his presentation of this specific kind of motion is deeply rooted in the scholastic theological tradition and that this tradition makes this chapter seem much less strange than it might seem at first glance. I will start the inquiry by presenting the chapter under consideration and giving a first outline of its argumentative structure (I). Then, I will show how some sections of this chapter are in line with a particular question found in Oresme's *Questions on Aristotle's Physics* (II). Third, on the basis of what was discussed in II, I will highlight the importance of some texts by Giles of Rome and by Thomas Aquinas to understand Oresme's *De Conf.* II, 37 as well as two questions of his *Problemata* (III). Finally, I will discuss Oresme's view on human success more generally in comparison with other authors from the long Peripatetic tradition and highlight some original aspects of the author's reading of Aristotle and theory of the particular notion of "*impetus*" (IV). An appendix provides two argumentative maps: first, of Oresme's *De Configurationibus* II, 37 and, second, of his commentary on *Physics* 197a 25-29.

I. A presentation of Oresme's *De Conf.* II, 37: on mental movements, on fortune and on throwing a javelin

Chapter 37 from Section II of Oresme's treatise known as *Tractatus de configurationibus qualitatum et motuum* is announced in the following way: "On the causes of certain effects arising in the subject itself, based on the prior statements."[1] In this chapter, Oresme

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[1] Nicole Oresme, *De Configurationibus* II, 36, in *Nicole Oresme and the Medieval Geometry of Qualities and Motions. A Treatise on the Uniformity and Difformity of Intensities known as Tractatus de configurationibus qualitatum et motuum*, edited with an Introduction, English Translation and

develops his own explanation of a series of phenomena by means of his doctrine of physical "configuration", that was mainly explained in the preceding chapters of the work. This notion, that the author calls elsewhere "*ymaginatio*", "*figuratio*", or even "*dispositio*", was developed by him to conceptualize the quantitative variation of qualities in space and time. The notion has been the object of an interesting doctoral dissertation by Philippe Debroise, who has shown the broad interest of this concept and its various applications in Oresme's work.[2] In *De Conf.* II, 37 (376,1-380,43) the notion of configuration is applied to explain the effects that prove to be useful or harmful for the author of the action under consideration. The main idea of this chapter is to use the "difformity of accidents of the soul" discussed in the previous chapter ("*De difformitate accidentium anime*"[3]) to account for some phenomena caused by a given action in the agent himself, whereas the following chapter will do the same for the phenomena caused by the agent "in an alien body."[4] In what follows, I will start by presenting the entire chapter, before focusing on the passage on throwing the javelin.

Following the reasonable structure suggested by Clagett's edition, one might divide *De Conf.* II, 37 into four main parts, corresponding to distinct argumentative steps. The first one (376,1-378,16) starts with a very general claim, namely that human imagination (*apprehensio aut cogitatio seu ymaginatio*) changes the body of the person who apprehends something, by reason of desire or passion (l. 3-4).[5] Oresme supports this claim by recalling the case of anger, which implies not only an intense desire for revenge, but also a face change and a strong motion of the blood (l. 5-6).[6] And he immediately extrapolates this famously (although tacitly) Aristotelian account of anger as an embodied phenomenon[7]

Commentary by M. Clagett (Madison, Milwaukee and London: The University of Wisconsin Press, 1968), 376,1-2: "De causis quorundam effectuum in subiecto proprio ex predictis." In what follows, I will systematically refer to this edition of the Latin text. The text sections which I quote in an English translation are also taken from this book, except for one particular instance, where I will mention it (below notes 10 and 16). As for the composition date of this treatise, for which there is no definitive evidence, Clagett claims that it is to go back before 1364 and perhaps even before 1362 (ed. 1968, 122-25). According to another hypothesis, also advanced by Clagett, CQM could have been composed between 1351 and 1355.

[2] Philippe Debroise, *Mathématiques de l'intensité et Merveilles de la nature. Etude sur le Tractatus de configurationibus qualitatum et motuum de Nicole Oresme*, PhD defended on 16 December 2019 at the Université de Paris Diderot (Paris: Université Paris Diderot).

[3] Nicole Oresme, *De Configurationibus* II, 36, 375,1-376,32.

[4] Nicole Oresme, *De Configurationibus* II, 38, 380,1-386,65: "De causis quorundam effectuum in corpore alieno secundum predicta."

[5] Nicole Oresme, *De Configurationibus* II, 37, 376,3-4: "Apprehensio aut cogitatio seu ymaginatio corpus hominis apprehendentis immutat, et potissime ratione appetitus concomitantis vel etiam passionis."

[6] Nicole Oresme, *De Configurationibus* II, 37, 376,5-6: "Nam si quis fortiter cogitet de vindicta cum affectione intensa, sanguis ipsius commovetur et facies immutatur, et eodem modo de timore et gaudio et aliis accidentibus anime."

[7] See Aristotle description of anger in *De Anima* 403a29-b1, a description involving "boiling blood" and followed by the remark that a satisfactory theory of emotions would involve reference

to all other kinds of human passions: the same holds true, he says, for fear, joy, and other accidents of the soul (l. 6-7).[8] And, he adds, "it is the same for dumb animals": this was made clear by the biblical story of Jacob's sheep in Gen. 30:32-43 as well as by many other examples found in Augustine, Avicenna, and other sources that all indicate the power of animal imagination (376,8-378,16).[9] All these instances showing the powers of imagination, that are well known and commonly admitted at Oresme's time, are presented only to prepare the following steps of his discussion, which are much more innovative.

In the second step of his discussion (378,16-29), Oresme gives a more detailed and personal explanation of the power of imagination, referring to his concept of configuration. The bodily movements, he says here, vary not only because of greater or lesser intensity of imagination or affection, but because of a "diversity as to difformity in the figuration of the aforesaid accidents in the soul" (l. 17-20). He illustrates this as follows: if someone thinks about revenge and (only) if the difformity of this cogitation is duly figured (*debite figurata*), this person will "execute some unprepared acts duly", so that he "will be as one particularly fortunate in carrying out or executing his intention" (l. 22-23).[10] And the contrary will happen, Oresme continues, when the same intention is executed in a "not duly figured way": in this case, one will not succeed, "even though the imagination or affection is sufficiently intense" (l. 23-25).[11] And, he concludes, the same must be said of all the accidents of the soul, which have to be thought "in the same way

not only to the cognitive content of emotions but also to their material make up. This implicit source of Oresme's discussion of passions in *De Conf.* II, 37 was not mentioned by Clagett nor by Debroise.

[8] Nicole Oresme, *De Configurationibus* II, 37, 376,6-7: "Homines etiam secundum varietatem istorum aliter et aliter operantur ad extra."

[9] Nicole Oresme, *De Configurationibus* II, 37, 376,7-378,16: "Et similiter bruta ut patet in Genesi de ovibus Jacob[i]. Et ad istud propositum adducit Augustinus exemplum de cameleonta et probat istud et declarat multipliciter in libro De Trinitate. Et similiter Avicenna 6° Naturalium per multa experimenta declarat qualiter ymaginatio immutat corpus ymaginantis in complexione et qualitatibus, sanitate et egritudine, et ita de aliis. Unde et de passione timoris narrat Solinus unum effectum satis notabilem dicens quod 'Athis filius regis Sardis, mutus ad id usque temporis, in vocem erupit vi timoris ; exclamasse enim dicitur 'parce patrio meo, Cyre, et hominem te vel casibus disce nostris'."

[10] Nicole Oresme, *De Configurationibus* II, 37, 378,17-23: "Possibile est igitur ut non solum propter intensionem maiorem et minorem ymaginationis vel affectionis varietur motus seu passio in corpore sed etiam propter diversitatem figurationis predictorum accidentium anime in difformitate. Verbi gratia, si quis cum affectione ymaginetur aut cogitet de vindicta et istius cogitationis vel ymaginationis difformitas fuerit debite figurata, tunc ipse actus imparatos exercebit debite et erit in prosecutione seu executione intentionis sue quasi bene fortunatus." The present translation differs from the one by Clagett, who rendered "tunc ipse actus imparatos exercebit debite" by "the act will duly carry out the commands", which is not only unprecise, but false. Indeed, *imparatus* (l. 22) means "unprepared", and such a capacity to "execute some unprepared acts duly" is precisely a defining feature of the "well fortuned man".

[11] Nicole Oresme, *De Configurationibus* II, 37, 378,23-25: "Si vero ymaginatio sive affectio indebite figuretur, ipse operabitur indebite, quamvis ymaginatio vel affectio fuerit sufficienter intensa."

as we spoke of the motions of the body in chapter 10 of this part and of the beauty of figuration of velocities in chapter eleven" (l. 25-29).[12] In these chapters, Oresme had considered that a difformity of velocities must be considered in the same way as a difformity of qualities and that all this might explain "marvelous" facts such as the action of the torpedo fish who causes the fishermen's numbing, the ability of the lion to separate the members of his prey, the power of certain substances to help or heal while others are poisons and, more generally, the fact that some kinds of movements seem to us to be "wonderful" or "marvelous".[13] In remembering all this in *De Conf.* II, 37, Oresme prepares a further step of the argumentation developed in this chapter, an explanation in which he systematizes the parallel between bodily and psychic figuration.

In this third section of *De Conf.* II, 37 (378,30-41), Oresme immediately comes to a discussion of the abilities of "one person who is hurling a javelin or spear", saying that when this person "shakes" this object "properly", he will fling it "more directly and in a more efficient way" (*directius and fortius*) than another who is stronger and throws the javelin with greater force, but "improperly" (*indebite*).[14] Let us address three questions, the two first on each term of the phrase *directius et fortius*, and the third on their relation. First, one might wonder what "directly" (*directe*) means. It is possible to distinguish at least between two kinds of meanings, the one being general and the second being geometrical. In a general sense, *directe* might be understood as meaning "in being directed", which could mean "in being mastered by the thrower to have the appropriate direction." As for the geometrical meaning, it could mean the shortest line between two given points. Such a meaning appears, for example, in Pecham's *Perspectiva communis* to say that "light departs powerfully from any point on a luminous body, and the more nearly perpendicular, the stronger it is."[15] Second, one might wonder what "*forte*" (*fortius*)

[12] Nicole Oresme, *De Configurationibus* II, 37, 378,25-29: "Et conformiter dicendum est de difformitate speciei amoris vel odii, et sic de aliis accidentibus anime. Nam de motibus anime quantum ad hoc dicendum est conformiter ad ea que de motibus corporis dicta fuerunt capitulo 10° huius et capitulo 11° de pulchritudine figurationis velocitatum."

[13] Nicole Oresme, *De Configurationibus* II, 10, 294,3-296,25 and II, 11, 296,1-14.

[14] Nicole Oresme, *De Configurationibus* II, 37, 378,30-32: "Unde contingit quod unus proiciens telum vel lanceam si debite vibraverit eam, directius et fortius percutiet quam unus alter fortior qui iaceret eam indebite cum fortiori conatu."

[15] John Pecham, *Perspectiva communis*, Part I, Prop 6, in David C. Lindberg, *John Pecham and the Science of Optics, Perspectiva communis, edited with an introduction, English translation, and critical notes* (Madison, Milwaukee and London: The University of Wisconsin Press, 1970), 64,40-42: "A quolibet puncto luminosi radius lucis digreditur virtuose et quanto directius tanto fortius." See also Robert Grosseteste, *De Lineis*, edited by L. Baur, in *Die philosophischen Werke des Robert Grosseteste, Bischofs von Lincoln, zum erstenmal vollständig in kritischer Ausgabe* (Münster: Aschendorff, 1912), 60,30-33: "Virtus igitur ab agente naturali aut veniet super lineam breviorem, et tunc magis est activa, quia patiens minus distat ab agente, aut super lineam longiorem, et tunc minus est activa, quia patiens magis distat." I owe this reference to the second revisor of my paper, whom I thank warmly for this.

means: although Clagett has rendered it as indicating a distance ("further")[16], I prefer to give it a relatively large meaning ("in a more efficient way"), although this could come to the same thing. Now, what is the relation between the two adverbs in *De Conf.* II, 37 (378,30-32)? If we opt for a geometrical meaning for *directe*, the texts on optics quoted above to illustrate this meaning strongly suggest that the conjunction of coordination "and" (*et*) between *directius* and *fortius* must be understood with some explanatory value: it is precisely because the javelin is thrown "directly" that it is thrown in an efficient way. In other terms, as in the texts on Optics quoted from Oresme's predecessors, it seems to be assumed here by him that the most intensive action is exerted along direct lines, as they are the shortest. Thus, the most efficient direction of throwing the javelin is in alignment with its shape rather than direction: slantwise or obliquely.

Now, a series of questions arise, some of which must left open here. First, would this mean that Oresme was not aware that a projectile has a parabolic trajectory? This question is difficult to answer, but it seems difficult to hold that he has been unable to realize, as Aristotle himself already did, that this trajectory is not rectilinear but has at least two stages (one upwards and the other downwards).[17] Second, is it necessary to take *directe* in this geometrical meaning to assume that Oresme establishes a strong link between the fact that a throw is made "directly" and the fact that it is made "efficiently"? In this case, I think that the answer is: no. Indeed, it cannot be excluded that Oresme claimed that the efficiency of a given throw results from its "directedness" (whatever the

[16] Nicole Oresme, *De Configurationibus* II, 37, 379: "Whence it happens that when one person who is hurling a javelin or spear shakes it properly, he will fling it more directly *and further* than another who is stronger [but] throws it improperly with greater force."

[17] On Aristotle's ballistics, see among others Bernd Manuwald, "Die Wurftheorie im Corpus Aristotelicum", in *Aristoteles Werk und Wirkung, Paul Moraux gewidmet, erster Band: Aristoteles und seine Schule*, edited by J. Wiesner (Berlin and New York: Walter de Gruyter, 1985), 151-167 and Michel Federspiel, "Sur le mouvement des projectiles (Aristote, *Du ciel*, 288a22)", *Revue des Etudes Anciennes* 94, 3-4 (1992): 337-345. On Oresme's ballistics, a comprehensive study remains to be done. For this, the passages from Oresme's *Questions on the Physics* where he discusses projectile motion are almost of no use: the case of the arrow and that of projectiles more generally are mentioned there very incidentally (edited by S. Caroti, J. Celeyrette, S. Kirschner and E. Mazet, 2012, q. VI, 4, *Consequenter queritur utrum motus possit velocitari in infinitum*, 681,110-113 and q. VII, 3, *Consequenter queritur utrum in omni motu movens et motum sint simul*, 729,14-18 as well as 735,189-195). A more systematic discussion of this kind of violent motion is made in his *Livre du ciel et du monde*: see Nicole Oresme, *Le Livre du ciel et du monde*, edited by A. D. Menut and A. J. Denomy, translated with an introduction by A. D. Menut (Madison, Milwaukee and London: The University of Wisconsin Press, 1968), 414-420, partially discussed by Debroise, *Mathématiques de l'intensité et Merveilles de la nature*, 525-527. Finally, it would perhaps be interesting to take into account Oresme's *Question Commentary on Aristotle's On the Heaven* – for this work that I have not been able to study systematically, see Claudia Kren, *The Quaestiones super de Celo of Nicole Oresme*, Unpub. Ph. D. Dissertation, University of Wisconsin, 1965 (with English translation) and the table of contents provided on the basis of ms. Munich, BSB, Clm 4375 by Daniel A. Di Liscia and Aurora Panzica, "The Works of Nicole Oresme: a Systematic Inventory", *Traditio* 77 (2022): to be published. I thank very much the authors for having left me read this unpublished inventory.

geometrical figure of this throw might be). In other terms, it seems to me that one might give to the conjunction "and" (*et*) coordinating *directius* and *fortius* an epexegetic value in all cases, whatever kind of reading one gives to each of the two terms. In sum, the conclusion of Oresme's discussion of the person who is hurling a javelin or spear in *De Conf.* II, 37 (378,30-41), is that the ability of some people to "shake" the projectile "properly" (increasing the lift exerted by the air) comes from nature, but might be trained as all kinds of human virtues and technical abilities. This allows Oresme to basically make two claims. First, that some people are naturally "adept at hurling things properly" while nature has denied this to some others. Second, that such diversity does not come from increasing the intensity of the velocity, but rather from its varying figuration.[18] And, he continues, one ought to think in this way of motions of the soul:

> And perhaps this is the cause of a common occurrence: namely, that one person easily carries out his intention, desire, or hope, while another person who hopes for something more intensely and acts with greater zeal, yet never, or scarcely ever, is able to achieve his goal. Accordingly, it can be said not unfittingly that a good and due configuration of the difformity of such accidents of the soul, a configuration to which someone is naturally inclined, is the good fortune of the man so inclined. And the contrary would be [his] bad fortune.[19]

Bad fortune, or a very particular instance of it, s the object of fourth and last section of *De Conf.* II, 37 (378,42-380,43). There, Oresme combines the conclusions just made with what was shown previously in *De Conf.* I, 22, to account for the negative influence exerted on human life by "certain movements of the mind" such as what he calls an "excessive zeal in foreknowing the future" (*ardor nimius prenoscendi futura*). This kind of superstition, he says, precedes or accompanies misery "just as itching precedes the scab" (378,44: *quemadmodum pruritus antecedit scabiem*)[20] – a claim that is made also in a crucial chapter of Oresme's *Livre de divinacions*, a pamphlet against all forms of superstition written in

[18] Nicole Oresme, *De Configurationibus* II, 37, 378,32-34: "Unde contingit quod unus proiciens telum vel lanceam si debite vibraverit eam, directius et fortius percutiet quam unus alter fortior qui iaceret eam indebite cum fortiori conatu, et sunt aliqui apti naturaliter ad debite proiciendum et alii sunt quibus hoc natura negavit. Talis autem diversitas non venit ex intensione velocitatis sed ex eius varia figuratione."

[19] Nicole Oresme, *De Configurationibus* II, 37, 378,34-41: "Et ita ymaginandum est de motibus anime. Et forsan ista est causa eius, quod communiter accidit, scilicet quod unus faciliter consequitur illud quod intendit, affectat aut sperat; alius autem quamvis intensius speret et diligentius agat nunquam tamen aut vix poterit propositum adipisci. Propter quod non inconvenienter potest dici quod bona et debita configuratio difformitatis talium accidentium anime ad quam aliquis naturaliter inclinatur est hominis sic inclinati bona fortuna, et contrarium esset mala fortuna."

[20] Nicole Oresme, *De Configurationibus* II, 37, 378,42-380,47: "Et sicut dictum fuit 22° prime partis huius [see 226-227] aliquotiens futuram infelicitatem precedunt quidam animi motus quorum unus est ardor nimius prenoscendi futura. Quemadmodum pruritus antecedit scabiem, ita superstitio aut prevenit aut concomitatur miseriam. Unde Seneca hoc inquit: 'humana conditio pessimum habet ut quos fortuna miseros fecit etiam superstitiosos facit'." See below note 94.

French, probably going back to 1356.[21] In *De Conf.* II, 37, Oresme continues and summarizes: "Further, this searching after fate is not only a sign of future misfortune, but it is also its cause, since one is catapulted into evil eventualities by the very fact that the mind is moved to act with unfitting difformity. When, moreover, deformed superstition is assumed, the mind, as by an obstacle, is accordingly damaged; it stumbles, becomes slippery, and takes a devious path."[22] And even more: "Freely adopted superstition pushes down into evil those, therefore, whom nature has so inclined. And the foolish hope or fear, born from the response of the divinator, produces a harmful effect that is greater than [the] helpful effect of the precaution which must always be more carefully employed after such things have been given up."[23] All this, Oresme concludes, justifies the many condemnations of divination that one might read in the Holy Scripture.[24]

To summarize the content of *De Conf.* II, 37, one might now recall the argumentative map of this text, which contains the following four steps. First, we have an outline of rather general views on the powers of imagination, made on the basis of some ancient philosophical and theological authorities. Second, Oresme gives a more personal interpretation of these views, in terms of his notion of configuration and of the Aristotelian term of fortune. Third, he applies the concept to the action of throwing of a javelin "duly" and more generally to the ability of some people to see their project "succeed". Fourth, he discusses the contrary situation, which is bad fortune and, more particularly, the negative influence of human superstition on future events. When faced

[21] This book was the object of a doctoral dissertation hold in Paris in 1992 by Sylvie Lefèvre, who edited the text on the basis of the ms. Brussels, BR, 11203-204 and who considered that this work dates back to 1356. Lefèvre's edition was published alongside an Italian translation of the text in Stefano Rapisarda, *Nicole Oresme, Contro la divinazione: consigli antiastrologici al re di Francia (1356)* (Roma: Carocci editore, 2009). See also Stefano Rapisarda, "From the *Tractatus contra astronomos judiciarios* (1349) to the (1356): Nicole Oresme lost in translation", in *El saber i les llengües vernacles a l'època de Llull i Eiximenis. Estudis ICREA sobre vernacularització*, edited by A. Alberni, L. Badia, L. Cifuentes and A. Fidora (Barcelona: Publicacions de l'Abadia de Montserrat, 2012), 231-255. For the passage which has to be compared with *De Conf.*, 378, 44, see here below note 94.

[22] Nicole Oresme, *De Configurationibus* II, 37, 380,47-53: "Hec etiam inquisitio fati non solum est signum futuri infortunii sed etiam causa, quoniam in malos eventus eo ipso inciditur quod mens ad agenda inconvenienti difformitate movetur, ut in presenti capitulo iam dictum est. Cum autem superstitio prava premittitur, ex hoc animus tanquam quodam offendiculo leditur cespitat, lubricat, exorbitant, et malis auspiciis exinde quasi claudicando procedit difformitate peiore, sicut est de illis quibus imprecatus psalmista dicens: 'Fiat via illorum tenebre et lubricum'."

[23] Nicole Oresme, *De Configurationibus* II, 37, 380,53-56: "Illos igitur voluntaria superstitio detrudit in malum, quos ad hoc inclinavit natura. Et plus nocet spes fatua aut timor ex divinatoris responso conceptus quam iuvet cautela que talibus omissis semper est diligentius adhibenda."

[24] Nicole Oresme, *De Configurationibus* II, 37, 380,56-63: "Sic igitur et lege nature et suis demeritis precipitantur a Deo, qui contra eius monita sortilegiis et divinationibus invituntur. Unde in Deuteronomio precipit Dominus suo populo dicens 'cave ne (...) inveniatur in te (...) ui ariolos sciscitetur, et observet sompnia atque auguria, ne sic sit maleficus neque incantator neque phytones (! pythones) consulat nec divinos', et cetera, et sequitur: 'omnia enim hec abhominabitur Dominus, et propter istiusmodi sclerea delebit eos', scilicet populos qui tales admittunt."

with such a discussion, a reader who is aware of some general aspects of late Aristotelian theories of motion might perhaps find remarkable that *De Conf.* II, 37 contains no mention of the concept of *impetus* – a concept that was brought to the fore by John Philoponus to account for all cases where a body keeps on moving even after having left contact with its mover.[25] And the modern reader, more generally, might be surprised by the variety of subjects implied and be interested to know more about their mutual relations. If the relation between the issue of fortune and human success in general is rather clear, one might indeed be curious to grasp the relations between these topics and the very act of throwing a javelin or projectiles more generally. In the section that follows, I will highlight some elements of the background of Oresme's approach to such questions, that will make their relations clearer.

II. A new concept of good fortune: Oresme's reading of Aristotle's *Physics* 197a 25-29 in light of the *Liber de bona fortuna*

In order to shed light on some key assumptions implied in *De Conf.* II, 37, I will first focus on the third section of this chapter, in which Oresme applies the concept of "configuration" to the action of throwing of a javelin "duly" and more generally to the ability of some people to see their project "succeed". As was already indicated by Debroise,[26] the paradoxical model of human success claimed by Oresme in this section is largely indebted to a passage of a previous work by Oresme, which is his *Questions on the Physics*. In the present state of research, there is only one witness of this work, a manuscript discovered by G. Beaujouan in 1964 and used by the authors of the 2013

[25] On the Late Greek and Arabic history of this concept, see Ahmad Hasnaoui, "Aspects de la synthèse avicennienne", in *Penser avec Aristote,* edited by M. A. Sinaceur (Toulouse: Eres, 1991), 227-244 (esp. 233-235); Ahmad Hasnawi, "Alexandre d'Aphrodise vs Jean Philopon: notes sur quelques traités d'Alexandre 'perdus' en grec, conserves en arabe", *Arabic Sciences and Philosophy* 4 (1994): 53-109 and Ahmad Hasnawi, "La théorie avicennienne de l'impetus Ibn Sīnā entre Jean Philopon et Jean Buridan", in *Views on the Philosophy of Ibn Sīnā and Mullā Ṣadrā Shīrāzī*, edited by M. Arfa Mensia (Tunis: The Tunisian Academy of Sciences and Letters and Arts Beït al-Hikma, 2014). On its Latin reception, see the fundamental work by Anneliese Maier, *Zwei Grundprobleme der scholastischen Naturphilosophie. Das Problem der intensiven Grösse. Die Impetustheorie* (Rome: Edizioni di storia e letteratura, 1968), 113-314 (esp. 236-258) and, recently, Daniel A. Di Liscia, "Breakings and Continuities: The Fourteenth Century and Galileo's Impetus Theory as a Complex Case of Conceptual and Historical Transmission", in *Spreading Knowledge in a Changing World*, edited by C. Burnett and P. Mantas España (London and Córdoba: UCO Press, 2018), 175-201.

[26] See Debroise, *Mathématiques de l'intensité et Merveilles de la nature*, 106: "(...) l'explication proposée par Oresme (...) est un développement de la thèse aristotélicienne de la fortune naturelle déjà amorcé dans le commentaire sur la *Physique*. (...) L'idée générale va donc être qu'une action est heureuse ou malheureuse selon la nature de la configuration psychique qui l'anime. (...) (1) *l'intensité* d'une appréhension psychique détermine un effet variable sur le corps et son mouvement; (2) sur le plan mécanique, un mouvement est plus ou moins *efficient* selon non son intensité, mais sa difformité."

edition of this text, the ms. Sevilla, Bibl. Capitular y Colombina, 7.6.30, ff. 2ra-78vb.[27] The set of questions contained in this manuscript cover only books I to VII of Aristotle's *Physics*, and they go back to the mid-1340s, when Oresme was a student at the Faculty of Arts in Paris, where he likely obtained his Master of Arts before 1342.[28] The most probable period for the dating of Oresme's questions on Aristotle's *Physics* has to be situated between 1342 (the year of his *inception* as a Master of Arts), and John of Mirecourt's condemnation of 1347.[29] This work by Oresme is relevant to our subject because it gives us some elements that will help us, first, to better understand the parallel systematically stressed by him between bodily and psychic figuration and, second, to locate the sources on the basis of which this author has developed his particular view on good fortune and his understanding of the act of throwing a javelin as an example of this kind of success.

[27] See Guy Beaujouan, "Manuscrits scientifiques médiévaux de la Bibliothèque de Séville", in *Actes du dixième Congrès International d'Histoire des Sciences*. Ithaca 26 VIII 1962-2 IX 1962, edited by H. Guerlac (Paris: Hermann, 1964), 631-634, esp. 633. There was a partial edition of questions III, 1-17, IV, 1-21 and V, 6-9 by S. Kirschner and of questions III, 1-8 by S. Caroti: Stefan Kirschner, *Nicolaus Oresmes Kommentar zur Physik des Aristoteles. Kommentar mit Edition der Quaestionen zu Buch 3 und 4 der Aristotelischen Physik sowie von vier Quaestionen zu Buch 5* (Stuttgart: Franz Steiner Verlag, 1997), 197-417 and Stefano Caroti, "La position de Nicole Oresme sur la nature du mouvement (*Quaestiones super Physicam* III, 1-8). Problèmes gnoséologiques, ontologiques et sémantiques", *Archives d'histoire doctrinale et littéraire du moyen âge* 51 (1994): 335-385. The entire set of questions was edited by S. Caroti, J. Celeyrette, S. Kirschner and E. Mazet in 2013: Nicole Oresme, *Questiones super Physicam* (books I-VII), edited by S. Caroti, J. Celeyrette, S. Kirschner and E. Mazet (Leiden and Boston: Brill, 2013).

[28] See William J. Courtenay, "The Early Career of Nicole Oresme", *Isis* 91 (2000): 542-548. As most of Oresme's commentaries in Latin, they result in his teaching activity in this institution. To this group of Latin commentary works on Aristotle belong Oresme's commentaries on Aristotle's *Physics*, *De generatione et corruptione*, *De celo*, *Meteorologica*, and *De anima*. If we admit Olga Weijers' view on the literary form of the late scholastic commentaries, we have to range Oresme's *Questions on the Physics* among the ones that were discussed by the author himself as a regent university master delivering the so-called *lectio ordinaria.* Indeed, on the basis of the university statutes, Weijers hold that the two main literary genres of the late medieval commentaries on Aristotle were the result of two different kinds of lectures offered at the university in the Faculty of Arts: on one side, the literal commentary, named *expositio* or *sententia*, weas the result of the *lectio cursoria* delivered by bachelors to give students a general overview of the Aristotelian text; on the other side, the question commentaries, entitled *questiones*, were the result of the *lectio ordinaria*, delivered by regent masters to discuss specific problems suggested by the text. See Olga Weijers, *Terminologie des universités au XIIIe siècle* (Rome: Edizioni del'Ateneo, 1987), 306-308; 324-335; Olga Weijers, *Le maniement du savoir. Pratiques intellectuelles à l'époque des premières universités (XIIIe-XIVe siècles)* (Turnhout: Brepols, 1996), 45-47. As a matter of fact, in his *Questiones* Oresme refers to a literal commentary on Aristotle's *Physics*, which, however, has not yet been identified. See Di Liscia and Panzica, "The Works of Nicole Oresme", (to be published).

[29] See Nicole Oresme, *Questiones super Physicam*, Introduction, 24*-25* and Stefano Caroti, "*Modi rerum* and Materialism: a Note on a Quotation of a Condemned Articulus in Some Fourteenth-century Parisian *De anima* commentaries", *Traditio* 55 (2000): 211-234.

The passage from Oresme's *Questions on the Physics* which is directly interesting to us is the fourteenth question of Book II, where he faces the question "whether the distinction – posited by Aristotle in *Physics* 197a 25-29 – between good fortune and bad fortune is convenient or not."(*Consequenter queritur utrum illa divisio sit bona, in qua dicitur quod quedam est fortuna bona et quedam mala*).[30] To the question posed, the author gives a positive answer and, to elaborate his answer, he gives no less than eleven references to the *Liber de bona fortuna* (hereafter: "*LdBF*"), a Latin compilation of two chapters on good fortune taken from the *Magna Moralia* (1206b30-1207b19) and the *Eudemian Ethics* (1246b37-1248b11), made around 1265 and then included for many years in the Aristotelian corpus.[31] Of course, Oresme is not the first author to discuss this Aristotelian opuscule, but he seems to be the first to offer an interpretation of this text that is entirely and systematically connected to the content of *Physics II.* To my knowledge, this text by the young Oresme is the first known *Commentary on the Physics* where *LdBF* is discussed.[32]

[30] Nicole Oresme, *Questiones super Physicam* II, 14 (197a 25-29), 268,5-276,232.

[31] These two chapters seem to have been combined after the translator had rendered into Latin a larger extract from the *Eudemian Ethics* that also included the last chapter on *kalokagathia* (1248b11-1249b25). On the history of this book, see among others Valérie Cordonier, "Sauver le Dieu du Philosophe: Albert le Grand, Thomas d'Aquin, Guillaume de Moerbeke et l'invention du '*Liber de bona fortuna*' comme alternative autorisée à l'interprétation averroïste de la doctrine aristotélicienne de la providence divine", in *Christian Readings of Aristotle from the Middle Ages to the Renaissance*, edited by L. Bianchi (Turnhoult: Brepols, 2011), 65-114, with the critical notes by Iacopo Costa, "L'Éthique à Eudème et la Grande morale dans l'oeuvre de Thomas d'Aquin", *Documenti e Studi sulla Tradizione Filosofica Medievale* 32 (2021): 73-133. For an overall (and provisory) account on the reception of the opuscule, see Valérie Cordonier, "Réussir sans raison(s). Autour du texte et des gloses du '*Liber De bona fortuna Aristotilis*' dans le manuscrit de Melk 796 (1308)", in *1308, Eine Topographie historischer Gleichzeitigkeit*, edited by A. Speer and D. Wirmer (Berlin and New York: De Gruyter, 2010), 704-770.

[32] There is no catalogue of all commentaries on Aristotle's *Physics.* In the list made by Albert Zimmermann, *Verzeichnis ungedruckter Kommentare zur Metaphysik und Physik des Aristoteles aus der Zeit von etwa 1250-1350* (Leiden and Köln: Brill, 1971), two items had drawn my attention, which are the commentaries contained, first, in ms. Oxford, Merton College, 272 and, second, in ms. Cambridge, Gonv. and Caius Coll. 509 and ms. Siena, Bibl. Com. degli Intronati L.III.2. See Silvia Donati, "Per lo studio dei commenti alla Fisica del XIII secolo. Commenti di probabile origine inglese degli anni 1250-1270 ca. Parte I", *Documenti e studi sulla tradizione filosofica medievale* 2, 2 (1991): 361-441, esp. 396-409; Silvia Donati, "Per lo studio dei commenti alla Fisica del XIII secolo. Commenti di probabile origine inglese degli anni 1250-1270 ca. Parte II", *Documenti e studi sulla tradizione filosofica medievale* 4 (1993): 25-133; Silvia Donati, "Commenti parigini alla Fisica degli anni 1270-1300 ca.", in *Die Bibliotheca Amploniana im Spannungsfeld von Aristotelismus, Nominalismus und Humanismus*, edited by A. Speer (Berlin and New York: De Gruyter, 1995), 136-256. According to Silvia Donati, who has transcribed these two anonymous works, they do not contain any explicit mentions of *LdBF.* The same is true of the *Questions on Aristotle's Physics* by Geoffrey of Aspall, who was a Master of Arts at Oxford between around 1250 and 1263: see Geoffrey of Aspall, *Questions on Aristotle's Physics*, edited by S. Donati, C. Trifogli and E J. Ashworth (Oxford: Oxford University Press, 2017), Part I, Liber II, q. 21, 462: "*Et quaeritur primo quid sit et quid significatur per hoc nomen 'casus'.*" As for the 14th century, the first author to be mentioned is Thomas Wylton, whose *Physics* commentary was written most probably before the *Quodlibet* at the very beginning of the 14th century: see Cecilia Trifogli, "Thomas Wylton on Final Causality", in *Erfahrung und Beweis. Die Wissenschaften von der Natur im 13. und 14.*

This fact has certain importance because, as we shall see, this opuscule provides the elements on which Oresme bases a radically new account of fortune: some elements are to be found directly in Oresme's *Questions on the Physics*, while some others will have to be found in some other texts related to the reception history of *LdBF*. Before entering Oresme's discussion of this concept in commenting on Aristotle's *Physics*, it might be useful to give some preliminary explanations concerning the vocabulary chosen to render some Latin terms present therein.

First of all, what I translate by "chance" is the Latin *casus*, which corresponds to the Greek αὐτόματον, sometimes rendered by "self-moving" or "the spontaneous" or "the accidental".[33] Second, one must make further distinctions, in the first instance between *casus* and *fortuna*. In different parts of his works, Aristotle introduces a concept that I render by "fortune": *fortuna* (*tuchè*, τύχη). In *Physics*, it is made clear that this concept means a kind of "chance" (*casus*) that follows some *intentional* action made by a given rational agent which brings unexpected results. Fortune is exemplified through the famous image of the man who finds some treasure while digging a grave: finding treasure, in this case, is the unexpected result that happens while the man is digging *for another purpose*.[34] So here "fortune", *without qualification*, means just the kind of unpredictable events that occur following an intentional action.[35] Now, "fortune" might be described

Jahrhundert; Experience and Demonstration. The Sciences of Nature in the 13th and 14th Centuries, edited by A. Fidora and M. Lutz-Bachmann (München: Oldenbourg Verlag, 2009), 249, note 5. As this commentary, which is a complete set of questions on the eight books of the *Physics*, is still unedited, I have read one of the four manuscripts containing it, ms. BAV, Vat. lat. 4709, ff. 1r-143r (for the relevant questions on Physics II, see fol. 25r-28v) and have found no mention of *LdBF*. The same negative result holds for the works on Aristotle's *Physics* by John of Jandun; see his *Quaestiones in libros physicorum Aristotelis* II, 41-42 (Venezia, 1488), 41v-43r: "*Utrum in corporibus celestibus contingant aliqua casualia et fortuita*" and "*Utrum casus et fortuna sint causae per accidens*"; by William of Ockham (which have been all edited for a long period of time) and by Walter Burley, *In Physicam Aristotelis Expositio et Quaestiones* (Venice, 1501; repr. Hildesheim; New York: Olms, G. Olms, 1972), 43-59. On the different Physics-Commentaries by Burley see Rega Wood, "Walter Burley's Physics Commentaries", *Franciscan Studies* 44 (1984): 275-327. Finally, I have found no mention of the opuscule either in John Buridan, *Quaestiones super octo libros Physicorum Aristotelis (secundum ultimam lecturam), Vol. i: libri i-ii*, with an introduction by J.M.M.H. Thijssen and a guide to the text by E. Sylla (Leiden: Brill, 2015), II, 5, 197a5-7, 33-36 and 308-315: "*Utrum definitio fortunae sit bona in qua dicitur 'fortuna est causa per accidens secundum propositum extra semper et frequenter eorum quae propter hoc sunt.*" This list of commentaries is in no way exhaustive.

[33] Instead, I prefer to render *casus* by the term "chance". Of course, this kind of chance has merely physical causes, so that this concept does not correspond to that of "moral luck" used in some modern approaches to ancient ethics (such as, e.g. Bernard Williams's theory of "moral luck").

[34] See *Metaphysics* V, 30, 1025a14-19 (where this image exemplifies the first definition of "accident") and *Rhetoric* I, 5, 1362a9 and *Eth. Nic.* III, 1112a27 (where this example illustrates one of the effects of τύχη). The Commentators of Aristotle have often referred to this example of the digging man to comment on *Physics*.

[35] Indeed, the concept of "fortune" that appears in the Aristotelian writings that were the most famous in the late-antique and modern traditions is thought of as a subcategory of the Greek concept that was translated as "the spontaneous" (αὐτόματον) used by Aristotle both to *explain*

more precisely in indicating the value of the outcome for the agent: if the man who digs a grave finds some treasure, he is certainly "well-fortuned", but if he finds a snake, he is "ill-fortuned".[36] In the Latin translations, such a man is not only said to "have" good or bad "fortune", but also, and more frequently to "to be well-fortuned" or "to be ill-fortuned" (*bene* vs. *male fortunatus esse*).[37] However, *LdBF* brings additional considerations. Indeed, this text contains, alongside the notions of "chance" (*casus*, αὐτόματον), "fortune" (*fortuna*, τύχη) and "good fortune" vs. "bad fortune" (εὐτυχία vs. δυστυχία) seen above, another notion of good fortune, which differs in the fact that the "well-fortuned" individual in this sense is lucky *in general* and successful in his life. So, to be "well-fortuned" (εὐτυχής) in this sense is also distinct from simply having good "fortune" (*tuchè*, τύχη): someone might benefit from such "fortune" (*fortuna*) only once, without being "well-fortuned" in the sense of *LdBF*. To specify this *long-term kind of fortune* that is under consideration in *LdBF*, the medieval commentators speak of a man who is well-fortuned "universally" or they speak of "continuous fortune".[38]

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some unpredictable events and to merely *designate* them, thus contributing to the ambiguity of this concept still to be found in modern languages, where "fortune" often overlaps with the terms "chance", "coincidence", "randomness", or even "contingency" and "accident". On this concept of "spontaneous", see *Physics* II, 5, 196b10-16 and 196b29-197a32 (two passages that were used by Scholastic readers to claim that *fortuna* is a specific case, or a species, of *casus*); *Metaphysics* VII, 15, 1032a27-32 and XII, 3, 1070a4-7 (where "fortune" and "the spontaneous" are mentioned together) and IX, 1049a3-5 (where "fortune", although it appears alone, has a similar meaning), *Eth. Nic.* III, 1112a20-29 (where "fortune" is listed among those things that do not depend on us and is therefore implicitly understood as a specific kind of "the spontaneous" and *Rhetoric* I, 5, 1361b39-1362a12 (where "good fortune" is thought of as the individual possession of all or most of the goods of "fortune") – in this last case, "good fortune" is a little closer to the concept under consideration in *Eudemian Ethics* and *Magna Moralia*. However, it is not certain that a man who possesses the exterior goods is equal to the "well-fortuned" in the sense expressed in *LdBF*. Indeed, in the two extracts forming the opuscule, Aristotle gives very scant information on the kinds of goods involved in this condition – although he regularly refers to particular cases as *examples* of "well-fortuned" men. And at any rate, it remains that one might possess the goods of fortune by mere "spontaneity" in the Aristotelian sense – not by the possession of the internal impetus which is specifically described in *LdBF*.

[36] Although the case of the snake is to be found only in medieval commentaries on Aristotle, the Aristotelian corpus itself presents a clear-cut distinction between "fortune" that is positively qualified and fortune that is negatively qualified (εὐτυχία vs. δυστυχία, see 197a15).

[37] *Fortuitus* (that I translate by "fortuitous"): as fortune, this term would cover good, neutral, and bad fortune.

[38] The adverb "universally" was used by Thomas Aquinas when quoting from *Magna Moralia* and *Eudemian Ethics* in his *Summa contra Gentiles*. At the end of his chapter on good fortune (book iii, chapter 92), after having quoted separately from the two chapters making up *LdBF*, Aquinas rephrases the main argument by asking how a man can be well-fortuned "universally" (*universaliter*) and "in all things" (*ad omnia*). As for the idea of a *continuous* fortune, it is present in *LdBF*, in the passage where Aristotle distinguishes between two kinds of fortune, which are equally irrational, but have a different origin: the first is "divine, continuous, and following a directive impetus", while the second is neither divine, nor continuous, and "beyond the impetus": Aristotle (2016: 1248b4-7):

What is relevant to our purpose here is that the concept of fortune presented in *LdBF* departs dramatically both from Boethius' concept of fate as well as from the concept of fortune which dominates Aristotle's *Physics* and *Metaphysics*. First, this concept departs from the standard view of fortune as it is depicted in the famous image of a wheel going back to Boethius' *Consolation*[39]: rather than portraying *Fortuna* as an unpredictable force causing human destinies to rise or fall according to her capricious will, the *Liber de bona fortuna* focuses on some *constant* aspects of fortune (its "continuity"). Second, it differs from the concept present in Aristotle's *Physics* and *Metaphysics* in as far as it means not only a kind of "chance", but some disposition that is present in the agent itself and makes him to be regularly fortunate. Instead of conceiving of fortune as an external force affecting men's destinies and maybe producing a fleeting moment of prosperity (whether moral or material) in their lives, *LdBF* describes fortune as a fixed gift enabling those who possess it to achieve success beyond any reasonable expectation. Oresme, who was perfectly aware of this particular meaning of fortune in *LdBF*, has precisely used this concept to make sense of a mention of good and bad fortune in *Physics* 197a25-29. This has led him to develop a concept of fortune that allowed for a parallel treatment of physical and psychical processes, and that has larger explanatory power as the concepts put forward by Aristotle. Let us now examine Oresme's reading of this passage of Aristotle's *Physics* more closely to isolate its more important results.

To argue in favor of the view that Aristotle's distinction between good and bad fortune in *Phys.* 197a25-29 is satisfactory, Oresme first lists the arguments against this view.[40] The third and the fourth of these opposite arguments (0.3 and 0.4) are themselves

"Iste autem est qui secundum impetum directivus, alius autem qui preter impetum; sine ratione autem ambo. Et hec quidem continua bona fortuna magis, hec autem non continua." The idea that the fortune that is "divine" and "according to the impetus" is also "continuous" seems to be another way to express the fact that the man who benefits from this kind of fortune sees his actions followed by good and unexpected effects. See Aristotle (2016: 1247b15-18): "deinceps (...) multotiens." A generation after Aquinas, a clear-cut distinction would be made by Giles in his commentary on *LdBF*: Aegidius Romanus, *Sententia LdBF*, edited in Valérie Cordonier, "Une lecture critique de la théologie d'Aristote: le 'Quodlibet VI, 10' d'Henri de Gand comme réponse à Gilles de Rome", in *L'aristotélisme exposé: aspects du débat philosophique entre Henri de Gand et Gilles de Rome*, edited by V. Cordonier and T. Suarez-Nani (Fribourg: Academic Press, 2014), 145,38-44: "Possumus autem et tertio respondere quod licet sit duplex bona fortuna et una sit magis continua quam altera, nulla tamen est adeo continua nec habet esse sic in pluribus ut natura. Quare licet una bona fortuna possit dici quasi continua respectu alterius, nulla tamen est continua nec est ut in pluribus respectu nature. Propter quod bene dictum est (1248b4-7) fortunam a natura differe propter hoc quod natura est similiter et ut in pluribus."

[39] See Boethius, *De Consolatione Philosophiae*, Livre II, prosa 1 [19], edited by C. Moreschini, translation and notes by E. Vanpeteghem, introduction by J.-Y. Tilliette (Paris: Livre de Poche, 2008), 88: "Tu vero volventis rotae impetum retinere conaris? At, omnium mortalium stolidissime, si manere incipit, fors esse desistit"; prosa 2 [9], 90: "Haec nostra vis est, hunc continuum ludum ludimus: rotam volubili orbe versamus, infima summis, summa infimis mutare gaudemus."

[40] Nicole Oresme, *Questiones super Physicam* II, 14 (197a25-29), 268,5-269,32, whereas these arguments are solved on 275,204-276,32.

taken from *LdBF*, but the opuscule also provides the unique argument in favor of Oresme's thesis (0.6).[41] Subsequently, *LdBF* mainly serves to defend Oresme's own doctrine, that confirms and expands *Physic*'s distinction between good and bad fortune on the basis of *LdBF*. To this purpose, Oresme distinguishes between the following questions to be answered step by step: I] What are good and bad fortune in general?[42]; II] Which are the causes of fortune?[43]; III] Which are the effects of fortune?[44]; IV] Which are the conditions of fortune?[45] Question I is answered by means of three preliminary notes, a conclusion and two corollaries. To answer II, Oresme starts from the distinction, explicitly taken from *LdBF*, between divine and natural fortune and lists three differences between the two, before limiting his discussion to mere natural fortune and, finally, positing two conclusions, the second of which consists of three points. To answer III and indicate the effects of fortune, the author first distinguishes different kinds of goods (the apparent and the true good, the interior and external goods), he then concludes that fortune concerns all of them and finally gives five proofs for such a conclusion. To answer IV and discuss the conditions of fortune, he claims five propositions before concluding that fortune is certain and predictable, although we do ignore its causes. Finally (V), Oresme answers the arguments, in basically the same order as the one in which they had appeared. Except for section V, which contains the response to the arguments, there is no single section of this question that contains no quote from *LdBF.* The total amount of quotes is thirteen (if we include the last one, which is not explicit). These references to *LdBF* have a decisive input on the results of Oresme's inquiry.[46]

[41] Indeed, three quotes from *LdBF* are made in the lists of the arguments. Two quotes are found in the arguments *quod non:* by the first quote (0.3, 268,15-17), Oresme recalls the definition according to which fortune is "nature without reason" in *LdBF* 1207a36 and by the second (0.4, 268,18-23), he seems to allude to *LdBF* 1207a15-16 in saying that "sometimes bad fortune is found in <good> human beings, as is made clear in the book *De bona fortuna.*" Then, the opuscule, alongside *Phys.* II, 5, 197a25-29, is a crucial reference to the unique argument *quod sic* when Oresme claims that Aristotle "makes a distinction between *infortunium* and *eufortunium*, that are said in respect to those events that are manifestly good or bad" and that "this is even made clear <in> *De bona fortuna*" (0.6, 269,27-29, see *LdBF* 1247a1-8).

[42] Nicole Oresme, *Questiones super Physicam* II, 14 (197a 25-29), 269,34-270,72.

[43] Nicole Oresme, *Questiones super Physicam* II, 14 (197a 25-29), 270,73-272,128.

[44] Nicole Oresme, *Questiones super Physicam* II, 14 (197a 25-29), 272,129-274,167.

[45] Nicole Oresme, *Questiones super Physicam* II, 14 (197a 25-29), 274,168-275,203.

[46] 3 quotes are made in part 0, 3 are made in part I, 2 are made in part II, 1 is made in part III and, finally, 3 explicit quotes and 1 implicit one are made in part IV. In addition to the quotes made in the preliminary arguments (see above note 41) three quotes are made in the section devoted to the discussion of fortune in general (Section I). The first two are to be found in the first subpart of the section containing "three notes on fortune and subsequently on chance (I.1): in the first of them (I.1.i, 269,33-39, see *LdBF* 1207b10 and 1247b18-21), Oresme uses the passages of the opuscule containing the term *impetus* to elaborate his second meaning of the term "fortune" as "a certain disposition or condition of it [*i.e.* the soul] by which it is inclined to good or bad events, which happen by a convergence of unforeseen causes", whereas in the second of these quotes (I.1.ii, 269,40-49, see *LdBF* 1207a36), he elaborates this meaning even further, to explain that when Aristotle

A more detailed presentation of all this reflection might be found in the argumentative map given as a second Appendix. Here are the most remarkable results of this reading of *Physics II* 197a25-29 made by Oresme in the light of *LdBF*. First of all, the author insists that fortune is not an absolute quality but that, because as a matter of fact all men are well-fortuned to greater or lesser degrees, and "ill-fortuned" just means "less fortuned": this claim, made for the first time in I.2.ii and then recalled in V.3, reflects Oresme's tendency of quantifying some Aristotelian concepts that were qualitative in nature, and it is also consistent with the author's strategy of demystifying the processes that were supposed "marvelous" (such as fortune).[47] As a second important result of Oresme's reading of *Physics* II, 197a 25-29 in the light of *LdBF*, one might mention the fact that he adds that claim I.2.ii, reached for fortune, also applies to the category of "chance": this extrapolation, which is justified on the basis of claim I.1.iii, is in line with the author's kind of mechanistic account of fortune and all other processes that imply some

defines fortune as "a kind of nature", he refers not to a distinct quality of the fortunate soul, but to the soul being in such a state. The third one appears in the subpart containing the "conclusions and corollaries": there (I.2.i, 270,56-62, see *LdBF* 1247b20-29) the opuscule brings to Oresme the major premise to claim that "bad fortune is nothing but a privation of good fortune" and that "no <<fortune>> inclines to evil." The following section (Section II) contains two important quotes from the opuscule. In the first one (II.1, 270,73-75, see *LdBF* 1247b16-1248a15 and 1247a15-1248b11), Oresme mentions the opuscule as the place where Aristotle "distinguishes between a certain good fortune that comes from God and another that comes from nature." In the second one (II.1.ii, 270,78-82, see *LdBF* 1247a36-37), Oresme refers to the passage where "Aristotle says that, as some have blue and others have dark eyes, in the same way this applies to fortune, namely that some are well- and some other ill-fortuned." In the following section too (Section III), dealing with the effects of fortune, the opuscule is quoted. In this section where Oresme claims that there is fortune in all kinds of goods, the opuscule helps to support the first proof given in favor of this claim: to this purpose, Oresme recalls the passage where Aristotle says that fortune is the master of external goods (III.3.i, 273,139-145, see *LdBF* 1206b33-34). Finally, Section IV contains three explicit quotes from the opuscule. First (IV.2, 274,175-181, see *LdBF* 1207a4-5) in the passage where Oresme opposes fortune to deliberation and free will, and recalls the famous passage where it is said that "<where> there is the intellect's free will, there is no fortune, and vice versa." Second in the subsequent proposition (IV.3, 274,182-189, see *LdBF* 1248b7) where Oresme recalls the distinction between two kinds of fortune and says that "This is stated by Aristotle in the same text", in clear reference to passage already quoted in II.3 (270,83-271,85). Third (IV.4, 274,190-275,195, see *LdBF* 1247a36-37), where Oresme explains that "some people are fortuned in one thing and other people in another" and supports this view in quoting the passage where Aristotle says: "as, for example some have clear eyes and some others dark eyes." Finally, in addition to these explicit quotes, one finds the following case of an implicit use of the opuscule: this is in IV.6, 275,198-203, where Oresme recalls that "the Ancients said that fortune is something divine coming from God, and some of them even considered it to be blind; and the cause of this is that this judge would be said <*spatium album*> blind, who would so do good to good men as to the bad indifferently, and fortune is of this kind." Although Oresme gives no explicit reference here, he probably alludes to the beginning of the opuscule, where it is said: "At the same time, if we attribute such <behavior> to God, we shall be making him a bad judge or unjust" (*LdBF* 1, 1207a10-12).

[47] Nicole Oresme, *Questiones super Physicam* II, 14 (197a 25-29), 270,63-65 and 276,220-221.

psychological states.[48] Third, Oresme says that this kind of fortune is sometimes augmented and diminished by the imagination of the soul and that this might be the case either of the imagination of the individual, or of the imagination or someone else: this claim, expressed in II.3.ii, is the most original aspect of Oresme's reading of Aristotle's concept of fortune.[49] It is precisely this aspect of the author's theory that gives the basis of *De Conf.* II, 37 when Oresme claims that good and bad fortune are only a good or bad configuration of a man who is, thus, inclined to be more or less successful (378,38-41).[50]

In the present section, Oresme's *Questions on the Physics* have helped us to understand better some aspects of *De Conf.* II, 37. Following a suggestion made by Debroise, I have shown that the account of fortune in *De Conf.* II, 37 is a further development of the views developed by Oresme at the occasion of his commentary of a passage from *Physics II* where Aristotle, in the course of his discussion of chance, mentions not only fortune, but also good fortune and bad fortune (197a25-29). These *Questions*, despite their scholarly character and their early position in Oresme's philosophical production, have a deep originality in comparison with the other texts discussing the opuscule even contemporarily to Oresme. Indeed, by means of a careful conceptual analysis of the main claims of this particular text, the author gives a radically new account of the Aristotelian notion of "chance" (*casus*) in general and, in connection to this discussion, he holds a new theory of human imagination that is recalled and reused in *De Conf.* II, 37 (378,31-48). Now, some aspects of *De Conf.* II, 37 remain unclear, most particularly in the third section of *De Conf.* II, 37 (378,30-41), where Oresme discusses the action of throwing a javelin. Concerning this passage, one might first wonder if Oresme has a particular experience in mind here.[51] Second, I think that it is important to ask the following question: is the act of *throwing a projectile* chosen by Oresme for some particular reason, or is it just a general case of physical performance chosen "just as an example", as if he could have mentioned any other kind of human activity? To address these two remaining questions, we have to consider a source that was particularly important to the reception of *LdBF,* as well as to Oresme's doctrine: this is the object of the following section.

[48] Nicole Oresme, *Questiones super Physicam* II, 14 (197a 25-29), 269,34-270,63-65 and 269,50-270,55.

[49] Nicole Oresme, *Questiones super Physicam* II, 14 (197a 25-29), 271,104-272,121.

[50] Indeed, the switch made in this passage from a merely physical analysis to an explanation of the "motions of the soul", is indebted to the "second conclusion" of Oresme's discussion of *Physics* 197a25-29, namely that II.3.ii natural fortune is sometimes augmented and diminished by the imagination of the soul.

[51] According to Philippe Debroise, it rather seems that the author proposes an *ad hoc* explanation, see Debroise, *Mathématiques de l'intensité et Merveilles de la nature*, 790: "Le lanceur doit 'faire vibrer comme il faut' sa lance, c'est-à-dire imprimer à son mouvement les variations de vitesse adéquates (...). Il est difficile de savoir si Oresme pense à une expérience balistique particulière. Il semble plutôt proposer une explication *ad hoc* du fait que certains projettent naturellement mieux ou avec plus de force une lance sans que leur corps ne soit visiblement plus fort."

III. The projectile thrower as a fortunate man: Giles of Rome and Thomas Aquinas in the background of Oresme's *De Conf.* II, 37 and *Problemata* 31-32

Oresme's reading of Aristotle's *Physics* 197a25-29, just presented in the previous section, is important not only because this question of fortune was the occasion for the author to develop his views on the role of imagination in good fortune, but also because it reveals to us another source that has remained unnoticed and that helps to understand *De Conf.* II, 37 more precisely: this is the first known commentary on the opuscule, namely *Sententia de bona fortuna* written by Giles of Rome around 1275-1278.[52] Oresme's familiarity with this text by Giles is evidenced at an early stage of his philosophical career by a passage from his *Questions on the Physics* in the beginning of the section of this question "on the causes of fortune" (II.1), were he says that "Aristotle, in the third chapter of *De bona fortuna*, distinguishes between a certain good fortune that comes from God and another that comes from nature."[53] To explain this reference, the editors of Oresme mention "*Eth. ad Eud.* 1247a23-31" and "*Magna moralia* 1207a6." But although these passages do allude to the distinction between natural and divine fortune, they cannot be meant precisely by Oresme in the text under consideration, because there he mentions the "third chapter" of the opuscule, whereas *LdBF* only has two chapters. Oresme seems to refer to the division made by Giles, according to which the first part of the treatise corresponds to the chapter taken from *Magna moralia* (1206b30-1207b19) whereas the second part covers a first section of the second chapter, taken from *Eudemian Ethics* (1246b37-1247b16) and the third part covers the second section of this chapter (1247b16-1248b11).[54] This so-called third part of the opuscule frequently refers to the multiplicity of the meanings of "fortune" and stresses the necessity of distinguishing between them.[55] As has now been made clear that Oresme was familiar with Giles' *Sententia* in the beginning of his scholarly career when commenting on *Physics* 197a25-29, this text by Giles might be assumed to rank among the sources behind *De Conf.* II, 37. In what follows, I will examine the parts of this work that might lie at the background of Oresme's discussion of fortune as well as his analysis of the javelin throw.

[52] For a first study of this work, see Cordonier, "Une lecture critique de la théologie d'Aristote", 143-180, which gives a partial edition of the text.

[53] Nicole Oresme, *Questiones super Physicam*, 270,73-75: "Quantum ad secundum, scilicet de causis fortune, sciendum quod Aristoteles in *De bona fortuna* capitulo tertio distinguit quod quedam bona fortuna est a Deo, et alia a natura."

[54] This division of the Aristotelian text is made clear, among others, in Aegidius Romanus, *Sententia LdBF*, 1206b36-7a2, 144,1-10: "'Primum quidem igitur super hoc utique quis ueniens etc.' (1206b36-1207a2). Premisso prohemio, in parte ista ponitur pars executiua siue tractatus, in quo philosophus tria facit, secundum quod tria in prohemio promisit se detractaturum. Nam primo determinat de ipsa bona fortuna, secondo ostendit qui sunt bene fortunati, tertio declarat circa quid et in quibus habet esse fortuna bona. Secunda ibi: 'quoniam autem non solum' (1246b 37), tertia ibi: 'Quid igitur probibet accidere' (1247b15). Circa primum duo facit, quia primo exsequitur de bona fortuna dubitando, secundo ueritatem determinando, ibi: 'Sed extra quidem hoc' (1207a12)."

[55] To be more precise, natural fortune is discussed in 1247b16-1248a15 whereas divine fortune is discussed afterwards in 1247a15-1248b11.

A source that certainly sheds light on Oresme's *De Conf.* II, 37 is Giles' commentary on the passage in *LdBF* where Aristotle compares the well-fortuned men to dice throwers (1247a21-27). In discussing this text, Giles goes indeed further than the Philosopher: rather than comparing the fortuned man to the winner of a game, he focuses on the physical process that occurs when the dice fall. By his description of this process, Giles aims to make the mechanism of "good fortune" clearer.[56] By drawing a rigid parallel between the trajectory of a die towards a "good number" and that of an individual towards a fortunate effect, he distinguishes between the factors affecting either trajectory. Beginning with the die, he claims that its final lie is determined by three factors that are the following: (a) the so-called "disposition" of the dice, (b) its position in the thrower's hand and (c) "the impulse according to which it is pushed by the hand."[57] Concerning (a), which is the physical configuration of the dice, Giles' idea is that no cube is ever equilateral, but it always presents one side that is larger / heavier than the others. Indeed, this configuration makes us obtain there this number rather than another given that the dice is, on one side, larger or longer than the other, or when it has (because of some lead or incurvation) some disposition on one part but not on another.[58] Concerning (b), the dice's position, he explains it in reference to the technique used by some expert dice players who can foresee the result just by adjusting the dice's position in their hands.[59] As for factor (c), it is described in a more ambiguous way, for Giles says: "when a die is thrown more or less, or in this or that way, one rolls one or another number."[60] The first mention (*ut magis et minus*) indicates the strength of the throwing, whereas the second mention (*ut aliter et aliter*) might indicate either simply the direction of the trajectory given to the die by the hand, or more specifically, the subtle way by which the thrower makes this object *spin*.

So, it seems that, according to Giles' description of the throw of dice, the impulse (*impulsus*) mentioned as the third relevant factor to explain the result of this throwing

[56] Aegidius Romanus, *Sententia LdBF*, 1247a22-23, 149,190-150,214.

[57] Aegidius Romanus, *Sententia LdBF*, 1247a22-23, 149,190-150,214: "Dubitaret ergo aliquis quomodo fortuna de qua hic intenditur assimilatur casu taxillorum. Dicendum quod ad hoc quod taxillus cadat in hoc puncto magis quam in alio, ex triplici de causa, quantum ad presens spectat, potest contingere. Primo ex dispositione taxilli, secundo ex situ quem habet in manu, tertio ex impulsu secundum quem a manu impellitur."

[58] Aegidius Romanus, *Sententia LdBF*, 1247a22-23, 149,194-200: "Ex dispositione quidem taxilli uenit ibi plus unus punctus quam alius, si taxillus in una superficie sit amplior uel longior quam in alia uel si propter plumbum et limationem habet aliquam dispositionem in una parte quam non habet in alia. Vnde et lusores taxillorum dicere consueuerunt aliquos taxillos esse de uno puncto, aliquos de alio, considerantes eos esse sic dispositos ut magis sint apti nati cubare in uno puncto quam in alio."

[59] Aegidius Romanus, *Sententia LdBF*, 1247a22-23, 149,200-150,204: "Secundo, hoc contingit ex situ quem habent in manu, quia secundum quod aliter et aliter situantur in manu, sic sunt apti nati ut cubent in alio et alio puncto. Vnde et lusores docti non permittunt ut ludentes cum eis aspiciant taxillos existentes in manu, ne cognoscentes eorum situm facilius proiiciant optatum punctum."

[60] Aegidius Romanus, *Sententia LdBF*, 1247a22-23, 150,205-206: "Tertio, hoc contingit ex impulsu, quia ut magis et minus uel ut aliter et aliter impellitur taxillus, iacit alium et alium punctum."

means a kind of subtle combination between the "force" with which the dice is thrown and the direction in which it is cast by the thrower's hand. Let us remember that an ambivalence similar to the one that marks Giles' description of the "impulse according to which" the projectile "is pushed by the hand" was also present in Oresme's description of the "efficient" javelin thrower, who was said to fling it "more directly and in a more efficient way" (*directius et fortius*) than another although the latter flings with greater force – in this passage was the one on which I have opted for a translation that differs from Clagett's one.[61] In both texts, it seems to be clear at least that the authors are not satisfied with an explanation that would only mention the *quantitative* aspect of the thrower's gesture – the "force" or "strength" by which he is throwing – and that it is precisely for this reason that they add a second factor that is more *qualitative* and that seems to imply the action of making the object spin in one way or in another. However, it is no less interesting to realize that in Giles' text, this qualitative dimension of the thrower's gesture, that was first mentioned when presenting the third factor at stake in the dice throw (150,205-206), finally disappears when the author summarizes his enumeration of the factors determining the fall of some dice. In this summary, he reduces the third factor to the mere fact that one throws the object "not more and not less than it is required for the desired number" (150,208-209: *neque plus neque minus impellitur, nisi quam requirit optatus punctus*). In the following translation of this passage from Giles' *LdBF*, this complicated Latin phrasing is rendered with the rather anachronistic phrase "with the force that is required for the desired number":

> Therefore, <because> the convergence of these factors (that is the fact that the die is positioned in that way in the hand, the fact that it has such a configuration and the fact that it is thrown exactly with the force required for the desired number) is by accident and at random, the dice play, unless there is some fraud and cheating, is contingent and fortuitus. For this reason, things are similar in the case of the roll of dice and in that of fortune because, as it is by fortune that all the factors converge to get the desired number, similarly it is by fortune that all these converge, so that one has the impetuses, that one perceives them and that one acts according to them, so that one achieves good outcomes.[62]

The passage of the *LdBF* just analyzed, which provides one of the most extensive explanations of contingency given by Giles, also gives us a convincing background to

[61] Nicole Oresme, *De Configurationibus* II, 37, 378,30-32, quoted here above with a discussion about its translation, in note 16.

[62] Aegidius Romanus, *Sententia LdBF*, 1247a 22-23, 150,207-210: "Quare quod ista concurrant (ut quod sic sit situatus taxillus in manu, et quod sic sit dispositus et quod neque plus neque minus impellitur, nisi quam requirit optatus punctus), sit per accidens et a casu, ludus taxillorum, nisi adhibeatur uersutia et malitia, est casualis et fortuitus. Simile est itaque de casu taxillorum et de fortuna, quia sicut ex fortuna est quod illa ibi concurrant et ueniat optatus punctus, sic ex fortuna est quod omnia hec concurrant ut quod habemus impetus et quod eos percipiamus et agamus secundum eos, secundum quos agendo consequamur bona."

Oresme's discussion of the javelin throwing.[63] However, it might be, at first sight, surprising that Oresme replaces Giles' dice with a javelin. To understand this switch, it will be useful to take into account another set of texts where Oresme discusses the throw of projectiles in a similar way: this is the "forty-four determined questions", a series of "problems" (in the Greek meaning of the term) that is transmitted in close connection with the texts traditionally labelled as *Questio contra divinatores horoscopios*, *De causis mirabilium*, *Tabula problematum*.[64] Assuming that all these "problems"[65] go back to the same

[63] The importance of Giles' commentary work on Aristotle to subsequent intellectual history has long been acknowledged. See Ernst Moody, "Ockham and Aegidius of Rome", *Franciscan studies* 9, 4 (1949): 417-442, reprinted in *Studies in medieval philosophy, science, and logic, collected papers* (Berkeley: University of California Press, 1975 [19671]), 161-188, here 420 and 427-430 and Annaliese Maier, *An der Grenze von Scholastik und Naturwissenschaft*, 2, Auflage (Rome: Edizioni di Storia e Letteratura, 1952), 90 s.

[64] I am following here the characterization of the works given by Di Liscia and Panzica, "The Works of Nicole Oresme" (to be published), but this characterization will be challenged by the new Latin edition with French translation prepared by Alain Boureau, Joël Chandelier, Sophie Serra, Maria Sorokina, Julien Véronèse and Nicolas Weill-Parot and to be published under the direction of Beatrice De Laurenti and Alain Boureau. In this new edition, the text quoted until now as "*De causis mirabilium*" (see below note 65) will be labelled "*De effectibus singularibus*" and vol. VI will contain four treatises: the *Tractatus contra astrologos iudiciarios*, the *Livre de divinations*, the *Editio* (a retroversion of the latter text into Latin) and the *Questio contra divinatores*; vol. VII will be devoted to the so-called *Tabula Problematum* (see below note 65) and to the so-called *De causa mirabilium*, newly intitled by Alain Boureau *De effectibus singularibus*; vol. VIII will include the *Problemata* (that were sometimes falsely named *Quodlibeta*). From this latter work, Questions 43 and 44 have been published with a French translation in Béatrice Delaurenti, "Contre la magie démoniaque et les incantations: les questions 43 et 44 des *Quodlibeta*", in *Nicole Oresme philosophe. Philosophie de la nature et philosophie de la connaissance à Paris au XIV^e^ siècle*, edited by J. Celeyrette and Ch. Grellard (Turnhout: Brepols, 2014), 279-297. An edition with French translation of these Questions is forthcoming in Nicole Oresme, *Écrits métaphysiques, politiques et théologiques,* section 2 : *Anthropologie des erreurs humaines*, vol. VIII : *Problemata*, directed by A. Boureau and B. Delaurenti (Paris: Belles Lettres, to be published). The text of Questions 43 and 44 will be slightly different from the text published by De Laurenti in 2014 quoted above. The following references that I will make to this text by Oresme are made on the basis of this edition. I thank very much Beatrice Delaurenti and Alain Boureau for having let me read some parts of their forthcoming edition of this important set of texts by Oresme.

[65] A list of these questions is extant in the *Tabula Problematum* edited as an "Appendix A" by Bert Hansen, *Nicole Oresme and The Marvels of Nature: A Study of his De causis mirabilium with Critical Edition, Translation, and Commentary* (Toronto: Pontifical Institute for Mediaeval Sudies, 1985), 366-393. However, the edition of selected questions announced by Hansen, *Nicole Oresme and the Marvels of Nature*, 27 n. 3 has never appeared. A new edition of this Table will soon be published in De Laurenti's and Boureau's edition: Oresme, *Tabula questionum tractandarum*, edited and translated by A. Boureau, in Nicole Oresme, *Écrits métaphysiques, politiques et théologiques*, section 2: *Anthropologie des erreurs humaines*, vol. VII (Paris: Belles Lettres, to be published). As De Laurenti and Boureau say in their introduction to the volume, this "*tabula*" is not to be understood as a table of contents, but rather as a sort of programmatic sketch of the topics to be discussed and, therefore, as a first redactional stage of Oresme's "*Problemata*", that would go back to the early 1370s.

relatively late period of Oresme's production,[66] we can first mention question 25 as a good indication that, in his advanced age, Oresme maintained his early view about the complementarity between *Physics II* and *LdBF*. For in this question, where he discusses good fortune according to the doctrine read in the opuscule, he insists on the importance of this short treatise to supplement doctrine of Aristotle's *Physics* which he declares insufficient in many respects.[67] But all the more interesting are questions 31 and 32. The first of the two asks why a man aiming at a target can reach it more than the target at which he had not aimed? Or: Why is this so, despite of the fact that he is equally able to reach each of the two targets and that, besides, his soul seems to intend the first target more than the other?[68] The second asks: "Why does it sometimes occur that a dice player proves lucky in the dice throw many times in the course of one or more hours while another, equally strong and expert and prudent in this art, cannot do so and, rather, cannot himself in one hour do and throw the pitch as he did previously. Does this come from heaven?"[69] Let us enter these two texts that shed light on *De Conf.* II, 37.

In *Problema 31*, the difficulty of throwing one pitch towards a target is explained by five remarks. First, a very little difference in the starting conditions might cause a huge

[66] The date composition of the whole work in four parts was discussed by Hansen, *Nicole Oresme and the Marvels of Nature*, 43-48. At the end of *Questio contra divinatores horoscopios* in Ms. Naples, BN, XI C 84 (ff. 1r-33v), one reads the date of 1370, which however is considered as non-reliable data by Clagett, *Nicole Oresme and the Medieval Geometry*, 128-13. On all this see Di Liscia and Panzica, "The Works of Nicole Oresme", XX and A. Boureau and B. Delaurenti, "Introduction aux tomes VI, VII and VIII", in Nicole Oresme, *Écrits métaphysiques, politiques et théologiques*, section 2: *Anthropologie des erreurs humaines*.

[67] Nicole Oresme, *Problema*, q. 25, in Nicole Oresme, *Écrits métaphysiques, politiques et théologiques*, section 2 : *Anthropologie des erreurs humaines*, vol. VIII: *Problemata*, directed by A. Boureau and B. Delaurenti (Paris: Belles Lettres, to be published): "Et omnia ista sunt in questione principali reprobata. Et pro nunc dico simpliciter loquendo: fortuna est causa ignota esse, causa rerum pertinentium ad divitias vel paupertatem, etc. Et ideo, ut dicit Linconiensis supra secundum *Phisicorum*, nichil simpliciter a fortuna, quia nichil est cuius causa non sit ab aliquo esse scita causa et intenta. Aristoteles secundo *Phisicorum* et alii actores satis tractant istam materiam et etiam differentiam inter casum et fortunam. Tamen, ut dixi, multis non sufficiunt sua dicta. Ideo specialius tractauit in *De bona fortuna.*"

[68] Nicole Oresme, *Problema*, q. 31, "Propter quid enim [*corr.*, Boureau non] potest homo proiciens ad aliquod signum id attingere sicut illud ad quod non proicit? Unde cum eque sit potens ad unum sicut ad aliud et cum hoc anima ad illud intendit videtur quod magis e contrario, etc." The Latin text seems to be problematic, but nevertheless the general meaning of the question seems to be clear.

[69] Nicole Oresme, *Problema*, q. 32, "Propter quid taxillator quandoque per unam horam vel plures proiciet in taxillis suam canciam pluries? Et alter eque fortis et prudens et cautus in hoc non potest illud facere, ymmo ipsemet in alia hora non poterit facere et proicere sicut prius. Utrum tunc a celo proveniat." Concerning the term *cancia* (an old French term meaning "chance"), Hansen hesitates and suggests as a possible alternative "[*l* caniculam *?*]", but the reading *canciam* is much more convincing. Besides, what I have translated by "it occurs that" is just the adverb *quandoque*. And what I have rendered by "to prove lucky in the dice throw" is the phrase "*proicere in taxillis suam canciam*."

difference in the results.[70] Second, some people might become experts in throwing things towards definite targets by training their memory, their imagination, and the faculties of their bodily members, as some others do for the art of writing or of playing the guitar.[71] Third, Oresme insists that there are much more ways to deviate than to reach the target, and fourth that many of such activities are much influenced by imagination and memory.[72] The fifth and last remark is the most interesting to us. It describes the technique by which the thrower uses his imagination and memory to evaluate the distance to the target and to remember how, during his previous throws at a given distance, he had "disposed himself" accordingly. Sometimes he does this calculation in a right way and sometimes, on the contrary, he does not measure correctly "all things, that is the intermediate space, the weight of the stone that he throws, the force of his own arm, the impetus or movement that he causes nor his hand's disposition when he lets the stone loose, because it might be that this stone deviates too much on this side."[73] And, Oresme adds, the difficulty of this technique is principally due to the multiplicity of the factors implied in this process: even a slight deficiency in one of them inevitably causes a deviation of this throwing of *a stone*.[74] In the two notes that follow this passage immediately, he replaces the stone by the examples of "a die or a coin" thrown "on a fix object such as a table."[75] In the very beginning of Problem 32, of which the main subject is the success in throwing dice, Oresme establishes

[70] Nicole Oresme, *Problema*, q. 31 (to be published): "Dico tamen quod in multis effectibus pauca et valde modica differentia in causis maximam causat diversitatem et in aliquibus effectibus et etiam causis non est sic."

[71] Nicole Oresme, *Problema*, q. 31 (to be published): "Nota secundo quod aliqui ex usu et memoria et ymaginatione et habilitate membrorum, ut manuum, vel etc., citius et melius faciunt aliqua quam aliqui alii, forte quam mille alii. Hoc patet in scriptura et guitaratione aut pulsatione cithare, vel etc."

[72] Nicole Oresme, *Problema*, q. 31 (to be published): "Dico tertio quod pluribus modis deviare contingit quam recte assignare. Ista est per se nota. Dico quarto quod multa sunt cum ymaginatione et memoria. Hoc patet per Alacen in primo et precise in secundo *De cognitione et visione sensibilium*."

[73] Nicole Oresme, *Problema*, q. 31 (to be published): "Dico quinto quod, quando homo proicit ad aliquod signum, tunc ymaginatur quanta est ibi via, secundo recolit et memoratur quod alias proiciebat ad tantum spatium et tunc sic nitebatur proicere et sic se disponebat. Quandoque autem ista facit recte, quandoque deficit ita quod non recte mensurat omnia, scilicet spatium, pondus lapidis quem proicit, fortitudinem bracchii et impetum seu motum quem facit nec etiam dispositionem manus in dimittendo lapidem, quia forte nimis declinat ad hanc vel illam partem." One might notice that this passage from Oresme's *Problemata*, q. 31 refers to the concept of *impetus*, a concept that was absent from Oresme's *De Conf.* II, 37 (discussed above in note 25). For a general discussion of this topic, see here below at the end of Section IV.

[74] Nicole Oresme, *Problema*, q. 31 (to be published): "Unde multa requiruntur ad hoc quod proiciat recte in tali loco, scilicet quod manus sic se habeat et digiti et bracchium et pectus et corpus, ymmo et pedes et ymaginatio et advertentia et quod inter lapidem et modum sit talis proportio et etiam inter ista et spatium. Sed ad hoc quod deviat sufficit defectus et error in altero istorum, ut notum est. De hoc autem apparet realiter quare facilius est deficere quam assignare, quia ad deficere pauciora requiruntur quam ad assignare recte."

[75] Nicole Oresme, *Problema*, q. 31 (to be published): "Et nota quod aliqui sunt effectus ad quos plura requiruntur et ad quos pluribus modis contingit deuiare et in talibus rara fit assignatio, sicut ad proiciendum taxillum vel denarium super rem erectam similiter tamquam super mensam."

an explicit link between this case and the one discussed in Problem 31, when he says "By this [*i.e.* by the answer given to Problem 31] the answer to the question on the dice throw is solved, neither more nor less." And he subsequently explains the different results in referring again to the answer to Problem 31.[76]

This short look at Oresme's *Problems* on projectiles and fortune allows one to understand why in *De Conf.* II, 37 he could so easily switch from Giles' description of throwing dice to his own presentation of throwing a javelin: to him, the throw of a stone, of a dice or of a coin on a table might be analyzed in the very same way.[77] For in all these cases, it is assumed that fortune is a mere label used by those who see the effects of a multifactorial process of which they ignore all the causes. This assumption also echoes Giles' approach. Of course, such a view was not assumed *explicitly* by Giles, but the conclusion that Giles' account of "fortune" actually leads to a deterministic view was reached by his colleague Henry of Ghent, whose *Quodlibet* VI, 10 was meant to attack this aspect of Giles' doctrine. Following Henry's polemical but convincing rephrasing of Giles' reading of *LdBF*, the action of the First Principle assumed by Giles to be the origin of fortune is limited and necessitated by the natural conditions of the beings to which it is applied; a true account of contingency is only possible if one takes into account the idea of a God who acts in a voluntary way and whose action is not limited by the world's conditions.[78] In other terms, it seems that Oresme's analysis of the so-called fortune meets the conclusions reached by Henry in reading Giles: "fortune" is nothing real, but it is the face of our ignorance, for this ignorance of the causes of a given effect leads us to attribute such an effect to fortune. Following this account of fortune, where this process is assumed to be, *as such*, completely predictable by a mind which is able to apprehend all the factors at stake, it is "natural" to discuss the dice throw, as Oresme does, in the same way as the

[76] Nicole Oresme, *Problema*, q. 31 (to be published): "Per hoc nec plus nec minus solvitur 32ª questio de proiectione taxillorum, etc. Et cum queris quare iste non ita bene proicit, ymmo idem in una hora bene et in alia male, etc., respondeo quod pro tunc talis proicit ut oportet ad hoc talis cancia veniat, sicut ille qui percutit signum, ut dixi." The phrase "percutit signum" refers to "proicit ad aliquod signum" in q. 31.

[77] It is not clear if Oresme was aware that the dice – given his physical shape and the *discrete* numbering of its sides – gives rise to a much more unpredictable result than a stone or a javelin. Indeed, the physical particularity of the dice as a cubic object numbered on each of its six sides implies that even practically small differences in the starting conditions happen to finally cause very *distinct* results (that must be represented not on a continuous series, but on a graduated scale). Hence the fact that the fall of a die might seem to be a highly contingent fact.

[78] See Valérie Cordonier, "Aristotle theologized: the importance of Giles of Rome's *Sententia de bona fortuna* to the Late Medieval and Renaissance peripatetism", in *Doctor Fundatissimus. Giles of Rome: His Thought and Influence*, edited by M. Benedetto, F. Marrone and P. Porro, *Quaestio: annuario di storia della metafisica / Quaestio: The Yearbook of the History of Metaphysics* 20 (2020): 150, and Valérie Cordonier, "Giles of Rome on the reduction of fortune to divine benevolence: the creative error of a Parisian theologian in the 1270s", in *Irrtum-Error-Erreur. Irrtum und Fortschritt – Mittelalterhistoriographie im Wandel, 40. Kölner Mediaevistentagung*, edited by A. Speer and M. Mauriège (Berlin and New York: Walter de Gruyter, 2018), 231-256.

throw of any kind of object.[79] In the case of the throwing of dice as in the throwing of any other kind of object, throwing might be approached and understood as a perfectly teachable technique, in which every human being might be trained. Now, it remains to be seen how the very idea of such a training, in itself, follows another line of the medieval reception of *LdBF*.

Although Oresme's general understanding of fortune and precise description of the dice throw are directly indebted to Giles' *Sententia LdBF*, things are different in the case of his idea that every individual might learn the art of being good at throwing different objects and at fortune, and that different men have different abilities in this respect. These views are in line with the content of a chapter from the *Book on the Truth of the Catholic Faith* ("Summa contra Gentiles"), written by Thomas Aquinas during his sojourn at the Papal Curia in Italy at the beginning of the 1260s. This work has marked the first appearance, in the Latin West of the two chapters respectively taken from the *Magna Moralia* (1206b30-1207b19) and the *Eudemian Ethics* (1246b37-1248b11) and that would be put together to form *LdBF*.[80] The passage from Aquinas' *Summa* that is relevant here comes from the chapter in which he discusses the original question: "How one is said to be well-fortuned and how man is assisted by superior causes."[81] For in the course of this chapter that is full of lexical distinctions and subtle conceptual precisions, the author explains that a man may be helped by "higher causes" not only to choose successful actions and to carry out what he has chosen, but that he may at times be assisted in regard to the outcome of his actions (*quantum ad exitus suarum actionum*), in receiving the physical efficacy needed to accomplish what he has chosen.[82] This help, Aquinas says, results from the influence of celestial bodies, and he adds that "nothing prevents a man, too, from getting (...) a certain efficiency in doing bodily actions that another man does not possess, for instance a physician in regard to healing, a farmer in regard to planting, and a soldier in regard to fighting."[83] In the light of this passage

[79] In this respect, the ordering of the subjects in Problems 31 and 32 is completely consistent. The issue of the organization of Oresme's Problems (if any) remains an open question.

[80] On the importance of this text, see Cordonier, "Sauver le Dieu du Philosophe", 84-95.

[81] Thomas de Aquino, *Summa Contra Gentiles* III, 92, in *Sancti Thomae Aquinatis Opera omnia iussu impensaque Leonis XIII. P. M. edita*, t. 14: *Summa contra gentiles ad codices manuscriptos, praesertim S. Doctoris autographum exacta. Liber III. cum Commentariis Franc. de Sylvestris Ferrariensis* (Romae: Ex Typographia Polyglotta S. C. de Propaganda Fide, 1926), 279: "Quomodo dicitur aliquis bene fortunatus, et quomodo adiuvatur homo ex superioribus causis." My translation of this title differs from that by V. J. Bourke, *Saint Thomas Aquinas, Summa contra Gentiles, Book III: Providence, Part II* (Notre Dame: University of Notre Dame Press, 1975 [1956]), 42, nº 4: "Next, we can show how a person might be said to be favored by fortune."

[82] Thomas de Aquino, *Summa Contra Gentiles* III, 92, 280b,44-46: "Consequitur autem homo ex superioribus causis et aliud auxilium, quantum ad exitus suarum actionum."

[83] Thomas de Aquino, *Summa Contra Gentiles* III, 92, 280,47-281,17, and in particular 281, 4-17: "Manifestum est enim quod etiam inanimata corpora quasdam vires et efficacias a caelestibus corporibus consequuntur, etiam praeter eas quae ad qualitates activas et passivas elementorum consequuntur, quas etiam non est dubium caelestibus corporibus esse subiectas: sicut quod magnes attrahat ferrum, habet ex virtute caelestis corporis, et lapides quidam et herbae alias occultas virtutes. Unde nihil prohibet quod etiam aliquis homo habeat ex impressione caelestis corporis

from a chapter by Aquinas, Oresme seems to build on the different examples of human activities where natural dispositions cause different abilities to be trained in given disciplines and to achieve some goals in particular.[84] Of course, contrary to his predecessor, he denies that these abilities come from the stars, but still, he connects them to the more general quality of being "well fortunate", considering that fortune might be the result of technical training. And instead of the different kinds of abilities mentioned by Aquinas, he chooses to illustrate fortune by the much more paradigmatic example present in Giles' *Sententia*, which is the dice throwing.

IV. Oresme's naturalization of fortune and divinatory practices: its originality in the Peripatetic tradition

Let us now come back to Oresme's *De Conf.* II, 37, to compare it first with Giles' text on dice throwing. In Giles' *Sententia*, the analysis of the trajectory of a die towards a desired number is a way to reflect – analogically – on the trajectory of an individual towards a fortunate effect. To this purpose, Giles considers God's influence on human will: this corresponds to what he calls "the disposition of the dice" (*dispositio taxilli*). This divine influence is not God's *grace* because Giles, in commenting on *LdBF*, aims to write a commentary that does not contain any reference to Christian doctrines, and regularly claims to analyze fortune "according the order that we see."[85] So, in this text by Giles that has been considered as a true philosophical manifesto,[86] God's influence has to be understood in a restricted sense: God is mentioned as the ultimate creator and governor of all nature – its first Mover (cf. *Phys* VIII and *Metaphysics* XII).[87] In Oresme's analysis of

aliquam efficaciam in aliquibus corporalibus faciendis, quas alius non habet: puta medicus in sanando, et agricola in plantando, et miles in pugnando."

[84] One might wonder whether the direct influence of Aquinas' *Summa Contra Gentiles* on Oresme is textually justifiable (as is his use of Gile's *Sententia de bona fortuna*). The only argument is a doctrinal parallel: the claim, endorsed both by Aquinas and Oresme, that one can become more "fortunate" in some actions through technical training. Of course, it is in no way excluded that such views came to Oresme through textual intermediaries, or even that Oresme did not need any source to consider that technical training might help us to become more fortunate! However, Aquinas' texts were an important authority in Oresme's day, and this was even more the case for the topic of good fortune (understood in the particular sense explained above on p. 169), which was rather new in the Latin Aristotelian tradition. For these reasons, in this essay I assume Oresme's direct drawing on Aquinas.

[85] Cordonier, "Giles of Rome on the reduction of fortune to divine benevolence", 239-249.

[86] Cordonier, "Giles of Rome on the reduction of fortune to divine benevolence", 249: "such a focus on secondary causes represents to him [Giles] an important feature of what has now appeared as his manifesto, the manifesto for a typically philosophical method that aims at accounting for contingency on the basis of the secondary causes and in making abstraction of the Christian faith."

[87] For further explanations on the way in which Giles justifies his philosophical project in the *Sententia LdBF*, see Cordonier, "Giles of Rome on the reduction of fortune to divine benevolence", 240-241.

fortune, similarly, there is no mention of divine grace.[88] But in Oresme, contrary to what happen in Giles' *Sententia LdBF*, even the first Mover is completely absent, and there is also no divine impetus (or "divine" influence) anymore. Instead, he allows for the influence of the celestial bodies on our actions, "as far as the first non-deliberate movements are concerned"[89] and, above all, he introduces a factor that was absent from Aquinas' and Giles' explanations of being fortunate, namely: imagination. This power of human and animal imagination might now appear as the "immanent" counterpart to the "transcendent" factors mentioned by the 13th century readers of *LdBF* and, in this way, it seems to be an important piece in the process of the naturalization of fortune in Oresme.

The process of naturalizing fortune found in Oresme's works is not entirely original. One finds similar approaches in other authors from the beginning of the 14th century. The most telling example in this respect is Peter Auriol (ca 1280-1322). In the specific version of the first book of his *Commentary on the Sentences* preserved in the ms. BAV, Vat. Lat. Borghese 329 called the "*Scriptum*", that was prepared at Cahors by a professional copyist hired by Auriol and finished on May 19, 1317,[90] there is an entire article devoted to "the opinion of the Philosopher on good and bad fortune and divination by dreams in the Book on good fortune", where the author discusses *LdBF* at length.[91] As was judiciously pointed out by Mikko Posti, one of the most original aspects of Auriol's account of good fortune is the fact that, to explain what Giles of Rome and Henry of Ghent called "continuous fortune", he connects this phenomenon to some human faculties that are described in Aristotle's *Nicomachean Ethics*, and in particular εὐβουλία (an excellence in deliberation) and εὐστοχία (an excellence in making conjectures).[92] Auriol bases himself on these truly Aristotelian concepts to argue, against Henry, that the Philosopher's doctrine allows for particular providence (by which God takes care of all individuals and human beings individually). This providence works because human beings do possess these specific virtues that Auriol describes following the very same chapter from Aquinas' *Book on the*

[88] This is already the case in the *Questiones super Physicam*: "divine" fortune, he says, the one that is more stable (and that was called "continuous fortune" by Giles), corresponds to what the theologians call "God's grace" (II.2.iii) and must be left aside in this commentary (II.2.iv).

[89] Nicole Oresme, *Questiones super Physicam* II, 14 (197a 25-29), 271,98-103. See here below "Appendix II", II.3.1.b.

[90] For a presentation of this major work produced by Auriol, of his importance of the history of late medieval thought and of its transmission, see William O. Duba, "Aristotle's 'Metaphysics' in Peter Auriol's 'Commentary in the Sentences'", *Documenti e Studi sulla Tradizione Filosofica Medievale* 12 (2001): 550-551.

[91] Peter Auriol, *Scriptum*, Liber I, dist. 40, a. 3, ms. Vat. Lat. Borghese 329, fol. 430r: "*De eufortunio et infortunio et veritate sompniorum, opinio Philosophi in libro de bona fortuna*". I thank Bill Duba for having sent me a transcription of this article, which would deserve an extensive study, made on the basis of all its late scholastic and Aristotelian sources. I hope to be able to do it in a separate essay.

[92] See Mikko Posti, *Medieval Theories of Divine providence 1250-1350*, Studien und Texte zur Gestesgeschichte des Mittelalters 128 (Leiden and Boston: Brill, 2020), 253-265 for the presentation of this article and, in particular, 261 for the importance of εὐβουλία and εὔστοχια in Auriols' interpretation of Aristotle's doctrine of good fortune.

Truth of the Catholic Faith that we have mentioned above to comment on Oresme's description of the javellin throw.[93] Auriol's discussion and use of the notion of εὐστοχία appears to have many similarities to Oresme's understanding of divination as it is expressed in particular in his *Livre de divinacions.* Let us have a short look in these passages.

In Chapter X of Oresme's *Livre de divinacions*, one finds many claims that are in line with some of the texts analyzed below. First, the comparison between the negative effect of superstition and some medical symptoms, already found in *De Conf.* II, 37.[94] A bit later one finds a claim that goes back to *LdBF*: "Or dit Aristote en Ethiques que se les autres choses sont pareille, la ou il a plus de passions il y a mains de raisons [*sic*] ; et il dit ou livre de Bonne Fortune que la ou il a mains de raison il a plus de fortune, et la ou il a plus de fortune, la ou raison deust estre, il y a plus de peril et de male fortune, sicomme il appert du gouvernement d'une nefs."[95] As was rightly pointed out by Rapisarda,[96] this claim is a free rephrasing of the passage from *Magna moralia* where it is said that "where there is most intellect and reason, there is least fortune, whereas where there is most fortune, there is least intellect", a passage that was frequently quoted in the late Middle Ages.[97] In addition, Oresme seems to combine this general idea with the more practical example of the "unwieldy vessel" (*nauis male regibilis*) that frequently "sails better" (*melius frequenter nauigat*), an example that happens to be given by Aristotle in the direct continuity of that of the fall of dice.[98] Finally, earlier in the same chapter from Oresme's *Livre de divinacions*, one reads the following argument against divination: "Item, je le prouve par raison de nature car second Aristote, fortune est une inclinacion naturelle a bonnes aventures qui aviennent sans conseil, se c'est bonne fortune, ou au contraire, se c'est male fortune. Et

[93] As was indicated by Posti, *Medieval Theories*, 257, his criticism of Aquinas' theory of good fortune focuses on Aquinas' view of angelic protection.

[94] Nicole Oresme, *Livre de divinacions*, ch. X, 126: "Item, tout aussi comme les frichons vont devant la fievre et la mangoison devant la rongne, et comme dit Claudius que plourer sans cause est presage, aussi parvoir trop grant desir de savoir sa destinee est signe, presage, et message, qu'il s'ensuivra malaventure." See Nicole Oresme, *De Conf.* II, 37, 378,44: "just as itching precedes the scab": *quemadmodum pruritus antecedit scabiem*, quoted above note 20.

[95] Nicole Oresme, *Livre de divinacions*, ch. X, 128.

[96] Rapisarda, *Nicole Oresme, Contro la divinazione*, 249-250, note 159.

[97] Aristoteles Latinus, *LdBF*, ch. I, 1207a2-5: "Propter quod et ubi plurimus intellectus et ratio, ibi [7a5] minima fortuna, ubi autem plurima fortuna, ibi minimus intellectus." οὗ πλεῖστος νοῦς καὶ λόγος, ἐνταῦθα ἐλαχίστη, τύχη, οὗ δὲ πλείστη τύχη, ἐνταῦθ' ἐλάχιστος νοῦς. Among the numerous examples of texts where his passage is used, one can mention Duns Scotus, *Quodlibet* I, 21 (1308), edited ny F. Alluntis, *Cuestiones cuodlibetales (Obras del Doctor Sutil Juan Duns Escoto, edicion bilingüe)* (Madrid: La Editorial Católica, 1968), xiv-xviii: "Quod autem non sit ratio, patet quia 'ubi plurimus intellectus et ratio, ibi minima fortuna; ubi autem plurima fortuna, ibi minimus intellectus', secundum Aristotelem."

[98] Aristoteles Latinus, *LdBF* II, 1247a19-27: "Circa naucleriam enim non maxime industrii bene fortunati, sed quemadmodum in taxillorum casu hic quidem nichil, alius autem iacit <s>ex eo quod naturam habet bene fortunatam, aut eo quod ametur, ut aiunt, a deo, et extrinsecum aliquid sit dirigens (ut puta nauis male regibilis melius frequenter nauigat, sed non propter se ipsam, sed quia habet gubernatorem bonum), sed sic quod bene fortunatum daimonem habet gubernatorem."

ceste inclinacion ne poons nous savoir avant les effees. Et posé que elle fut sceue, si ne peut l'en savoir les particulières effees avenir."[99] Concerning this passage, Rapisarda's remarks might be now completed: although it remains true that Oresme refers to *LdBF* in an imprecise way,[100] it might be interesting to add that this summary of Aristotle's doctrine of fortune given in this passage of the *Livre de divinacions* is consistent with Oresme's reading of Aristotle's *Physics II* as it was explained here above.[101]

Oresme's naturalization of fortune and of the practice of divination, as it was operated in his *Livre de divinacions* and in his commentary on *Physics* 197a25-29, has many similarities to Auriol's discussion of these topics in his *Commentary on the Sentences*. Indeed, both authors consider that there is nothing supernatural there because this supposed "human divination" proves to be a merely natural ability. However, compared to Auriol's, Oresme's naturalization of fortune appears much less "psychologizing".[102] Or, to be more precise, it is so in another way. First and most obviously, because Oresme's account of fortune is totally separated and independent from any theological view. While the framework of Auriol's discussion is his *Commentary on the Sentences* in the section devoted to God's providence, predestination and forethought, the framework of Oresme's discussion is a commentary on Aristotle, in which any theological perspective is systematically avoided.[103] Second and less evidently, but perhaps more importantly, Oresme's psychologization of fortune is more mechanistic: the powers of imagination are described in privileging quantitative over ontological aspects; they are considered to be possibly "trainable" exactly as is the art of throwing a javelin, a stone, a coin or... a die. In Auriol's account of the ability to be well-fortuned, there is no indication of the way by which a given man might improve his talent for fortune, and at any rate, it is nowhere said that such an improvement, if any, would be possible by a physical or a bodily training. In Oresme, the gift for fortune that is already present in some men by nature (as an innate gift granted by the stars) might be developed as is the case for any physical or bodily force.

A modern reader – or, more precisely, a reader who has read the Aristotelian corpus with attention – might be surprised that Oresme's naturalistic ideas on fortune seem to have no link to the few but important passages where Aristotle goes precisely in the same direction and/or even mentions ballistic examples. The first set of passages are read in the treatise *On Divination by Dreams*,[104] that offers a naturalistic discussion of the

[99] Nicole Oresme, *Livre de divinacions*, ch. X, 124.

[100] Rapisarda, *Nicole Oresme, Contro la divinazione*, 244-245, note 149.

[101] See here above Section II.

[102] See Posti, *Medieval Theories*, 254: "As will be shown below, Auriol mainly interprets *LdBF* in a naturalistic and psychologizing manner."

[103] Nicole Oresme, *Questiones super Physicam*, 271,85-86, which corresponds to II.2.iv in the argumentative map given in Appendix.

[104] This title "*On Divination by Dreams*" is a translation of Περὶ τῆς καθ᾽ ὕπνον μαντικῆς (in Latin *De divinatione per somnum*). Other English titles are "*On Divination in Sleep*" or "*On Prophesying by Dreams*". This is a text in which Aristotle discusses precognitive dreams and offers a rational inquiry into this phenomenon. In Medieval times, the treatise belonged to a set of very short works dealing with

phenomenon of precognitive dreams. After the very skeptical presentation of so-called prophetic or divinatory dreams made in Chapter 1,[105] Chapter 2 of this treatise is pervaded by ballistic models. There, Aristotle first refers to gamblers to explain the fact that the power of foreseeing the future is found in "inferior" persons, such as those who have "a melancholic temperament": these people experience many movements of every kind, so that they just happen to have right visions, their luck in these matters being comparable to that of persons who play at dice.[106] Thus, he adds, the principle of the gambler's maxim is valid in this case: "if you make many throws, your luck must change."[107] A second reference to ballistic comes near the end of the treatise, where Aristotle gives the reason why certain persons "who are liable to derangement" have vivid dreams and the ability to foresee future events: the reason is, he explains, that "their normal mental movements do not impede the alien movements" so that "they have an especially keen perception of the alien movements" (464a25-31). In this way, "melancholic persons, owing to their impetuosity, are, when they shoot from a distance, expert at hitting, while, owing to their mutability, the series of movements deploys quickly before their minds."[108] Another

"psychological" and "physiological" issues that were later canonized under the title *Parva naturalia*. This set included the works *On sense and sensible objects*, *On memory and recollection*, *On sleep and waking*, *On dreams*, *On prophecy in sleep*, *On length and shortness of life*, *On youth and old age*, *On respiration*, *On life and death*, but it also included a set of short treatises ascribed at the time to Aristotle and associated with the group of works just mentioned on the basis of their shortness and their 'interdisciplinary' content, such as, among others, the treatises *On the movement of animals* and *LdBF*. The three treatises related to sleep, *On sleep and waking*, *On dreams* and *On prophecy in sleep* were considered as a single work transmitted under the general title "*De somno et vigilia*". On the Medieval *Parva naturalia*, see Pieter De Leemans and Pieter Beullens, "Aristote à Paris. Le système de la *pecia* et les traductions de Guillaume de Moerbeke", *Recherches de théologie et philosophie médiévales* 75 (2008): 87-135; *Aristoteles Latinus, De progressu animalium, De motu animalium. Translatio Guillelmi de Morbeka*, Aristoteles Latinus XVII 2.II-III, edited by P. De Leemans (Turnhout: Brepols, 2011), lxii-lxvii; Pieter De Leemans, "Parva Naturalia, Commentaries on Aristotle's", in *Encyclopedia of Medieval Philosophy. Philosophy Between 500 and 1500*, edited by H. Lagerlund (Dordrecht: Springer, 2011), 917-923; and Silvia Donati, "Albert the Greaet as a Commentator of Aristotle's *De somno et vigilia*: The Influence of the Arabic Tradition", in *The Parva Naturalia in Greek, Arabic and Latin Aristotelianism*, edited by B. Bydén and F. Radovic (Cham: Springer, 2018), 169-209. In what follows, where I discuss the Greek text independently from Latin translations, I quote the following edition: *Aristotelis Parva Naturalia graece et latine* (Collectio Philosophica Lateranensis), edited by P. Siwek S.J. (Rome: Desclée et C°, 1963).

[105] See in particular Aristotle (1963), i, 462b20-22, where Aristotle argues that, although "the senders of such dreams should be the gods" it is nonetheless the case that those to whom they are sent are not the best and wisest, but merely commonplace persons, and i, 463a31-b1 where he says that most so-called prophetic dreams are to be classed as mere coincidences that have natural causes.

[106] Aristotle (1963), 463b15-18: σημεῖον δέ· πάνυ γὰρ εὐτελεῖς ἄνθρωποι προορατικοί εἰσι καὶ εὐθυόνειροι, ὡς οὐ θεοῦ πέμποντος, ἀλλ᾽ ὅσων ὥσπερ ἂν εἰ λάλος ἡ φύσις ἐστὶ καὶ μελαγχολική, παντοδαπὰς ὄψεις ὁρῶσιν·

[107] Aristotle (1963), ii, 463b20-22: ὥσπερ γὰρ καὶ λέγεται "ἂν πολλὰ βάλλῃς, ἄλλοτ᾽ ἀλλοῖον βαλεῖς" καὶ ἐπὶ τούτων τοῦτο συμβαίνει.

[108] Aristotle (1963), ii, 464a32-b5: οἱ δὲ μελαγχολικοὶ διὰ τὸ σφοδρόν, ὥσπερ βάλλοντες πόρρωθεν, εὔστοχοί εἰσιν, καὶ διὰ τὸ μεταβλητικὸν ταχὺ τὸ ἐχόμενον φαντάζεται αὐτοῖς. Interestingly, to describe the greater or lesser ability of the archers taking aim at their target,

passage where Aristotle mentions a ballistic example in a way that could have been of some interest to Oresme is *Rhetorics* I, 5, 1362a1-15 and, in particular, 1362a6-10, where the unexpectable and unpredictable aspect of fortune is illustrated not only by the example of the one who "finds a treasure that everybody else has overlooked", but also by the example of "a missile" that "hits the next man and misses you" (ἢ εἰ τοῦ πλησίον ἔτυχεν τὸ βέλος, τούτου δὲ μή).[109]

As a matter of fact, it is difficult, not to say impossible, to determine if these texts were known by Oresme or not. But one might assume that he knew them and try to see his reasons to omit them. Concerning the passage from Aristotle's *Rhetorics*, it is clear that, if Oresme had known it, he had good reasons to omit it: the particular use of the ballistic model made by Aristotle in this passage was not in line with Oresme's thinking, because the aspect that was underlined there by the Philosopher is the fact that the throw of arrows escapes human calculations and proves, as such, to be fully unpredictable. As for the other ballistic examples, those that are read in the treatise *On Divination by Dreams*, the absence of any mention in Oresme's discussion of the throw of the javelin is, at first sight, less understandable. Indeed, many ideas that are made explicit in this text seem to be in line with Oresme's approach to the act of throwing objects successfully: first, the very idea of an expertise at hitting (464a32-b5), second and consequently the view that the repetition of such a gesture might increase the probability to make a successful hit (463b18-22) and, finally and more generally, the probabilistic model of such an art.[110] The

Aristotle uses the adjective εὔστοχος (464a 33), a term that corresponds to the quality put forward by Auriol to explain good fortune (εὐστοχία) and meaning something like "well-aimed", "making good shots", or "guessing well". See n. 92.

[109] Aristotle (1978), I, ch. 5, 1362a5-12, Anonymous version, edited by B. Schneider, *Aristoteles Latinus XXXI 1-2 Rhetorica Translatio Anonyma sive Vetus et Translatio Guillelmi de Moerbeka* (Leiden: E. J. Brill, 1978), 25,3-8: "Est autem et inrationabilium bonorum causa fortuna, ut puta si alii quidem mali fratres, hic bonus, et si alii non invenerunt thesaurum, hic vero invenit, aut si vicinum contingat sagitta, hunc vero non, aut si non venit solus, semper iens, hii vero venientes destructi sunt; omnia enim huiusmodi eutichimiates esse videntur" and Moerbeke's version, 178,29-179,5: "Est autem et eorum que extra rationem bonorum causa fortuna, ut puta si alii fratres turpes, unus autem pulcer, et si alii nesciverunt thesaurum, hic autem invenit, aut si propinquum tetigit sagitta, hunc autem non, aut si non venit solus, semper pertransiens, alii autem semel venientes interempti sunt; omnia enim talia eufortunia videntur esse." The Greek term translated by Moerbeke by the Latin "*eufortunium*" is εὐτύχημα. This term was rendered in the same way in *LdBF* 1207a34 and 1207a35, whereas in 1247a9 Moerbeke rendered the genitive by another phrase: τῶν εὐτυχημάτων -> eorum que bone fortune. As for the term εὐτύχεια in 1247b15, Moerbeke rendered it as "eufortunatio".

[110] The passage was not unknown in the Arts Faculty, since it is discussed by Radulphus Brito in the 1290s, when he was Paris master. See Radulphus Brito, *Questions on Memory and Dreams*, q. II.6 ("Utrum somnia per quae contingit divinare immitantur a deo"), edited by S. Ebbesen, "Radulphus Brito on Memory and Dreams. An Edition", *Cahiers de l'Institut du Moyen-Âge grec et latin* 85 (2016): 74-75: "Sed illa non fuit intentio Philosophi. Ideo secundum intentionem Philosophi breviter est dicendum de illis somniis quae habent originem a nobis quod illa non sunt a deo, nec de istis est quaestio, sed de illis quae habent originem ab extrinseco. Et dico quod talia somnia non sunt immediate a deo, ut somnia sunt sive cognitio futurorum per talia somnia, sed sunt illa somnia secundum modum quem ponit

only reason that might explain Oresme's (supposed) avoidance of this text in his own description of ballistic arts is a recurrent aspect of Aristotle's presentation of this art in this treatise, that goes against Oresme's view: this is the idea that the ability to make good shots is particularly present in people who have mental diseases, such as melancholic persons. The view that melancholic persons are particularly able to make fortunate choices is actually present in *LdBF* (1248a 38-b03), but in a passage that is clearly distinct from the one comparing fortunate men to dice throwers (1247a21-27) and much less insistent on the advantages of human melancholy. The fact that the treatise *On divination by Dreams* insists on these advantages and links them directly to the art of making good shots was clearly contrary to Oresme's endeavor to rationalize good fortune and to neutralize Aristotle's definition of fortune as "nature without reason" (*sine ratione natura*) that carries an individual towards good things "without reasoning" and in being unable to explain his behavior (1207a35-37). This remains speculation untill we have evidence of Oresme's knowledge of Aristotle's treatise *On divination by Dreams.*

A last aspect of Oresme's discussion of throwing physical objects might strike the modern reader, which concerns the use of the Latin term "*impetus*". Indeed, at the beginning of the presentation of Oresme's *De Conf.* II, 37, I have highlighted the absence of any mention of the concept of *impetus* in this text.[111] But this concept of late Neoplatonic origin was present in Oresme's *Problem 31*, in the passage where Oresme describes in all its complexity the kind of calculation that a man must do to measure correctly all the factors implied in the throwing of any kind of object.[112] In this passage, "*impetus*" is used interchangeably with the more common term "*motus*" ("*impetum seu motum*"). It must be noted that the term "*impetus*" was already present in Boethius in his *Consolation* to mean "the impetus of the wheel [of Fortune]."[113] The same term was used again by Moerbeke to render, in the chapters forming *LdBF*, the many occurrences of the substantive ὁρμή and of the verb

Philosophus in Littera, dicit enim quod sicut est in motu proiectorum, ita est in immissione illorum somniorum a corporibus caelestibus; modo sic est in motu proiectorum quod, primo et principali proiciente cesante, aer vel aqua in qua fit proiectio recipit virtutem impellendi illud proiectum a primo proiciente et impellit ipsum proiectum usque ad aliam partem aeris, et illa usque ad aliam, et sic consequenter quamdiu virtus primi impellentis durat, sicut etiam virtus corporis caelestis per vehiculum sui in quo[d] est motus et lumen impellit sive movet corpus contiguum sibi, et illud aliud, et sic consequenter usque ad aerem contiguum corpori dormienti, et iste aer sibi contiguus intrat organum phantasiae, et illa phantasia sic mota virtute corporis caelestis format phantasma simile illi effectui cuius causa est motus corporis caelestis, et istud phantasma mittitur ad sensum communem, et tunc homo incipit somniare, et sic fiunt somnia de futuris."

[111] See here above note 25.

[112] See Nicole Oresme, *Problemata*, q. 31 (to be published): "Quandoque autem ista facit recte, quandoque deficit ita quod non recte mensurat omnia, scilicet spatium, pondus lapidis quem proicit, fortitudinem bracchii et impetum seu motum quem facit nec etiam dispositionem manus in dimittendo lapidem (...)" quoted above note 73.

[113] See Boethius, *De Consolatione Philosophiae*, Livre II, 88: "Tu vero volventis rotae impetum retinere conaris?" quoted above note 39.

ὁρμάω.[114] In the treatise, the term "*impetus*" was almost systematically linked to one of the two main concepts of fortune distinguished there by Aristotle, the first being "divine, continuous, and following a directive impetus", while the second is neither divine, nor continuous, and "beyond the impetus".[115] The term reoccurs many times in Giles' analysis with similar meaning and function.[116] Oresme was perfectly aware of the content of the term from his very first contact with *LdBF*. For in commenting on Aristotle's *Physics II* on fortune, he precisely distinguishes between two meanings of "fortune", the first being fortune as dealt with principally in *Physics II* and as a *per accidens* cause, and the second being a certain disposition condition of the soul by which it is inclined to good or bad events, which happen by a convergence of unforeseen causes, before adding that "In *LdBF* Aristotle calls it an impetus."[117] In this section of Oresme's *Questions on Aristotle's Physics*, the term "*impetus*" is synonymous with "*inclinatio*" and, in this sense, Oresme also uses it to claim that the so-called "healthy people" are actually those who "have a natural impetus towards health."[118] In all these passages the term "*impetus*" has not the specifically ballistic meaning it had in Philoponus to mean the property of a body that keeps moving even when separated from its mover. It rather has a very general meaning, close to that of the terms "*motus*" and / or "*inclinatio*" – with no direct relation to the content of *Physics VII* and *VIII.* This particular use of the term "*impetus*" strongly suggests the importance of studying the history of the Peripatetic physics in considering *all kind of works* of the Latin Aristotelian corpus, including the works that are supposed to concern moral philosophy.

V. Conclusion

In the history of Ancient philosophical or scientific texts, it frequently happens that obscure documents become much clearer when read in parallel with other texts dealing

[114] Indeed, ὁρμάω was rendered by "impetum facere" in 1207a38, 1247b20 and 1248a30 and ὁρμή was rendered by "impetus" in 1207a36, 1207b4, 1207b8, 1207b14,1247b18, 1247b34, 1248b5, 1248b5.

[115] See Aristotle (2016: 1248b4-7): "Iste autem est qui secundum impetum directivus, alius autem qui preter impetum; sine ratione autem ambo. Et hec quidem continua bona fortuna magis, hec autem non continua." And Aristotle (2016: 1247b15-18), quoted here above in note 38.

[116] See Aegidius Romanus, *Sententia LdBF*, 1247a22-23, 150,207-210: "Simile est itaque de casu taxillorum et de fortuna, quia sicut ex fortuna est quod illa ibi concurrant et ueniat optatus punctus, sic ex fortuna est quod omnia hec concurrant ut quod habemus impetus et quod eos percipiamus et agamus secundum eos, secundum quos agendo consequamur bona", quoted above note 62.

[117] Nicole Oresme, *Questiones super Physicam* II, 14 (197a 25-29), 269,33-39: "Quantum ad primum, notandum quod fortuna uno modo accipitur pro ipsa anima agente que dicitur fortuna respectu effectui inopinati, et ita accipitur principaliter secundo huius cum dicitur quod est causa per accidens. Alio modo pro quadam dispositione seu conditione ipsius, per quam ipsa declinatur ad eventus bonos seu malos et contingentes ex concursu causarum inopinatarum. In *De bona fortuna* Aristoteles vocat eam impetum." See here below Appendix II, I.1.i and ii.

[118] Nicole Oresme, *Questiones super Physicam* II, 14 (197a 25-29), 273,146-148: "Secundo aliqua est bona fortuna corporis, sicut circa sanitatem et pulchritudinem, quia alimentamur per causam fortunatam; et aliqui habent impetum naturalem ad sanitatem qui dicuntur sanativi." See here below Appendix II, III.3.ii.

with similar or related topics. In this essay, I have used selected scholastic sources to make some key assumptions implied in Oresme's *De Conf.* II, 37 clearer and to shed light, by this means, on the content of this chapter. These scholastic sources used to reconstruct the background of Oresme's reflection on throwing a javelin were all linked to the Peripatetic tradition, but in diverse degrees and different respects. First, in presenting the argumentative map of this chapter, I have claimed that a passage from Aristotle's *De anima* is an important piece in the background of this chapter by Oresme. Second, to shed light on the last sections of *De Conf.* II, 37, I have shown the importance of a question discussed by Oresme in commenting on Aristotle's *Physics* in a passage where the author, as a young Parisian bachelor student of arts, found the occasion to write a short commentary on the *LdBF* (*Questiones super Physicam* II, 14, related to Aristotle's *Physics* 197a25-29). Third, I have highlighted the role of a singular chapter from Aquinas' work where this theologian discussed good fortune and even more particularly the concept of "good naturality" attached to Aristotle's notion of good fortune (*Summa contra Gentiles* III, 92). Fourth and more importantly, I have brought to the fore a passage from Giles of Rome's commentary on the same opuscule (*Sententia de bona fortuna* II, 1247a22-23) which contains some elements that appear to have been decisive for Oresme. In what follows, I summarize the results of the reading of Oresme's *De Conf.* II, 37 that were made in the light of these documents.

The importance of the passage from *De Anima* 403a29-b1, which was neglected until now, is decisive but in a rather broad way: Aristotle's description of anger as implying a strong motion of the blood in this text is an important piece in the background of Oresme's view on the psychosomatic aspect of human imagination in general. The importance of Oresme's reading of Aristotle's *Physics* 197a25-29, which was still recognized by Philippe Debroise in his doctoral thesis on Oresme's *De Configurationibus*, is more precise. Following Debroise's suggestion, I have shown here that Oresme's commentary on this passage contains (i) a first development of the paradoxical model of human success that is put forward in *LdBF*, (ii) a reading of this model in which this concept of fortune is given a maximal extension as far as it is said to concern all men in almost all their actions or enterprises, (iii) a claim according to which fortune has to do with the power of imagination and that this power might explain human success not only at a psychic and / or social level, but also at a merely bodily level (physical strength, etc.). Point (iii) helps us to see, in turn, the main relevance of Aquinas' reading of the *LdBF* in his *Summa contra Gentiles* III, 92: in this text where Aquinas discussed Aristotle's description of the "well-fortuned man" for the first time, Oresme found the idea that some people, as a result of the action of celestial influence on their bodies, have a certain special efficiency in doing some bodily actions which other men do not possess. But while Aquinas gave the examples of the ability of a medical doctor in regard to healing, of a farmer in regard to planting, and of a soldier in regard to fighting, these were replaced by the author of *De Conf.* II, 37 by the unique example of the thrower of a javelin. And this example was then interpreted following Giles of Rome – which leads us to the third source to be discussed.

In addition to the texts by Oresme and by Aquinas just mentioned, I have highlighted a further element of the background of Oresme's *De Conf.* II, 37, which is Giles' discussion of

Aristotle's allusion to the throwing of dice in the *LdBF*. In this text, which was crucial for the reception of the opuscule in the Latin West and that was seemingly already known by the young Oresme when he commented on Aristotle's *Physics*, this author found (i) the claim that the specific concept of fortune explained in *LdBF* might be compared in a systematical way to the movement of a projectile (a die) thrown by some hand, (ii) the idea that such a comparison might be used as an analogy to isolate all the factors that make a given action result in a given effect (be it "successful" or not), (iii) the view that each factor actually has a definite and, hence, a predictable effect, although the convergence of all factors might remain unpredictable. While Giles had given no precision concerning the cause and the very limits of this unpredictability (is the convergence unpredictable *as such* or only *for our limited minds*?), Oresme seems to have clearly opted for the second interpretation: the result of any action in this lowly world is fully predictable as such, and the reason why some events remain nevertheless unpredictable to us is only that some of the factors implied vary in a way that remains *imperceptible* or *hidden*. As a matter of fact, the idea of imperceptible changes occurring in the process of the projectile's throw was itself suggested by Giles' presentation of the throwing of dice by some players, but without being commented on by this author in detail to explain good fortune. Oresme combines this description by Giles with the famous notion of "hidden quality" that he had also found in the 13th century and, above all, in Aquinas' account of the bodily forces in his *Summa contra Gentiles* III,92. But here again, Oresme has reworked an existing concept to give him a larger extension and a stronger explanatory power: while Aquinas had mentioned such qualities just in passing, Oresme considers that they are present in all kinds of physical processes, as was suggested by Giles' description of the falling of dice. Because Oresme admits that psychical powers must be treated as physical forces, such hidden qualities are necessarily present in all processes involving imagination.

Oresme's reading of the process of throwing objects is much more radical than Giles' reading, in that it does not entail any kind of contingency: Giles' dice have been replaced by the javelin, and the supposed "luck" encountered by the dice players has been replaced by the ability of the thrower of a javelin, which is clearly described by Oresme as a technical skill. As such, this skill might be trained – as every physical ability. Oresme's description of this ability includes imagination to construe it as a process that is highly complex as far as it is multifactorial and, at the same time purely deterministic and, in that respect, predictable. While it was important for Giles to maintain the idea present in *LdBF* that the object thrown is a die – as an example of the contingent side of fortune –, for Oresme, it comes to the same thing as a stone or any other object that might be thrown. While Giles' reading of *LdBF* reflects his endeavor to save a kind of contingency in the Aristotelian world, Oresme's reading corresponds to a radically other worldview, according to which so-called fortune is just a multifactorial process of which we ignore all the causes and their ponderation. According to this view, Oresme replaces the example of the dice found in Giles by that of the javelin and, in the *Problemata*, he even assimilates the throwing of dice to the throwing of other kinds of projectiles such as a stone or a coin. It might be worth situating this result against Oresme's position towards another kind of determinism, which is astral determinism. It is generally assumed that this author refuses

astral determinism; but his analysis of chance and fortune seems to lead to a version of physical determinism. The question of whether human free will can be preserved in such a view must be left open here, but it seems to be clear, in any case, that our freedom of choice must lie, in such a view, in our ability to make rational choices – as opposed to the mere physical actions implied in the training of our skills, and to the irrational acts influenced by the stars (see *Questiones super Physicam* II, 14, II.3.1.b.).

On the basis of the preceding pages, Oresme's *De Conf.* II, 37 appears to be, on one side, much more Aristotelian than it might seem at first sight and, on the other, much indebted to the previous scholastic tradition. It is more Aristotelian than expected because it might be considered a free extrapolation of some sources that have been neglected until now: not only Aristotle's texts on human passions and his description of anger in *De Anima* 403a29-b1, but also his texts on fortune and chance in *Physics* II and, more importantly, in *Magna Moralia* 1206b30-1207b19 and *Eudemian Ethics* 1246b37-1248b11. It is much indebted to the previous scholastic tradition because Oresme's description of the motion of the javelin is a transposition of Giles' analysis of the dice throwing in his *Sententia de bona fortuna*, that also integrates some elements of Aquinas' presentation of physical powers in his chapter on good fortune (*SCG* III,92). It is remarkable that these scholastic sources are theological in nature: these are texts written by theologians on theological subjects. At the same time, *De Conf.* II, 37 does not refer to any kind of divine cause in the process described: in this text, Oresme maintains the principles advocated in commenting on Aristotle's *Physics*, an option that implies a clear separation between revealed theology and philosophy, but also inside philosophy an explicit refusal to imply God as an explanatory factor of physical processes. In short: no element from Giles or Aquinas is taken by Oresme in a passive or neutral way, without being reworked and made fully consistent with the author's basic assumptions. From Giles' *Sententia* Oresme reuses principally the discussion of the example of the throwing of dice, that he transforms into a throw of javelin or of projectiles more generally. From Aquinas, he exploits the idea of some technical skills that are naturally more present in some individuals than in others, and that might nevertheless be trained.

I hope that the present study has made clear how crucial the example of the javelin thrower is to Oresme's account of fortune and of human abilities more generally. In *De Conf.* II, 37 the discussion of this example is the occasion for the author to draw important conclusions from the views of fortune that he had already expressed in commenting on Aristotle's *Physics* 197a25-29, and to make the role of human imagination in this process much more precise. Oresme's understanding of Aristotle's doctrine of good fortune in *LdBF*, when considered in the long-term reception of this opuscule in the Peripatetic tradition, appears to be particularly encompassing and radical. This understanding is encompassing as far as it is systematically connected to the doctrine of *Physics* II. On the basis of this connection, Oresme applies some conclusions reached in *LdBF* for fortune to the more general concept of "chance" (or "the spontaneous" αὐτόματον): these categories apply to all kinds of goods and the so-called "bad fortune" and "bad chance" are just diminished fortune and chance. This understanding is radical because, in so

doing, Oresme reuses and exploits the ideas of his scholastic predecessors in a way that is far from conciliatory, but that is highly selective. In combining views on fortune taken from the Latin Aristotle (in particular from *LdBF*) with elements taken from Giles and Aquinas, Oresme develops a new conception of contingency, a conception that is at the same time naturalistic and mechanistic: although the roots of a naturalistic account of fortune were already present in Aristotle and even developed by some previous Latin thinkers (such as, e.g. Peter Auriol), the mechanization of the process offered by Oresme seems to be much more original. In the present state of research, it appears to be deeply innovative. As for Oresme's reading of Aristotle's doctrine of contingency (understood as 'chance' *and* 'fortune'), it strikes by its constant strive for consistency.

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APPENDIX I

Argumentative map of Oresme's *De Conf.* II, 37

p. 376,3-378,16: general views on the powers of imagination
p. 378,17-378,29: interpretation by means of the concept of configuration and fortune
p. 378,30-378,41: application to the javelin throw and to good / bad fortune generally
p. 378,42-380,63: application to the acts of predicting future events

APPENDIX II

Argumentative map of Oresme's *Questiones super Physicam* II, 14

0. Arguments *quod non* and *Quod Sic*
1. There is no such distinction for chance, hence it is not justified for fortune
2. Every kind of fortune is bad as its effects are not intended
3. Every kind of fortune is good as far as *LdBF* defines it as a nature
4. There is no fortune that is good in any sense of this term
5. The division is insufficient as it ignores the fortuitous events that are indifferent
6. Unique argument *quod sic*: the authorities in *Physics* and in *LdBF*

I. On good fortune in general

1. Three notes on fortune and subsequently on chance

i. One must distinguish between fortune meaning the soul itself and fortune meaning the soul's inclination to good or bad fortune

ii. In *LdBF*, it is in reference to the second meaning of fortune that Aristotle defines it as "nature without reason"

iii. A similar distinction as that between two meanings of fortune can be applied to chance, but in this case, the inclination is a hidden quality

2. Conclusions and corollaries

i. First conclusion: bad fortune is a mere privation of good fortune

ii. All men are well-fortuned to greater or lesser degrees, and "ill-fortuned" just means "less fortuned" (*cf.* V.3)

iii. If ii were not true, human individuals would often die very early on account of the numerous dangers that they encounter

iv. Second conclusion: the distinction between good and bad fortune is justified provided one understands "bad fortune" as meaning diminished good fortune

II. On the causes of fortune

1. In *LdBF*, Aristotle makes a distinction between divine and natural good fortune

2. The two kinds of good fortune distinguished in II.1 have many differences, which are:

i. Divine fortune comes from God immediately, whereas natural fortune comes from God mediately and from nature immediately

ii. Divine fortune is only present in "good" men, who receive special care from God, whereas natural fortune is present in good and bad men

iii. Divine fortune is much more stable than natural fortune and it corresponds to what the theologians call "God's grace"

iv. Divine fortune, that is equal to "God's grace" (*cf.* II.iii) must be left aside in what follows

3. Conclusions concerning natural fortune

i. First conclusion: natural fortune produces its effects by means of the influence of heaven

a. This conclusion is proved by sign following the doctrine of the authors who make judgements according to constellations

b. From this it follows that our soul is subject to celestial bodies as far as the first non-deliberate movements are concerned

ii. Second conclusion: this kind of fortune is sometimes augmented and diminished by the imagination of the soul

a. This can be the imagination of the fortuned individual

b. This can be the imagination of someone else

c. The power of the imagination is confirmed by the sayings of merchants

III. On the effects of fortune

1. Preliminary distinctions between different kinds of goods (*cf.* IV.1)

2. Conclusion: there is fortune in all kinds of goods

3. Proofs of the conclusion by induction

i. About external goods (wealth, honors, etc.)

ii. About the goods of the human body (health)

iii. About practical arts (military or literary art)

iv. About speculative sciences (or: how to find conclusions)

IV. On the conditions of fortune

1. Fortune is present in almost all human enterprises (*cf.* III.2)

2. Fortune is opposed to deliberation and free will

3. There is a kind of fortune that is continuous, which comes from good birth

4. Different men are fortuned in different kinds of enterprises

5. Bad fortune can often affect good men

6. The fortune's supposed instability is only apparent

V. Response to the arguments

1. The absence of a distinction between good and bad chance does not indicate that the distinction is not justified for fortune: Aristotle does not mention it because it is not as manifest as the distinction between good and bad fortune

2a. It is false to say that every kind of fortune is bad: although its effects are not intended by the particular nature, they are intended by universal nature

2b. Although it is true to say that chance events are always less good than what was intended, this does not hold true for fortuitous events

3. It is true to say that that every kind of fortune is good – but one must add that it is good to greater or lesser degrees (*cf.* I.2.ii)

4. It is false to say that there is no good fortune: the distinction between different goods is not exhaustive

5. It is true to say that the distinction between different goods is not exhaustive (*cf.* V. 4); but one must add that fortune is good to greater or lesser degrees (*cf.* I.2.ii and I.3) and that its situation is judged according to the events.

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THE CONCEPT OF MOTION IN JACQUES LEGRAND'S PHILOSOPHICAL *COMPENDIUM*

EL CONCEPTO DE MOVIMIENTO EN EL *COMPENDIUM* FILOSÓFICO DE JACQUES LEGRAND

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Abstract

The following paper investigates the concept of motion in Jacques Legrand, a hitherto little-studied author of the early fifteenth century. Legrand, an important member of the *Order of Hermits of Saint Augustine*, wrote a philosophical *Compendium* for the students of his Order. This contribution first attempts to provide a contextualization of Legrand's treatment of motion within this work. Legrand's contribution to philosophical encyclopedism is here discussed. Secondly, it reviews the most important theories on the nature of movement in the Middle Ages. Thirdly, it offers a detailed analysis of Legrand's arguments in support of the nominalist view that it is unnecessary (if not wrong) to consider the local motion as a *fluxus* added to the moveable body. The article suggests that Legrand's generalized nominalist position may be connected with certain lines to be followed within his own Order or even with the anti-realist ideology of the conciliarists philosopher, like Pierre D'Ailly and Jean Gerson.

Keywords

Aristotle; Jacques Legrand; Nominalism; Medieval Encyclopedism; Medieval Physics

Resumen

El siguiente artículo investiga el concepto de movimiento en Jacques Legrand, un autor de principios del siglo XV hasta ahora poco estudiado. Legrand, miembro importante de la Orden de los Ermitaños de San Agustín, escribió un compendio filosófico para los estudiantes de su Orden. Esta contribución intenta en primer lugar proporcionar una contextualización del tratamiento del problema del movimiento llevado a cabo por Legrand en su *Compendium*. Aquí se discute la contribución de Legrand al enciclopedismo filosófico. En segundo lugar, se revisan las teorías más importantes sobre la naturaleza del movimiento en la Edad Media. En tercer lugar, se ofrece un

análisis detallado de los argumentos de Legrand en apoyo de la visión nominalista según la cual es innecesario (si no erróneo) considerar el movimiento local como un *fluxus* añadido al cuerpo en movimiento. El artículo sugiere que la posición nominalista generalizada de Legrand puede estar conectada con ciertas líneas a seguir dentro de su propio orden o incluso con la ideología antirrealista de los filósofos conciliaristas, como Pierre D'Ailly y Jean Gerson.

Palabras clave

Aristóteles; Jacques Legrand; nominalismo; enciclopedismo medieval; física medieval

Introduction*

In this paper I shall examine Jacques Legrand's ideas about the concept of motion as presented in a special chapter of his only known text on natural philosophy, the *Compendium utriusque philosophie*.[1] By treating the concept of motion, it is evident that my primary aim will be to contribute to our understanding of the late medieval history of natural philosophy. However, this will only be as a subordinated purpose derived from the very nature of Legrand's *Compendium*, this paper is also intended to enrich our knowledge of the late medieval encyclopedic tradition – a research topic which has a long history and has received new attention in the last decades.[2]

As his name does not stand on the top of the list of the best-known Schoolmen philosophers, a few words about Legrand will be of use for the general contextualization

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[1] This text, to which I shall refer in abbreviated form as "*Compendium,*" has never been printed. It is conveyed in two manuscripts which are independent of each other: **G** = Genova, Biblioteca Berio, C.F.53, fols. 2r-235v; **P** = Paris, Bibiothèque Nationale, lat. 6752, fols. 4r-236r. For further indications about the manuscripts, see Daniel A. Di Liscia, "The Subject Matter of Physics and Metaphysics in Jacques Legrand's *Compendium utriusque philosophie*", *Revista Española de Filosofía Medieval* 24 (2017): 258-259.

[2] For an overview, see Christel Meier, "Grundzüge der mittelalterlichen Enzyklopädik. Zu Inhalten, Formen und Funktionen einer problematischen Gattung", in *Literatur und Laienbildung im Spätmittelalter und in der Reformationszeit. Symposion Wolfenbüttel 1981*, edited by L. Grenzmann and K. Stackmann (Stuttgart: J. B. Metzlersche Verlagsbuchhandlung, 1984), 467-500, and Christel Meier, "Organisation of Knowledge and Encyclopaedic Ordo: Functions and Purposes of a Universal Literary Genre", in *Pre-Modern Encyclopaedic Texts. Proceedings of the Second COMERS Congress, Groningen, 1-4 July 1996*, edited by P. Binkley, Brill's Studies in Intellectual History 79 (Leiden: Brill, 1997), 103-126.

of this paper and its scope. Jacques Legrand (Jacobus Magnus; approx. 1360?-1418?) was a member of the *Order of Hermits of Saint Augustine* – a fact which is significant for the text I am discussing in this paper.[3] Besides, he gained considerable fame at the royal court, especially due to his critical sermons reprehending the dissipated life of the court. As champion of the Armagnacs against the Bourguignons, he was also deeply involved in the political affairs of the French Kingdom.[4]

Although we are allowed to assume that Legrand aspired as a young man to an academic career, basically only two major works by him are extant in this style: A *Commentary on the Sentences*, which is conserved in only one manuscript and remains still unstudied, and the *Compendium* itself, which originally was intended to also include a part on moral philosophy. The rest of Legrand's literary activity, which is no doubt significant in itself and worthy of attention, is yet scarcely relevant for our topic.[5] He was particularly

[3] There is uncertainty about the exact dates of Legrand's birth and, especially, death. According to Roth, for instance, Legrand lived until 1425 (see Francis Roth, "Jacques Legrand (Jacobus Magni) † 1425", *Augustiniana* 7 (1957): 313-326. The entry "Jacques Le Grand" in ARLIMA (https://www.arlima.net/il/jacques_le_grand.html) limits Legrand's life until 1415 and 1418, which seems to be more likely. For an in-depth survey of Legrand's life and writings, see Evencio Beltrán, "Jacques Legrand prédicateur", *Analecta Augustiniana* 30 (1967): 148-209. Evencio Beltrán, "Jacques Legrand O.E.S.A. Sa vie et son oeuvre", *Augustiniana* 24 (1974): 132-160 / 387-414.

[4] Legrand was part of the legation sent in 1408 to negotiate with Pope Benedictus XIII about his resignation at the next council. Object of Legrand's verbal strikes were not only the Queen – Isabeu de Bavière – but even the King himself, Charles VI (called "le Bien-Aimé," but also "le Fou") and his brother, the Duke of Orléans, whose assassination in 1407 brought the already complicated situation to an unprecedented state of instability in both foreign and domestic political affairs. For Legrand's sermons, see the previously mentioned papers by Roth and E. Beltrán and Dora M. Bell, *L'idéal éthique de la royauté en France au Moyen Âge d'après quelques moralistes de ce temps* (Genève and Paris: Droz and Minard, 1962), 83-87. Legrand's sermon from Christmas 1396 before the Queen was published by Evencio Beltrán, "Un sermon français inédit attribuable à Jacques Legrand", *Romania* 93 (1972): 460-478, at 468-78 (Legrand's authorship is not sure but Beltrán considers it "très probable," 466). For the political background see Bertrand Schnerb, *Les Armagnacs et les Bourguinons. La maudite guerre* (Paris: Perrin, 1988).

[5] Two different texts on the *Sentences* can be attributed to Legrand: a *Lectura super Quattuor libros sententiarum* (MS Tarragona, Biblioteca provincial, 103) and a "*Collatio*" or "*Collectio*" *super Sententias*, which – somehow implied by the elusive information given in Beltrán, "Jacques Legrand O.E.S.A", 587, 401-402 – is contained in MS Paris, BnF, Arsenal, 481, ff. 28r-36r (the reference to BnF, Arsenal, 542, ff. 28r-36r in ARLIMA (https://www.arlima.net/il/jacques_le_grand.html, N° 11 is most likely mistaken. This manuscript contains certainly a series or sermons and other works by Legrand, as his Bible commentary and his *Ars memorandi* but, as far as I can see, not a commentary on the *Sentences.* For a general description, see Henry Martin, *Catalogue des Manuscripts de la Bibliothèque de l'Arsenal*, vol. 1 (Paris: Plon, 1885), 402-404). At least in a subordinated way, one could also include into this group Legrand's *Dicta* on Seneca, Boethius and Aristotle contained in the same MS 481 (Beltrán, "Jacques Legrand O.E.S.A", 587-588. ARLIMA adds MS Würzburg, Universitätsbibliothek, M.ch.q.3, f. 116-145). In two of the "moral" works there are sections on logic and mathematics (see next fn.). Especially the part on Aristotle could have played some role for the multiple references to the Aristotelian corpus within the *Compendium*.

celebrated as an author of a number of moral works, the most famous of which are probably his *Sophilogium* (conserved in more than hundred manuscripts), the *Archiloge Sophie*, and the *Livre des bonnes moeurs*.[6]

For the discussion to follow, it is important to note that there is a direct connection between Legrand's *Compendium* and his academic aspirations within his order. The *Augustinian Hermits* promoted, from the very beginning, the study of grammar and logic. Besides, the chapter held in 1338 at Siena required special training in natural philosophy to become a teacher.[7] Legrand's textbook was intended to attest his own expertise in this field, and thus to fulfil the applicable conditions for becoming a professor within his order. Hence, aspiring to an academic career in this context, it is not surprising that Legrand's *Compendium* complied with the general lines of thought promoted at this time by the *Augustinian Hermits*.[8]

Despite his *Compendium*, Legrand's life did not develop in an academic direction. As significant as his engagement in France's politics and in Church affairs might have been, he was surely not a university figure of the same pedigree as Jean Buridan, Nicole Oresme, Albert of Saxony, or Marsilius of Inghen. Neither can he, in this regard, be compared to his contemporaries, Pierre D'Ailly and Jean Gerson, whom he knew very well.

However, his *Compendium* deserves more attention in many respects, since it displays at many places a deep knowledge of the matter and includes – as far as we can assess according to the current state of research – many original thoughts. As we will see, Legrand's treatment of motion is argumentative, skillful and sophisticated. Furthermore, the *Compendium* represents a suitable tool to evaluate the development of the physical

[6] For a general list of works and manuscripts, see the mentioned entry "Jacques Le Grand" in ARLIMA (https://www.arlima.net/il/jacques_le_grand.html). For a critical edition of Legrand's *Archiloge Sophie* and *Livre des bonnes moeurs*, see Jacques Legrand, *Archiloge Sophie et Livre des bonnes mœurs* (Bibliothèque du XV^{e} siècle 49), edited by E. Beltrán (Paris: Champion, 1986). The first work includes sections on logic (68-82) and on arithmetic, including algorithm and practical computation (227-261). The short-cut characterisation of the above-mentioned works by Legrand as "moral" is – strictly taken – insufficient, as they include many questions on theology, grammar, poetry, and literature in general. But this is not the topic of the present contribution. Some aspects concerning literature and rhetoric are examined by Elsa Marguin-Hamon, "Jacques Legrand: deux langues, deux espaces, un projet double", in *L'expérience des frontières et les littératures de l'Europe médiévale* (Colloques, congrès et conférences sur le Moyen Âge 26), edited by S. Lodén and V. Obry (Paris: Champion, 2019), 271-292 and Amandine Mussou, "'Declairier aucunes choses que la rime contient': lumières de la prose, étincelles du vers chez Évrart de Conty et Jacques Legrand", in *Sens, rhétorique et musique. Études réunies en hommage à Jacqueline Cerquiglini-Toulet*, vol. 1 (Colloques, congrès et conférences sur le Moyen Âge, 21), edited by S. Albert, M. Demaules, E. Doudet, S. Lefèvre, Ch. Lucken and A. Sultan (Paris: Champion, 2015), 459-472.

[7] For a general presentation of the education within the Augustinian Hermits, see Eelcko Ypma, *La formation des professeurs chez les ermites de Saint-Augustin de 1256 à 1354. Un nouvel ordre à ses débuts théologiques* (Paris: Centre d'Études des Augustins, 1965).

[8] According to Beltrán (Beltrán, "Jacques Legrand O.E.S.A.", 140), this was the immediate background and motivation for Legrand's writing of his *Compendium*.

theories once the "classical century of natural philosophy" came to an end, a time populated by authors many of whom have been under scrutiny by various scholars since Duhem attributed to them a decisive role in the emergence of modern scientific thought.[9]

My focus being the understanding of Legrand's ideas on the concept of motion in an adequate context, I will first describe the immediate textual environment within which Legrand's discussion of local motion takes place. I think it important to take into consideration how Legrand divided the subject matter to be treated in his *Compendium*. Second, I will provide the reader with some basic historical and conceptual background needed for a better understanding of Legrand's ideas. This section contains an abridged presentation of the *forma fluens* and *fluxus formae* theories of motion that preceded Legrand. Third, I will revise Legrand's discussion following closely the statements of the *Compendium* one by one and trying to reconstruct the main lines of argumentation.[10] I will conclude my contribution with some remarks about the possible consequences of this tradition of thought in natural philosophy, which might be more significant than up to now assessed, even if Legrand's text itself seems to have experienced only a limited spread.

1. The study of motion in Legrand's *Compendium*

Legrand's *Compendium* forms part of a long tradition of textbooks on "philosophical encyclopedism" in which the focus was put on a presentation of the matters conveyed in the Aristotelian corpus. Yet, Legrand does not "comment" closely on the Aristotelian text itself; he rather carries out his own selection of the topics, also explaining the opinion of other authors which he seldom mentions by name (*aliqui*) and, of course, his own views.[11]

His text, he emphasizes, deals with natural philosophy, but this does not have to mean that metaphysics is left out of the program. On the contrary, both disciplines can

[9] After having abundantly scrutinized the concept of motion in one of her *Studien*, Anneliese Maier concludes: "Das Jahrhundert, das um 1277 mit dem Physikkommentar des Aegidius Romanus beginnt und 1377 mit dem *Traité du ciel et du monde* des Nicolaus von Oresme endet, ist eben noch kein erstes, klassisches Jahrhundert der Physik', aber es ist ohne Zweifel ein klassisches Jahrhundert der Naturphilosophie," Anneliese Maier, *Zwischen Philosophie und Mechanik*, Studien zur Naturphilosophie der Spätscholastik V (Roma: Edizioni di storia e letteratura, 1958), 382.

[10] In this paper I will give the passages of Legrand's *Compendium* from my still unpublished critical edition. Occasionally, I shall add some single remarks when the difference between both manuscripts is relevant for the content of this paper.

[11] Legrand's *Compendium* seems to satisfy thoroughly the three conditions uttered by Ventura to describe a "philosophical encyclopedia"; see Iolanda 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 Age. Actes du colloque de Louvain-la-Neuve, 19-21 mai 2005* (Réminiscences 9), edited by G. de Callataÿ and B. Van den Abeele (Louvain-la-Neuve: Centre de recherche en histoire des sciences, 2008), 199-245, at 200-201.

collaborate with each other.[12] Motion – the key notion for the understanding of nature – is a good example of this double and complementary approach from a physical and metaphysical point of view:[13]

Thus, when the natural philosopher considers the questions of whether the local motion is successive, it would also be suitable to investigate what such a motion is and whether it is to be distinguished from the moveable thing. The first consideration belongs to natural philosophy, the second one to metaphysics.

At the beginning of Part IV, in chapter 37, the content of which we are going to discuss in section 3, Legrand makes it clear that local motion is, as Aristotle had already established in his *Physics*, the principal kind of motion, that its name is derived from the very fact that it takes place "in loco" and – this being the decisive point here – that its successivity results from the resistance of a medium. Yet, before we go ahead – he notes –, it is necessary to discuss "whether local motion is some kind of accident which inheres in the moved thing."[14] Thus, we learn from Legrand's foreword that the question he is going to discuss below in his chapter on local motion is, strictly taken, a metaphysical question embedded, of course, within a natural philosophical framework.

Besides, Legrand's arrangement of the different topics he covers in his encyclopedic work is noteworthy. The *Compendium* is made up of six parts, following one of the already established orders of Aristotelian books on natural philosophy.[15] Legrand aims at an all-

[12] "Nam considerationes phisice et metaphisice, cum sint speculative, rationabiliter possunt adunari, quinimmo difficulter possunt ab invicem separari quando precipue aliqua materia debet profundari," Legrand, *Compendium*, **G**, f. 12r; **P**, f. 4r.

[13] "Nam cum philosophus naturalis considerat de motu locali utrum sit successivus, bene etiam congrueret investigare quid sit talis motus et utrum distinguatur a re mobili. Prima tamen consideratio pertinet philosophie naturali et secunda metaphisice," Legrand, *Compendium*, **G**, f. 12r; **P**, f. 4r.

[14] "Inter species mutationis loci mutatio una numeratur, quinimmo motus localis est prior omni motu, ut dicitur 7° *Physicorum*. Et ideo tale nomen accepit, quia fieri habet in loco. Eiusque successio causatur ex resistentia medii vel etiam ex resistentia mobilis vel utriusque, ut dicit Commentator 4° *Physicorum.* Antequam tamen ulterius progrediamur, videre oportet utrum motus localis sit aliquid accidens inherens rei mote," Legrand, *Compendium*, **G** 149v, **P** 144r.

[15] Commentaries or "summaries" of this sort usually start with the *Physics*, it follows *De caelo*, then *De generatione et corruptione*, *Metheora* or *De anima* (here there were some divergent approaches) and the *Parva naturalia*, as far as they are connected to psychology. After this series of genuine Aristotelian texts, the study of more specific matters was planned, assuming to this aim the treatment of the animals, plants and minerals (using respectively *De animalibus*, and *De planctis* and *De mineralibus*). Of course, there are some variations. Paul of Venice, for instance, who was roughly a contemporary of Legrand and also a member of the Augustinian Order, sets forth his *Summa naturalium* with a treatment of the *Metaphysics* after *De anima* (see Paul of Venice, *Summa philosophiae naturalis magistri Pauli Veneti noviter recognita ... restituta* (Venice, 1503; reprint Hildesheim and New York: Georg Olms Verlag, 1974), 92vb-126ra). It seems to be clear that Legrand's *Compendium* follows the mentioned sequences of the *libri naturales*, starting with the first books of the *Physics* and the principles of nature and going through other books to more specific and concrete objects belonging

embracing presentation of natural philosophy which should be useful for students. The intent to offer a "modern" approach to a particular discipline trying not to simplify things too much and giving some place also to contemporary topics and theories is an old challenge. Legrand meets this particular task by arranging the complete part IV of his *Compendium* around the general concept of "mutation" or "transmutation." Thus, he starts with the notion of transmutation in general (chapters 1-3).[16] After a short discussion of the concept of nature (chapter 4), he goes over to a set of problems all related to the "motion according to the substance" (chapters 5-11). He incorporates, here, some of the questions usually treated in the commentaries on *De generatione et corruptione*. Next, he provides a quite detailed analysis of the usual field of *maxima et minima* as integrated into the commentary tradition (chapters 12-17). Then, he starts the study of the "motion according to the quality" (chapter 7) which represents the background for the discussion of the qualitative changes between contraries (chapters 18-23) and the intensification and remission of forms (chapters 24-26).[17] In the following chapters (27-32) he deals with the "motion according to the quantity" (chapter 27) and further problems related to the notion of quantity itself, as for instance on the continuity of matter (chapters 28-29) and the concept of infinity (chapters 33-36). Finally, he treats the "motion according to the place" (ch. 37, discussed in this contribution), which he follows with two chapters on the concept of place (chapters 38-40), two about the void (chapters 41-42), and two on the concept of time and duration (chapters 43-44). Part IV is concluded with a very short final chapter of action and passion. To sum up: It seems evident to me that Legrand has taken, above all, the main subject matter of *Physics* V, which is the classification of changes, as a guiding criterion to order the materials in part IV of his own *Compendium*. By resorting to these four types of *transmutatio*, "according to the substance," "according to the quality," "according to the quantity," and "according to the place," he was able to condense thematically the content of the books III, IV, and V of the

to alchemy, botany and mineralogy in the last books. A still useful general overview – with the title of the chapters according to the Paris manuscript – can be found in Thorndike, who was the first to draw attention to this text, see Lynn Thorndike, "An Anonymous Treatise in Six Books on Metaphysics and Natural Philosophy", *The Philosophical Revie*w 40 (1931): 317-340 and Lynn Thorndike, *A History of Magic and Experimental Science*, 8 vols. (New York: Columbia University Press, 1923-1958), here vol. 3 (1934), 569-584 and 761-66.

[16] For an edition of chapters IV, 1-2, see Daniel A. Di Liscia, "Transmutación y movimiento según el tiempo en Jacques Legrand (*Compedium utriusque philosophie* IV, 1-2)", in *Per philosophica documenta. Estudios en honor de Francisco Bertelloni*, edited by C. J. Fernández and M. Pérez Carrasco (Buenos Aires: Editorial de la Facultad de Filosofía y Letras, 2021), 151-175, at 163-173.

[17] By the way, examining in chapter 26 the special question (dubium) regarding how to distinguish "actus" from "habitus," Legrand anticipates the theory he is going to support later in chapter 37: "Sic enim dicere solemus quod motus localis non distinguitur a re mobili sed est quedam applicatio mobilis ad spatium..." Legrand, *Compendium*, **G** 136v; **P** 130r.

Physics integrating the subjects of the Aristotelian texts he considered unavoidable for students into a general but at the same time critical presentation.[18]

2. Late medieval theories on the nature of motion

Legrand's reflections on local motion are aimed to clarify the notion of motion itself and its metaphysical implications. There was a long chain of discussion descending from Aristotle's admission into university teaching until the beginning of the fifteenth century. For, the essence of motion, of this at its core unstable entity, was for medieval philosophers an obscure question to be examined over and over again. Contrary to a modern approach to physics, such an inquiry was thought to be immediately linked with the logical task of "defining" motion and, consequently, of determining the category to which the *definiendum* belongs.

A curt and careless answer to this problem resorting to authorities was, in this case, hardly possible, since Aristotle himself had backed contradictory positions in different texts and, despite many attempts at clarification, misunderstandings between the Schoolmen themselves were not unusual.[19] When defining "motion" in *Physics*, Aristotle

[18] It is to be noted that this traditional classification of (trans)mutations is for Legrand not at all exhaustive. According to him, we are allowed to speak also of a motion according to time. The issue is not directly connected to the problem of the nature of motion we are dealing with here, but rather to its measurement. However, as time is also a *successivum* and an essential element of every motion, it will be judicious at least to explain it briefly now. Legrand is of the opinion that actually Aristotle has himself omitted this kind of transmutation. The central argument is based on the principle according to which it is impossible to pass from one contradictory to another contradictory without mutation (a principle also mentioned in the discussion about the nature of motion). So, let us suppose that a thing would be subjected to none of the before-mentioned transformations, i.e., no substantial, qualitative, quantitative, or local change would be at work. In this case, the thing could keep on existing for one day or one hour; its duration would be different even if all the rest of it remained unchanged. Thus, the sentence "Socrates is 20 years old" and the sentence – after a certain time – "Socrates is not exactly 20 years old" (since he got older...) are mutually contradictory. A change must have taken place, which is none of those, until now known. So, there has to be an additional kind of "motion according to time." Legrand even declares that we do not need any special act of God to affirm this; we can assume this motion according to time *physice loquendo*. For a more detailed discussion of this aspect and the corresponding text see Di Liscia, "Transmutación y movimiento según el tiempo", 151-175. Some chapters below, discussing time and duration, Legrand reminds the reader: "Sicut ab exordio libri huius dicebatur inter motus naturales reperitur motus qui fit ad tempus quem non memoravit Aristoteles qui nomine communi dici potest duratio seu antiquatio," Legrand, *Compendium*, **G** 158v; **P** 154r.

[19] In this section I will restrict myself to the main theories which are relevant for the understanding of Legrand's *Compendium*. For a general account of the different positions in the Middle Ages on the nature of motion, the work done by Anneliese Maier is still the most excellent help. See above all, Anneliese Maier, *Die Vorläufer Galileis im 14. Jahrhundert*, Studien zur Naturphilosophie der Spätscholastik 1, 2nd ed. (Rome: Edizioni di storia e letteratura, 1966), 9-25, and Anneliese Maier, *Zwischen Philosophie und Mechanik*, 61-143. As a help for the reader, I have added

emphasized that there is nothing common to the changes according to the substance, to the quality, to the quantity, and to the place, so it does not make any sense to think of motion as something constituting a category in itself.[20] On the contrary, in the *Categories* – in a much more obscure passage – Aristotle stated that movement would be a special kind of affection, or as it is often said in the commentary tradition from the fourteenth century onward, a *passio* in itself.[21]

Including references to Averroes and Avicenna, Albert the Great formulated the problem in terms which later generations assumed as a basis for further discussion. Averroes had labelled Aristotle's explanation in the *Categories* as *famosior* and the opinion held in the *Physics* as *verior*. He described the problem contraposing the *via* toward the *terminus* to be reached in the process of motion with the *terminus* or *perfectio* itself. For Averroes, according to the *verior* theory, there is no fundamental ontological difference between the process of change and the *perfectio* acquired through it. The existing difference is not but a mere distinction of "more or less" (*magis et minus*). Yet, this "more or less" does not justify the introduction of an independent category for motion, since *de*

some bibliographical references about the main authors mentioned in this section. The discussion on the different approaches as well as further details are beyond the scope of this paper.

[20] "There is no such thing as motion over and above the things. It is always with respect to substance or to quantity or to quality or to place that what changes, changes. But it is impossible, as we assert, to find anything common to these which [201a1] is neither 'this' nor quantity nor quality nor any of the other predicates. Hence neither will motion nor change have reference to something over and above the things mentioned; for there is nothing over and above them," Aristotle, *Physics*, III.1 200b32-201a10, in *The Complete Works of Aristotle. The Revised Oxford Translation,* 2 vols., edited by J. Barnes (Princeton: Princeton University Press, 1984); translated by R. P. Hardie and R. K. Gaye, vol. 1, 1-16, at 36 (Bollingen Series LXXI.2).

[21] The statement of the problem in terms of "categories" into which motion is to be placed may be typical for medieval philosophy, but as a matter of fact, it hardly fits the way Aristotle had explored the problem. As Cecilia Trifogli warns "Aristotle himself never poses this question in such terms. He does claim that motion or change is always in respect of categorical properties. He also argues that change, strictly speaking, is not in respect of just any categorical properties, but only in respect of properties belonging to four categories: substance, quality, quantity and ubi," Cecilia Trifogli, "Thomas Wylton on Motion", *Archiv für Geschichte der Philosophie* 77, 2, (1995): 135-154, at 137-138. While, however, the *Physics* text is clearer regarding the categorisation problem, the corresponding passage in the *Categories* is very short and by no means unproblematic: "Doing and being-affected admit of contrariety and of a more and a less. For heating is contrary to cooling, and being heated to being cooled, and being pleased to being pained; so they admit of contrariety. And of a more and a less also. [5] For it is possible to heat more and less, and to be heated more and less, and to be pained more and less; hence doing and being-affected admit of a more and a less," Aristotle, *Physics*, translated by J. L. Ackrill, vol. 1, 2-27, at 18 (Bollingen Series LXXI.2). The main idea seems to be that the qualitative motions of "being heated" and "being cooled" are exemplary cases belonging to the category of "passio." From here, one could assume as a generalization that all motions are passions. Besides these two main Aristotelian sources, a passage in *Metaphysics* V.6 (1016a5-7), where Aristotle considers motion as a continuous quantity, was occasionally brought into discussion. This idea seems to have found supporters in William of Alnwick and Walter Burley (see below fn. 25).

genere motion belongs to the same category within which it occurs. As Anneliese Maier has pointed out, it was this very distinction as applied to the process of intensification and remission of qualities, that Avicenna found particularly untenable. For him – using Maier's words – "motion is not the form in the process of changing, but the change of the form itself, its *fluxus*."[22] In his commentary on *Physics*, Albert reformulated the problem.[23] According to him, the theory sustained by Aristotle in his *Physics*, called "verior" by Averroes and accepted by Albert himself, conceives the process of motion like a "*forma fluens*" which is essentially identifiable with its *terminus*. For this theory, the *negritudo* in doing, or on the way to its term, is nothing other than the *negritudo* itself, it is nothing different from it *in essentia*, but only *in esse*. According to the second theory, advanced also by Aristotle in his *Categories* and defended by Avicenna, "motion" means an independent "*fluxus formae*," a particular "*passio*" or a special category inhering in the moveable thing. This theory affirms a fundamental diversity *in essentia* between the motion *ad negritudinem* and the term of the motion, the *negritudo* itself, which belongs to the category of the quality. The same conceptualization transposed to local motion, would result in the fact that the process of moving in space from one point to another would be present in the *mobile* itself as special kind of quality.

William of Ockham's turnaround in natural philosophy has a determining effect for the following generations; as so it was for the discussion around the theories on the nature of motion and, consequently, also for Legrand. Ockham concentrated much of his efforts on a logical-semantical approach to the problem. He emphasized the negative consequences that a careless use of language could have in philosophical controversies, especially regarding the kind of entities which were understood as "successive," first in line, of course, time and motion. In Ockham's minimal ontology, there is no place for such things; only permanent entities like substances and their qualities are accepted. A more accurate analysis of the language would show that an unnecessary multiplicity of entities

[22] "Und allgemeiner: nicht die sich verändernde Form ist die Bewegung, sondern die Veränderung der Form, ihr *fluxus*," Maier, *Zwischen Philosophie und Mechanik*, 73. This work contains also the essential passages for the understanding of Avicenna's and Averroes's account of motion (62-73). The essential passage of Averroes in his *Physics* Commentary is: Averroes Cordubensis, *Aristotelis de Physico Auditu* (*Aristotelis Opera cum Averrois Commentariis* 8) (Venice, 1562; repr. Frankfurt, 1962), 3.4, ff. 87ra C-rb E.

[23] *Alberti Magni Opera Omnia*, Physica, Pars I, Libri 1-4, edited by P. Hossfeld (Münster: Aschendorff, 1987), lib. III, tract. 1, ch. 3: *An in predicamentis sit motus et qualiter sit in illis* (149-156). On Albert's analyses in terms of *forma fluens* and *fluxus formae*, see Ernest J. McCullough, "St. Albert on Motion as Forma Fluens and Fluxus Formae", in *Albertus Magnus and the Sciences. Commemorative Essays, 1980*, edited by J. Athanasius Weisheipl (Toronto: Pontifical Institute of Medieval Studies, 1980), 129-153. As Maier has pointed out, this distinction and the clear attribution respectively to Averroes and to Avicenna did not appear until John of Jandun's examination of the question "utrum motus sit eiusdem essentiae cum termino ad quem tendit" (see Maier, *Zwischen Philosophie und Mechanik*, 83-85).

could be avoided by re-interpreting the involved statements in terms of *permanentia*.[24] Regarding the nature of motion, Ockham's reductive program derives in nothing but a new support of the traditional "verior" view of the *forma fluens* championed by Averroes Albert and others.[25] In fact, Ockham was convinced that a linguistic purification of the question cannot have another output: "Motion" is to be identified with the moving body and with the acquired perfection itself. Aristotle and Averroes – if read carefully – would have affirmed nothing but this theory. In Ockham's approach, however, there is a crucial difference from the previous ways to support the *forma fluens*. According to this theory, we have to deny that motion is a special *fluxus* or category over and above. Ockham agrees with that only via a generalized negation: "Motion" itself, whatever the theory behind it might be, is only a word, not a real entity. We use this word to mean briefly that this particular body was at different places in different times. All there is, in reality, is the body itself (the thing) and the *terminus* (in case of the local motion, the place, the *ubi*). These are *permanentia*, not successive things.[26]

Ockham's general approach to physics provoked different reactions. Walter Burley, for instance, objected on the one side that this deprivation of reality to motion makes natural philosophy impossible in general. On the other hand, resorting to a special passage of Aristotle's *Metaphysics*, he indicated that there are different ways to consider motion and, at least in one of these ways, motion can be understood as the succession or

[24] From the numerous texts of Ockham dealing with the concept of motion and claiming the necessity of an accurate linguistic approach, I would like to quote only the following passage from the *Summula*: "Propter modum loquendi multae videntur difficultates de motu quae mihi videntur secundum principia Aristotelis magis vocales quam reales. Si enim uteremur praecise istis vocabulis: movens, motum, motivum, mobile, movere, moveri et huiusmodi, et non talibus: motus, mutatio et consimibilius, quae secundum commune modum loquendi et opinionem multorum pro rebus permanentibus non videntur supponere, multae difficultates et dubitationes essent exclusae. Nunc autem propter talia videtur quod motus sit aliqua res secundum se totam distincta a rebus permanentibus. Videtur enim quod motus sit quidam fluxus, sed res permanens non est fluxus sed per se stans, igitur etc ...," William of Ockham, *Summula philosophiae naturalis*, edited by S. Brown, Guillelmi de Ockham Opera Philosophica et Theologica, Opera Philosophica VI (New York: St. Bonaventure University, 1984), 135-394 at 266-267.

[25] However, one has to remember that Averroes' scrutiny received strong criticism by Thomas Wylton and other English authors. Emphasizing the physical aspects of the problem, Wylton rejected the identity between motion and terminus and affirmed at the same time the reality of motion as a *via ad formam* (Trifogli, "Wylton on Motion", 142 and 145). Others described motion as "defluxus et transitus", as for instance the anonymous commentator in MS. Oxford, Merton College 272, (for the corresponding Latin passage and an English translation, see also Trifogli, "Wylton on Motion", 142). So, it seems that Averroes' approach was not accepted throughout, as until now assumed.

[26] For Ockham's physics see in general André Goddu, *The Physics of William of Ockham*, Studien und Texte zur Geistesgeschichte des Mittelalters 16 (Leiden: Brill, 1984), 83-209. Ockham's concept of motion is analysed in Maier, *Zwischen Philosophie und Mechanik*, 100-105; Herman Shapiro, *Motion, Time and Place according to William Ockham* (New York: St. Bonaventure University, 1957); and Marilyn McCord Adams, *William of Ockham* (Notre Dame: University of Notre Dame Press, 1987), vol. 2, 798-827.

the duration itself of a continuous quantity. Moreover, Burley affirmed that motion as a successive quantity is "a thing different from the moveable, since it is an act existing subjectively in the moveable."[27] On the contrary, Ockham's views on natural philosophy found a positive reception in Gregory of Rimini, the General of the *Order of Hermits of Saint Augustine* since the Chapter held in Montpellier (1357). Gregory was rather hostile to several theological doctrines of Ockham, but he integrated a great deal of English philosophical-logic and Ockham's reductive arguments on natural philosophy into this *Commentary to the Sentences*. In a long question to the second book, he examined, in detail, the concept of motion focusing on the problem of existence of successive things. There are some philosophers – Gregory points out – who say, indeed, that motion is a certain entity, which is different *according to its totality* (i.e. not part after part, like in the *successivae*) from the permanent things involved in the motion.[28] This opinion is wrong – he concluded: no motion is such a thing as different from the permanent things, as this opinion sustains.[29]

Jean Buridan followed Ockham's reductive program except for local motion. He conceded that, for the other cases of motion, we can remain within the conceptual frame of the *forma fluens* theory, but for the particular case of the local motion, we cannot get by only with permanent things and need to assume a special *fluxus* added to the moveable.[30]

[27] "Patet etiam quod est res distincta a mobile, cum sit actus existens in mobili subiective," quoted by Maier, *Zwischen Philosophie und Mechanik*, 106-117, at 113. This position had been anticipated by William of Alnwick when dealing with the question "utrum motus sit de genere termini ad quem est" (see Maier, *Zwischen Philosophie und Mechanik*, 89-90). For a discussion of Burley's position, above all in comparison to Averroes and Ockham, see Cecilia Trifogli, "Motion and Time", in *A companion to Walter Burley*, edited by A. Conti (Leiden and Boston: Brill, 2013), 267-299.

[28] "Dicunt enim quod motus quilibet est quaedam entitas, secundum se totam et quodlibet eius distincta a qualibet et quibuslibet rebus permanentibus, quae fuerunt antequam mobile moveatur, aut sunt dum moveatur, aut errunt postquam cessabit moveri, et illis atque istis simul," Gregorii Ariminensis OESA, *Lectura super Primum et Secundum Sententiarum*, t. IV, Super Secundum, dist. 1-3 (Berlin and New York: Walter de Gruyter, 1979), 125. To be absolutely clear, the difference meant here is valid also with respect to things which could have existed before, during, and after the motion having occurred.

[29] "...nullus motus est aliqua talis res a permanentibus distincta, ut fingit opinio," Gregorii Ariminensis, *Lectura*, 128. The background is very-well explained by Kevin Smith, "Ockham's Influence on Gregory of Rimini's Natural Philosophy", in *Dialexeis: Akademaiko etos 1996-7*, edited by V. Syros, A. Kouris and H. Kalokairinou (Nicosia: Homilos Philosophias Panepistemiou Kyprou, 1999), 107-142. Gregory might have had above all Burley's ideas about motion as a model for the theory to be rejected (see Smith, "Ockham's Influence on Gregory of Rimini", 121-22). See also Stephen F. Brown, "Gregory of Rimini (c. 1300-1358)," in *Routledge Encyclopedia of Philosophy 10*, edited by E. Craig (London: Routledge, 1998), 170a-172b and Stephen F. Brown, "Walter Burley, Peter Aureoli, and Gregory of Rimini," in *Medieval Philosophy* (Routledge History of Philosophy 3), edited by J. Marenbon (London: Routledge, 1998), 368-385.

[30] For this group of authors, though focusing on Buridan, see Johannes M. M. H. Thijssen, "The Debate over the Nature of Motion: John Buridan, Nicole Oresme and Albert of Saxony. With an Edition of John Buridan's *Quaestiones super libros Physicorum, secundum ultimam lecturam*, Book III, q. 7", in *Evidence and Interpretation in Studies on Early Science and Medicine*, edited by E. D. Sylla and W. R.

Thus, for Buridan and many of his colleagues, "being in motion" means that a body is somehow changing its behavior with regards to itself, not necessarily to something else exterior to it.[31] Supporting also in his own way the notion of a *fluxus* or motion as a "successive thing which is in itself different form permanent things," Nicole Oresme developed a special ontology to tackle the problem in his questions on the *Physics*.[32] Albert of Saxony also dedicated a great deal of space to discuss this problem in his question on the *Physics*. He also considered it unnecessary to assume a special category for the qualitative motion, but for local motion he felt compelled to accept a *fluxus superadditus*. Manifesting contrast to Ockham, he emphasized that whatever motion might be, it is for

Newman (Leiden: Brill, 2009), 186-210. For Buridan's discussion are also the questions 6, 8, and 9 relevant, edited in John Buridan, *Quaestiones super octo libros Physicorum Aristotelis (secundum ultimam lecturam) Libri III-IV*, Medieval and Early Modern Philosophy and Science 27, edited by M. Streijger and P.J.J.M. Bakker, guide to the text by E. D. Sylla (Leiden and Boston: Brill, 2016), 60-98.

[31] John Buridan, *Quaestiones super octo*, "Item aliter et aliter se habet intrinsece" (78,23).

[32] This is the fifth opinion examined by Oresme in his questions on *Physics*: "Ex predictis potest elici quinta opinio, scilicet quod motus est res successiva distincta simpliciter a permanentibus," Nicole Oresme, *Questiones super Physicam* (*Books i-vii*), Studien und Texte zur Geistesgeschichte des Mittelalters 112, edited by S. Caroti, J. Celeyrette, S. Kirschner and E. Mazet (Leiden: Brill, 2013), question III.6, 334,100-101. In the third book of his commentary of *Physics*, Oresme carried out an extensive discussion of the problem in six questions (Nicole Oresme, *Questiones super Physicam*, III.2-7, 304-341), which we cannot consider here in detail (fortunately, there is enough bibliography on this aspect of Oresme's natural philosophy, a selection of which the reader can find below). It is important to make clear, however, that Oresme did not give a straightforward and unconditional support to the *fluxus* theory. Moreover, understanding this theory as a "fluxus ad modum unius forme distincte" (Nicole Oresme, *Questiones super Physicam*, 341,163-164), it is "omnium pessima" (ibid.). However, if we understand that this is "modus" or "condicio" of the moveable, then, this theory "est verissima, et probabilior, et facilior inter omnes, et concordat dictis Aristotelis et philosophorum" (Nicole Oresme, *Questiones super Physicam*, 341, 167-168). On Oresme's concept of motion, see: Ernst Borchert, *Die Lehre von der Bewegung bei Nicolaus Oresme*, Beiträge zur Gesch. der Philos, und Theol. des Mitt. XXXI/3 (Münster i. W.: Aschendorf, 1934). Borchert's presentation is based on Oresme's *Livre Du ciel et du monde* and his *De anima* commentary. For Oresme's previous ontological analysis in his *Physics* commentary, see Stefano Caroti, "Oresme on Motion. (*Questiones super Physicam* III, 2-7)", *Vivarium* 31 (1993): 8-36; Stefano Caroti, "La position de Nicole Oresme sur la nature du mouvement (*Questiones super Physicam* III, 1-8): Problèmes gnoséologiques, ontologiques et sémantiques", *Archives d'Histoire Doctrinale et Littéraire du Moyen Age* 61 (1994): 303-385; Stefan Kirschner, *Nicolaus Oresmes Kommentar zur Physik des Aristoteles*, Sudhoffs Archiv Beihefte 39 (Stuttgart: Franz Steiner Verlag, 1997), 52-78; and Stefano Caroti, "Nicole Oresme et les *modi rerum*", *Oriens-Occidens* 3 (2000): 115-144.

sure that it is something real.[33] Also, Buridan affirms the reality of motion.[34] For Buridan, Albert of Saxony, and for many other authors discussing this problem from 1277 onward, there was a pending issue. Article 49 of Tempier's famous condemnation stated that it is forbidden to say that "God cannot move the heavens with rectilinear motion, and the reason is that, in this case, an empty space would emerge."[35] According to the Aristotelian understanding of nature, the lack of a place beyond the last sphere would render such a rectilinear motion of the whole world impossible. But, as philosophers are not allowed to transfer this limitation to God himself, one has to assume that it belongs to the realm of the possible because God would be able to produce such a case. Rethinking the problem of the categorization of motion on this basis, Buridan, Albert of Saxony, and others came to the conclusion that, in fact, a reduction to the *forma fluens* for the case of the qualitative motion is possible, but the "casus divinus" requires a new understanding of local motion as *fluxus formae*, i.e., as a special entity different from the place (the *terminus* of motion) and the moving body itself.[36] Particularly, Albert of Saxony declared that within the realm of the "divine cases" and assuming that the concept of motion involves the "aliter et aliter

[33] "Isto notato, pono istam conclusionem quod, sive motus sit fluxus distinctus a rebus permanentibus, sive non, concedendum est quod motus est," Albert of Saxony, *Expositio et Quaestiones in Aristotelis Physicam ad Albertum de Saxonia attributae*, 3 vols., edited by B. Patar (Louvain and Paris: Éditions Peeters, 1999), vol. 2, 492. Albert dedicates the question III.3-8 to the problem (Albert of Saxony, *Expositio et Quaestiones in Aristotelis Physicam*,, 481-527). For Albert of Saxony, see the detailed study by Jürgen Sarnowsky with valuable remarks on other commentaries as well: Jürgen Sarnowsky, *Die aristotelisch-scholastische Theorie der Bewegung. Studien zum Kommentar Alberts von Sachsen zur Physik des Aristoteles* (Münster: Aschendorf, 1989), 125-149. Albert was familiar with Buridan's commentary (*tertia lectura*). Moreover, his questions might have emerged after Oresme's questions; see Jürgen Sarnowsky, "Nicole Oresme and Albert of Saxony's Commentary on the Physics. The Problems of Vacuum and Motion in a Void," in *Quia inter doctores est magna dissensio. Les débats de philosophie naturelle à Paris au xiv^e siècle*, Biblioteca di Nuncius 52, edited by S. Caroti and J. Celeyrette (Florence: Olschki, 2004), 161-175.

[34] John Buridan, *Quaestiones super octo libros physicorum*, 62,2-4: "Licet secundum veritatem motus sit res distincta a mobili et loco, ut in alia quaestione dicetur, tamen sequitur quod ipse est, quia nihil est idem vel diversum, nisi sit ens, ut dicitur decimo *Metaphysicae*".

[35] *Chartularium Universtitatis pariisiensis*, edited by H. Denifle and A. Chatelain (Paris: Ex typis fratrum Delalain, 1889-1897), vol. 1, 546: "Quod Deus non possit movere celum motu recto, et ratio est, quia tunc relinqueret vacuum". For further details, see Edward Grant, *Much Ado About Nothing. Theories of space and vacuum from the Middle Ages to the Scientific Revolution* (Cambridge: Cambridge University Press, 1989), 108-115, For a general study on the prohibition of 1277, see Roland Hissette, *Enquête sur les 219 articles condamnés à Paris le 7 mars 1277*, Philosophes médiévaux 22 (Leuven: Publications universitaires, 1977), esp. 118.

[36] See John Buridan, *Quaestiones super octo libros physicorum*, with reference to the Tempier article (76,2-15). The first answer to the rationes adduced runs: "...manifestum est quod sine dispositione superaddita non potest salvari quod ultima sphaera se habeat aliter et aliter intrinsece, sicut se habet," John Buridan, *Quaestiones super octo libros physicorum*, 79,10-12.

se habere" intrinsically, this "intrinsecum" is not the moveable thing, although it is something inherent to it.[37]

These are – reported briefly – the main ideas operating in the background of Legrand's discussion of the nature of motion. First, the sources of Aristotle, Avicenna, and Averroes. Second, the incorporation of the sources into the discussion formulated by Albertus Magnus in terms of *forma fluens* and *fluxus formae*. Third, Ockham's nominalism and its critical reception in – among others – Buridan's and Albert of Saxony's natural philosophy. Fourth, Ockham's nominalism and its minimalist ontology – for the case of motion and other physical notions – as assumed by Gregory of Rimini, the major philosophical figure for the Augustinian Hermits before Legrand.

3. Legrand's discussion on the nature of motion

With this background in mind, let us now examine Legrand's main ideas about what motion is and, above all, what motion *is not*. The background about *forma fluens* or *fluxus formae* is still clearly present in Legrand's examination of the problem (in what follows I will often use the abbreviations *Fa* and *Fu* for these theories, respectively); however, not in its original state but after having passed through the linguistic philosophy of Ockham and the criticism (on Ockham) by Burley and the Paris philosophers.[38] This must also be the reason why Legrand concentrates his discussion specifically on local motion when discussing the concept of motion as such. It is anyway evident hat Legrand intends to refute the *fluxus formae* theory. Introducing the question posited as *"Is the local motion an accident inherent to the moving body?"* he summarizes the opinion of those who are in favour of an affirmative answer in the following way: "And some say that the local motion is a flowing and successive accident (*accidens fluxibile atque successivum*), different from the moved thing"; an accident that, by the way, is not something already done, but which is in the process of being done.[39]

[37] Albert dedicates a complete question to discuss the *casus divinos*: "Utrum admittentes casus divinos oporteat concedere quod motus localis sit alia res a mobile et a loco," Albert of Saxony, *Expositio et Quaestiones in Aristotelis Physicam,* q. 7, 515-520. For this special case of the world moving as a whole, the "moveri" means "aliter et aliter intrisece" (516,46-47) and "illud intrinsecum non est illum mobile, licet sit aliquod sibi inhaerens" (517,53-54). Thus, "illud intrinsecum secundum quod mobile aliter et aliter se habet est ipse motus seu fluxus" (517,59-60).

[38] Still after Gregory of Rimini but some decades before Legrand, Hugolino of Orvieto reports that discussion of the question in terms of *forma fluens* and *fluxus formae* is usual (and he decides himself for the first one): "Aut motus ad formam est forma fluens vel fluxus forme, sed non est fluxus forme, ut patet ex prima conclusione, igitur es forma fluens. Maior patet secundum communiter loquentes in ista materia de motu, qui dicunt istam disunctam esse necessariam," Stefano Caroti, "Hugolinus ab Urbeveteri, '*Questiones super Physicam*', III, 1-3 (avec quelques souvenirs personnels)", *Przegląd Tomistyczny* 24 (2018): 91-134, at 120,136-39.

[39] "Antequam tamen ulterius progrediamur, videre oportet utrum motus localis sit aliquid accidens inherens rei mote. Et dicunt aliqui quod motus localis est quidam accidens fluxibile atque

The whole chapter 37 (*De motu secundum locum*) is made up of a short introduction, a series of six main arguments for the *Fu* thesis and ten "positive" reasons for the thesis he wishes to defend, according to which "motus" is nothing but the "mobile." Legrand discusses and refutes the arguments for *Fu* in the same passage in which they are explained. For the last argument (number 6), he proposes a series of counterarguments.

3.1. The arguments *pro* and *contra* the *fluxus* theory of motion

The discussed arguments (*rationes*) are as follows:

1) If motion were identical with the moveable (*mobile*) (i.e., "if *Fa* in its nominalist version were right"), then it would follow that "whenever there is a moveable, there is also motion." But this is wrong, and therefore the thesis affirmed in the conditional's *antecedens* is also wrong. The implied result of the argument is that motion is not identical with the moveable; which means that there must still be something else, the supposed "*fluxus*" aimed at by the *Fu* theory. We can now ask ourselves: How can the falsity of the consequence be ensured? The supporter of *Fu* has to give reasons for the affirmation "sometimes there is a moveable, but there is no motion." How is that possible at all? In Legrand's rendering of this thesis, the supporters of *Fu* point out that we *perceive* that "sometimes we have a *mobile* without motion."[40] Thus, when this one body – which was not moving – starts moving, something else has been added to it. At this point, the discussion threatens to turn itself into a simple verbal divergence: Can we use the term "*mobile*" for something that is not in motion? Or are we, from the moment we do it, already accepting that in the body itself, there is something like "motion," which has now been added to the body (and therefore is now better called *mobile* than "body")? Legrand objects to this argument by saying that *mobile* and *motus* are identical and still one could find a resting *mobile*, and by this he means a body which is not yet in motion. The presentation of the argument for *Fu* and the intended refutation are, unfortunately, too

successivum distinctum a re mota cuius accidentis esse consistit in fieri et non in facto esse," Legrand, *Compendium*, **G** 149v, **P** 144r. For the understanding of quoted texts, it will be useful to keep in mind that – as not unusual in late medieval philosophy – the refutation of a theory, for instance of *Fu*, is not always carried out directly. Often enough, the refutation is built upon the *modus tollens* so that the thesis to be refuted is presented in the *antecedens* of a conditional sentence. The strategy consists mostly in searching for reasons to negate the *consequens* (and then transfer the negation back to the *antecedens*) or in negating the necessity of the implication (*consequentia*) itself.

[40] "Prima ratio est quia, si motus idem esset quod mobile, tunc sequitur quod quandocumque mobile esset, motus esset, cuius oppositum experimur. Igitur, non sunt idem. Hec autem ratio non valet, quia stat quod mobile sit idem quod motus, et tamen mobile quandocumque potest esse quando non movebitur. Quo posito, verum est dicere quod mobile(*!*) est, licet non sit motus, quia illa res, que est idem quod motus, est; sed nullus est motus, quia ipsa res non movetur in casu posito," Legrand, *Compendium*, **G** 149v, **P** 144r. **G** has omitted "tunc sequitur quod". The passage needs editorial emendation, since both manuscripts convey "motus" for "mobile" in the argument's refutation (indicated with *!*).

narrow and pressed to permit a completely reliable interpretation. However, it is clear that it is not Legrand – the nominalist – but the *Fu* supporter who resorts to experience to substantiate his position. This seems to be one of those cases of a preference for a *quia* rather than a *propter quid* approach to knowledge which Anneliese Maier has pointed out precisely in connection with the *fluxus* theory of motion.[41]

2) Bringing into the discussion a particular case of motion, the second reason of the *fluxus* supporters is more physically anchored. In this case, the *Fu* argument states that the down and up motion of the heavy and light bodies is caused by the qualities "heaviness" and "lightness" (*gravitas* and *levitas*) respectively, although heaviness and lightness do not cause the bodies themselves.[42] In short: we cannot reduce this kind of motion to the moving body, since the cause of this motion is clearly not the cause of the body. Legrand replies that we can, nevertheless, accept this reduction also for this case. For "heaviness" and "lightness" are nothing but something that arises from condensation and rarefaction of matter, which are respectively an approaching or distancing of its parts. Thus, he concludes, "if the local motion is an effect of the heaviness, then also it is an effect of the heavy body itself."[43]

3) A similar argument – however, built upon the inverted causal relationship – can be adduced regarding the heavenly bodies. These – say the defenders of *Fu* – have their influences from their motions. Hence, their motions are distinguishable from themselves. "Motion" in this argument is not conceived as the effect but as the cause of that quality or capacity present in the planets, called their *influentia*. As it is not to be doubted that these are in the planets, we need a cause for them: Their motions. So, again, these result to be some sort of *fluxus* independent from the planets themselves. Legrand can destroy this argument with less effort: The motion of the heavens is nothing else but a behavior of the heavens themselves. One could accept that the heavens have different influences in their parts, but this is neither inconvenient in itself nor a proof of the independence of motion. For, we say, for instance, that by the process of condensation, a thing gets harder without anything being added.[44]

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[41] See Maier, *Die Vorläufer Galileis*, 22.

[42] "Secunda ratio eorum est quia motus localis in gravibus et levibus causatur a gravitate et levitate, sed ipsum grave non causatur a gravitate et levitate. Igitur videtur quod mobile non sit idem quod motus, quia ipsum grave est mobile," Legrand, *Compendium*, **G** 149v, **P** 144r.

[43] "Ad hoc dicendum est quod, licet grave non sit effectus gravitatis inquantum est aliqua res naturalis, verumtamen gravitas potest esse causa, ut sic se habeat, scilicet ut moveatur localiter. quia motus localis non est nisi quidam modus se habendi. Item potest dici quod gravitas et levitas non dicunt aliquam rem distinctam a gravibus et levibus nec sunt accidentia realia eis inherentia. Unde gravitas consurgit ex condensatione et levitas ex rarefactione. Condensatio autem nihil aliud est nisi partium approximatio," Legrand, *Compendium*, **G** 149v, **P** 144r.

[44] "Tertio arguunt, quia corpora celestia a suis motibus habent suas influentias, videtur ergo quod motus eorum ab eis distinguantur. Ad hoc dicendum est quod motus celi nihil aliud est nisi celum sic se habens. Et conceditur quod ad sic se habere celi in parte suas habent influentias nec istud est inconveniens nec tamen tales motus ab eis distinguntur. Sic enim dicimus quod per

4) Following the same line of argumentation, the fourth *ratio* states that "motion" is a cause of warmth and of health, but this cannot be said of the moving body. So, it is evident that motion and moving body are not identical. For the refutation, Legrand resorts to the previous argument: "The *mobile* is the cause of the health, not as far as there is such a thing, but only as far as it behaves that way when being in motion." That could be generalized for many other cases, he points out.[45]

5) The next argument for the theory *Fu* is also constructed in a conditional form and is related to the general theory of mutation. The argument affirms that if there were no distinction between motion and moved thing, we would have to assume that a transit from one *contradictorium* to another *contradictorium* would be possible without the production of a new thing. This is, however, a fundamental principle we cannot deny. According to the standard Aristotelian understanding of change and generation, the passage from one to another *contradictorium* supposes the production of something new.[46] Against this special argument for the *Fu* theory, one can argue on two fronts: on the one side, one could try to show that from this, it does not follow that we have to accept a distinction between motion and moving thing. On the other side, we could also try to explain that this principle does not necessarily get violated if we know how to understand it. The *fluxus* supporters pose an imaginative case: suppose there were only one thing in the world and this thing does not move. Then, this proposition would be true: "There is no motion." Let us then set this one thing in motion. In this case, the contradictory proposition would be true: "There is a motion." Legrand gives a double answer to the case: first, in good nominalist mood, he affirms, that there is no problem in not producing a new thing in a case of "transit from one *contradictorium* to another," for it is sufficient that a *relatio* arises, which is by no means an independent, new entity. Second, he adds that "maxima famosa" should be not understood in the sense that a new thing must necessarily be produced. It is sufficient that *solus fluxus temporis* be present.[47]

condensationem res alterius et alterius redditur conditionis et tamen per condensationem nulla res nova sibi superadditur," Legrand, *Compendium*, **G** 150r, **P** 144v.

[45] "Quarto arguitur quod motus est causa caloris atque sanitatis. De re autem mobili hoc non dicitur. Videtur igitur quod non sint idem. Ad hoc dicendum sicut prius, scilicet quod mobile est causa sanitatis non inquantum est talis res sed inquantum sic se habet per motum; et similiter responderi potest ad infinitas similes rationes," Legrand, *Compendium*, **G** 150r, **P** 144v.

[46] Simo Knuutila and Anja Inkeri Lehtinen, "Change and Contradiction: A Fourteenth Century Controversy", *Synthese* 40 (1979): 189-207.

[47] "Quinto arguunt quia, si motus non distinguatur a re mobili, tunc sequitur quod fieri potest transitus de contradictorio in contradictorium sine productione nove rei; quia, posito casu quod esset una sola res in mundo que non moveretur, tunc hec esset vera 'nullus motus est'. Si autem postmodum movetur, tunc sua contradictoria esset vera, scilicet 'aliquis motus est'. Ad hoc dicendum ⟨est⟩ quod nullum est inconveniens fieri transitum de contradictorio in contradictorium sine productione nove rei, quia sufficit alius modus se habendi seu relatio que nullam rem distinctam dicit. Nec illa communis maxima sic intelligenda est qua dicitur quod fieri non potest transitus de contradictorio in contradictorium sine mutatione rei, quia per illam maximam non est intelligendum quod sit necesse aliquam rem novam produci si motus aliquis debeat fieri, imo sufficit

The next reason involves a series of arguments, all of which are related, imagined cases occasioned by an omnipotent God. As it was previously mentioned, the discussion's background is the Thesis 49 in Tempier's condemnation of 1277. In our text, however, the discussion is not about a possible vacuum and the nature of space, but about the concept of motion. Article 49 is relevant since it urges to accept that God, in his unlimited power, could move the heavens with a straight motion. Hence, the existence of an empty space and its concrete physical consequences are not necessarily involved in our discussion. It is about the need for further information, of another body, or of "a system of reference" that would enable us to establish the existence of motion at all. Albert of Saxony's questions illustrate very well the kind of ideas to which Legrand's criticism is addressed: if we admit the "divine cases," we will have to assume, for local motion especially, a *fluxus* successively acquired by the *mobile*.[48] Let us now revise the argument itself.

6) This argument for the *Fu* resorts to God's decision making *and* to the late medieval understanding of motion as "behaving differently" ("aliter se habere") in itself. Are both compatible with the more traditional *Fa* theory? Let us suppose that God would annihilate all existence except only one *mobile*. We have to assume that such an action be possible for the Christian God. In this case, since only these two contraposed theories are under examination, one can affirm the real existence of motion by refuting the opposite theory, *Fa*. For, if *motus* is nothing but the *mobile* (as *Fa* sustains), then we will have to accept that the moving body does not fulfill the definitional condition of "behaving differently." The reason for this is that, by hypothesis, there is nothing else with respect to which we could establish that this body is moving. But we have accepted that there is motion (produced in this one body by God himself). Therefore, a contradiction arises: the body would be moving (because of God's action) and, nonetheless, it would not be behaving differently (which is conceptually required). Thus, "from this reason they conclude that in such a case, the moving body behaves differently because of the motion or because of a *fluxus* superadded to him and distinct from him."[49]

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solus fluxus temporis, ut in sequentibus dicetur," Legrand, *Compendium*, **G** 150r, **P** 144v. This is not the first time that Legrand resorts to this "maxima famosissima"; see Di Liscia, "Transmutación y movimiento según el tiempo", 165. For the sake of avoiding possible misunderstandings I would like to indicate that Legrand follows the nominalist approach not only regarding motion but also regarding time: "Ex quo sequitur quod quia motus non distinguitur a re mobili consequenter nec tempus distinguitur ab illa re cuius motus est tempus," Legrand, *Compendium*, **G** 159v, **P** 149v. It is here where Legrand's idea of a "motion according to the time" can be useful, since it is one and same thing (nothing new!) which has experienced the passing of time (see the remarks in the previous fn. 18).

[48] "Septima conclusio: in omni mobili quod movetur localiter, volentes admittere casus divinos oportet ponere fluxum seu motum inhaerentem mobili qui successive illi mobili acquiritur," Albert of Saxony, *Expositio et Quaestiones in Aristotelis Physicam,* q. 7, 517,66-68.

[49] "Sexto arguunt ponentes casum quod deus omnia entia creata annihilaret dempto unico mobili quod moveatur. Quo posito petunt quid sit realiter motus eius: Si dicatur quod sit ipsummet mobile, tunc sequitur quod aliquid movetur quod aliter se non habet, quia in tali casu tale mobile non se habet aliter respectu dei nec se habet aliter respectu alicuius extrinseci, quia nullum est, nec

(6.1.) First counterargument:

Before getting into a more detailed discussion of this argument, Legrand makes it first clear that the motion in question could not be a rectilinear motion, since in this case, one has, in fact, to assume the existence of something else exterior to the *mobile*, which is the place needed for local motion.[50] Once having established this, Legrand faces this imaginative argument with a counter-imagination. Let us call the imagined body proposed by the *Fu* theory *A*, a unique body created by God as staying in motion.[51] Against the imagination of a body moving without any further bodies, Legrand proposes to take the case of another imagined body *B*, which would not *but could* exist exteriorly to the body *A* in question. This would satisfy the concept of motion without introducing any additional *fluxus*, since already the possibility of this body *B* would be enough for us to say that there is a "aliter se habere respectu extrinseci" (even if this exterior body *B* did not exist). Legrand seeks to clarify this less intuitive argument through an analogy: The essential perfection of a thing can be "measured" according to its distance to the pure potential, i.e., to matter. However, it is not necessary that matter factually does exist for this "quantification." One could anyway affirm that this kind of perfection "distaret si materia esset." Thus, in the same way, it would be possible to imagine a unique body, the behavior of which is changing with respect to another body if there were one.[52] Legrand's

ratione motus advenientis, quia motus est idem quod mobile. Relinquitur ergo quod tale mobile movetur et tamen aliter se non habet, quod videtur implicare contradictionem – ut ipsi dicunt –, quia moveri nihil aliud est nisi aliter se habere. Si vero dicatur quod motus distinguatur a re mobili tunc ipsi habent propositum. Imo ex ista ratione concludunt quod in tali casu mobile se habet aliter per motum seu per fluxum motus sibi superadditum et ab eo distinctum," Legrand, *Compendium*, **G** 150r-v, **P** 144v-145r.

[50] "Ad istam rationem dicendum est quod in tali casu mobile non potest moveri motu recto, quia tunc necesse esset dicere quod esset aliud sibi extrinsecum, utputa locus in quo movetur. Conceditur tamen quod posset moveri motu circulari, sicut de celo concedimus," Legrand, *Compendium*, **G** 150v, **P** 145r.

[51] "Et cum queritur utrum tale mobile aliter se habeat respectu alicuius extrinseci, dicendum est quod non. Sufficit tamen dicere quod aliter se haberet si aliquod extrinsecum sibi esset, quia, si tale corpus quiesceret, non se haberet aliter respectu extrinseci, si esset. Ad hoc igitur quod moveatur sufficit quod aliter se haberet respectu extrinseci, si esset, et, si nullum extrinsecum est, non propter hoc minus movetur. Sic enim dicimus quod rei perfectio essentialis potest attendi penes distantiam a pura potentia seu matéria," Legrand, *Compendium*, **G** 150v, **P** 145r. I am adding the denomination *A* and *B* which does not occur in the text to clarify Legrand's example.

[52] "Et tamen, si materia non esset, ad hoc quod rei perfectio quantificetur, sufficit dicere quod ipsa distaret si materia esset; quinimmo dicimus quod penes non esse simpliciter essentialis perfectio potest attendi et tamen non esse nihil est. Non esset ergo inconveniens imaginari tale corpus moveri, quia imaginatur aliter se habere respectu extrinseci, si esset," Legrand, *Compendium*, **G** 150v, **P** 145r. Reasoning in terms of degrees of *perfectio* is one of Legrand's favourites argumentative approaches. For further information about this, see Daniel A. Di Liscia, "Perfections and Latitudes. The Development of the Calculators' Tradition and the Geometrisation of Metaphysics and Theology", in *Quantifying Aristotle. The Impact, Spread and Decline of the* Calculatores *Tradition*, Medieval and Early Modern Philosophy and Science, edited by D. A. Di Liscia and E. D. Sylla (Leiden: Brill, 2022), 278-327, for Legrand see 295-304.

opponent could object to this argument that it actually sounds like a linguistic excuse. For, to mean that "this body would behave differently with respect to another extrinsic body *if there were any*" essentially means "this body would move, if it were in motion." Nonetheless, this objection is not acceptable for Legrand, for it applies the concepts of "actuality" and "conditionality" wrongly, as if it were necessary to use them symmetrically on both sides of the argument. Legrand counterargues that this is erroneous, since for the *actual motion* of the body, it is enough that the "aliter et aliter se habere" can be affirmed *conditionally*.[53] Thus, conditionality and potentially are not always interchangeable.

(6.2.) Second counterargument:

Legrand still brings further arguments tending to affirm that even in the adduced, imagined case, no *fluxus* is needed because the objection resorting to the (non-existing) exterior body is not conclusive. For instance – he points out –, we could consider the motion of the body in question not in its totality but merely according to its parts, so that one part changes its behavior with respect to another. That could be done by putting points onto a spherical body, so that we could appreciate that one part of such point goes back and the other one moves forward. Thus, even under the case's presupposition that there is nothing but this one body, one should be able to appreciate the different positions the points put on a sphere are assuming while its motion is taking place.[54]

(6.3.) Third counterargument:

Legrand seeks to strengthen this line of argumentation by introducing a special case which, taken without further qualification, seems questionable. We could imagine – he now adds – an immobile sky in which we set an arbitrary point (for instance at 20 degrees of altitude from the horizon in the East) as a reference for the motion of other things. This point would itself be *immobilis*, so that the presupposition of the case is not contradicted, but – here is an "imagination" against the previous imagination – only imagined as if it

[53] "Sed contra hoc ipsi replicant quia tunc sequeretur quod tale corpus precise moveretur condicionaliter, quia idem videtur dicere 'hoc corpus aliter se haberet respectu extrinseci, si esset', et dicere 'hoc corpus moveretur, si moveretur'. Ad hoc dicendum est quod non est idem, quia ad hoc quod mobile moveatur actualiter sufficit quod aliter se habeat conditionaliter, ut patet, quia res quiescens non se haberet aliter conditionaliter. Bene ergo apparet quod ad moveri sufficit conditionaliter se habere aliter, ut predictum est," Legrand, *Compendium*, **G** 150v, **P** 145r.

[54] "Item potest dici quod tale corpus se habet non respectu alicuius extrinseci sed una pars se habet aliter respectu alterius. Et hoc sufficit quia etiam tale corpus non movetur secundum se totum sed secundum partes, quarum autem una pars se habeat aliter respectu alterius. Patet, signatis aliquibus punctis in tali corpore circulari, certum est quod una pars a tali puncto vel punctis recedit vel ad ipsa accedit," Legrand, *Compendium*, **G** 150v-151r, **P** 145r-v. P conveys "Ad hoc dicendum est quod *mihi* est idem" instead of "Ad hoc dicendum est quod *non* est idem".

were immobile. Thus, we could "quantify the motion" according to this point used as a reference.[55]

(6.4.) Fourth counterargument:

A further argument proposed by Legrand consists of seeing the concept of motion not as a kind of changing of behavior with regard to something else but as being *in potentia* to something that the body does not yet have, which is, in this case, the place to which the body moves. Thus, having this "potentiality" to another place (for which one does not need the real existence of this place so that the condition is satisfied) is sufficient for "being in motion."[56]

(6.5.) Fifth counterargument:

The next argument changes the discussion's strategy: It targets the sense and utility of the argument claimed by the *fluxus* supporters. Let us suppose that motion was such a quality inherent to the *subjectum* of motion. Even in this case – Legrand objects –, they have to add something, i.e. some other body, with respect to which this *aliter se habere* can be appreciated. In other words: they could not say that the body is moving, staying on its own, and so the imagined case itself does not make sense (or it is superfluous).[57]

(6.6.) Sixth counterargument:

Thus, the *fluxus* theory is based on a wrong understanding of what motion is, which Legrand indicates in the following remark: *aliter se habere*, according to local motion, does

[55] "Item nos possumus motum rerum considerare secundum accessum vel recessum a puncto signato in celo dummodo imaginetur tanquam immobilis, etiam supposito quod talis punctus signetur in zodiaco in quo nullus est punctus immobilis. Verbi gratia, si cum quadrante notaveris punctum elevatum versus orientem per 20 gradus, certum est quod penes distantiam a tali puncto poteris considerare quantum alie res sunt mote et utrum aliter se habeant, et tamen talis punctus signatus non est immobilis sed imaginatur tanquam immobilis. Sic ergo in proposito imaginari possemus in tali corpore signato punctum immobile, quo imaginato secundum recessum et accessum possumus quantificare motum. Unde quolibet puncto signato in tali corpore dummodo imaginetur immobilis, tunc quelibet pars talis mobilis signati aliter et aliter se habet respectu illius, dummodo tamen talis punctus signatus non sit centrum talis corporis, quia penes distantiam ab eo motus partium non potest attendi eo quod equaliter semper se habent respectu illius," Legrand, *Compendium*, **G** 151r, **P** 145v. A special condition – for the previous argument, but not introduced until now – is that the signed point in the body does not need to be its center which is useless to this end since all parts of the sphere would steadily remain at the same distance of it during the motion.

[56] "Item potest dici quod moveri non est aliter se habere respectu alicuius sed potius illud dicitur moveri quod est in potentia secundum quod in potentia ad illud quod non habet, quia igitur in tali casu una pars est in potentia secundum quod in potentia ad locum alterius. Ideo quelibet pars talis corporis movetur," Legrand, *Compendium*, **G** 151r, **P** 145v.

[57] "...miror quia etsi motus distingueretur a re mobili adhuc per hoc, non respondetur ad argumentum quod ipsi faciunt, quia sicut alias dicetur formale loci attenditur penes aliquid immobile signatum vel signabile. Si ergo motus esset quedam qualitas aliter et aliter subiecto inhereret, non tamen illud moveretur nisi respectu alicuius aliter se haberet saltem, si esset," Legrand, *Compendium*, **G** 151r, **P** 145v.

not denotate that an accident inheres but rather, it denotes the *distance or proximity* regarding a signed (or signable!) movable.

(6.7.) Seventh counterargument:

Besides, and still questioning the concept of motion based on the predicate of *aliter se habere*, the *Fu* supporters wonder about the fact that one should accept that something is in motion but not "behaving differently" in itself, without noticing that exactly the same problem occurs while contemplating the problem from the opposite point of view. Moreover, one should rather wonder about the fact they are assuming, which is: a body is "behaving differently" but, strangely enough, is not moving. This is, for Legrand, absurd to the point of implying that God could not produce this quality (*accidens*) in the center or in the poles of the world, since these are not moving.[58]

3.2. Reasons for not distinguishing *motus* from *mobile*

Should we, then, assume that the local motion is to be distinguished from the moveable thing? Legrand means to have refuted through the previous arguments the affirmative answer to this question as supported by (his rendering) of the *Fu* theory. Now, after having shown that the above explained reasons "do not conclude that the local motion is to be distinguished from the moveable thing," Legrand still adds some concluding reasons to prove that "local motion is not to be distinguished from the moveable thing."[59]

1) In the same nominalist way, Legrand is against a similar distinction between quantity and quantified thing, as he referred to in the previous passage in the

[58] "Item sicut ipsi habent pro mirabili quod aliquid moveatur et non se habeat aliter – quod tamen non sequitur, ut dictum est –, sic et peramplius habeo pro mirabili quod aliquid se habeat aliter et non moveatur, quod tamen sequitur ex dictis eorum, quia ex quo motus distinguitur a re mobili suppono quod deus talem qualitatem producat in aliquo subiecto et quod ipsum non moveatur, non video quid dicant nisi quia idem est motum in aliquo producere et facere quod illud moveatur Hoc enim non satisfacit, quia tunc sequeretur quod deus non posset tale accidens producere in centro vel in polis mundi qui moveri non possent," Legrand, *Compendium*, **G** 151r-v, **P** 145v-146r. Additionally, Legrand mentions briefly (nr. 6.8. following my numeration) that in the case that such an *accidens* were to be separated from every subject, one could ask whether it can be locally moved or not. The negative answer is unacceptable, but the affirmative leads to the affirmation of an *accidens* of an *accidens*, which is not better.

[59] "Ex his ergo patet quod predicte rationes non concludunt motum localem distingui a re mobili. Sed restat ponere rationes quibus moveor dicere quod motus localis non distinguitur a re mobile," Legrand, *Compendium*, **G** 151v, **P** 146r. After having examined ten different arguments, Legrand concludes at the end of his treatment of the notion of quantity in chapter 28: "Ex his igitur rationibus et similibus videtur esse concludendum quod quantitas non distinguitur a re quanta..." Legrand, *Compendium*, **G** 139v, **P** 133r.

Compendium, where he deals with this problem. Thus, for the same reason, or even all the less (*a potiori*), we should not admit a distinction between motion and moveable thing.[60]

2) In the processes of rarefaction and condensation – both cases of quantitative motion – there is local motion of some of the parts. During these processes, an acquisition or loss of a quantity takes place. Since this quantity cannot be distinguished from the quantified thing, the corresponding motion is also not different from the thing under rarefaction and condensation. The remarkable twist of the argument consists in reducing the quantitative motion to local motion.[61]

3) The distinction between motion and moveable thing supposes that nothing can be moved unless God produces something new. This can be doubted since the local transfer of things without the need to produce anything new is a capacity hardly deniable to God.[62]

4) The fourth reason shows us how perplexing and puzzling the arguments are: this argument, for instance, is not about God moving or not moving a thing from one point in space to another, but about transferring the (supposed) quality of "motus localis" itself from one thing to another without producing a new thing. There are two possible answers, and both are against the *fluxus.* Either this is possible for God, and then, one could affirm the same about the moveable thing itself (so the *fluxus* turns out to be superfluous); or not, and then it follows that a motion is moved by another motion and so *in infinitum*, which does not seem to be acceptable.[63]

5) If so, – and now we are arriving at the hardcore nominalist objections – we are obliged to accept endlessly new accidents added to the heavenly orbs, just because of the fact that they are eternally in motion.[64]

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[60] "Prima enim ratio est quia quantitas non distinguitur a re mobili, ut prius dictum est. Ergo videtur quod nec motus localis distinguatur. Hec enim ratio procedit a potiori," Legrand, *Compendium*, **G** 151v, **P** 146r.

[61] "Item omne quod rarefietur vel condensatur movetur localiter secundum quodlibet sui movetur; talis autem motus nil aliud videtur nisi quantitatis acquisitio vel deperditio; sed talis quantitas non distinguitur a re quanta, ut probatum est, ergo nec talis motus," Legrand, *Compendium*, **G** 151v, **P** 146r; "rarefietur vel condensatur" was omitted in **P**.

[62] "Item si motus localis a re mobili distingueretur tunc sequitur quod nulla res posset localiter moveri nisi deus de novo aliquid produceret. Hoc tamen non aparet verum quia verisimile est quod deus potest unam rem transferre de uno loco ad alium absque nove rei productione," Legrand, *Compendium*, **G** 151v, **P** 146r.

[63] "Item queritur an deus posset huiusmodi motum localem transferre de uno loco ad alium absque productione nove rei. Si dicatur quod sic, igitur de mobili hoc idem potest dici. Si dicatur quod non, tunc sequitur quod motus movebitur per alium motum et sic in infinitum," Legrand, *Compendium*, **G** 151v, **P** 146r.

[64] "Item sequeretur quod nova accidentia continue advenirent orbibus celestibus, quia continue movebitur" (Legrand, *Compendium*, **G** 151v, **P** 146r). Legrand defines this notion thus: "Accidens autem intentionale dicitur illud quod non educitur per transmutationem neque conservatur in virtute qualitatum primarum sed ex sola potentia obiecti in subiecto apto nato recipere producitur atque per solam presentiam sine transmutatione reducibili ad qualitates primas conservatur;

6) Even more, since in every motion there are infinite parts, we would consequently have an infinity of generations and corruptions.[65]

7) One may ask whether such a motion is educed from the potentiality of the matter. Since everything that is moved is also being altered (the motion being conceived as nothing but a quality), warm or cold will arise. That is manifestly wrong for the case of the heavenly bodies. Hence, the positive answer to this question is not assumable. Besides, mixed bodies can move without such alteration (from which it would follow that this quality is not needed). Moreover, if motion arose from the eduction of matter through alteration, it would follow that all that is moved by alteration would also be moved locally. But experience contradicts this assertion. Only the possibility of an "intentional accident" remains, but this is something that nobody affirms.[66]

8) As it could not be lacking in this line of reasoning, the razor principle is to be followed. And Legrand affirms it with full validity and clarity: "No multiplicity of entities is to be introduced without necessity." Everything can be efficiently explained assuming that motion is not distinguishable from the moved thing. To be clear: The problems can also be explained "per oppositum," i.e., accepting in fact the distinction between *motus* and *mobile*; only this is not necessary and hence one has to prefer the other, the simplest explanation.[67]

9) If a body is moved by many different motions at the same time – for instance, when something is moving with circular and rectilinear motion, or with different circular motions – then it would necessarily have several different accidents of the same species

huiusmodi est species in médio," Legrand, *Compendium*, **G** 67v, **P** 58r. Accordingly, an intentional accident, like the *species in medio*, is real but it possesses a weaker ontological status: "Ulterius sciendum quod talia accidentia sunt realia ad istum sensum quod realiter existunt quia tamen eorum realitas non dependet a subiecto nec a transmutatione rerum, ut pertactum est; ideo sunt diminutione realia seu minus realia. Item quia eorum realitas minus praecipitur ideo quasi non realia dicuntur," Legrand, *Compendium*, **G** 68r-v, **P** 58v-59r.

[65] "Item sequeretur quod in quolibet motu fierent infinite generationes et corruptiones, quia quilibet motus habet infinitas partes," Legrand, *Compendium*, **G** 151v, **P** 146r.

[66] "Item queritur an talis motus educatur de potentia materie. Si dicatur quod sic tunc sequitur quod omne quod movetur alteratur | et consequenter efficitur calidus vel frigidus. Hoc tamen manifeste falsum est, sicut patet de corporibus celestibus. Imo etiam in corporibus mixtis accidere potest, ut localiter videantur moveri absque tali alteratione. Imo si motus educeretur de potentia materie | per alterationem tunc necesse esset omne quod alteraretur localiter moveri, cuius oppositum experimur. Relinquitur ergo quod motus est accidens intentionale quod numquam legitur," Legrand, *Compendium*, **G** 151v-152r, **P** 146r-v).

[67] "Item non est ponenda multiplicitas entium absque necessitate. Sed omnia eque bene possunt salvari ponendo motum non distingui a re mobili, sicut ponendo oppositum," Legrand, *Compendium*, **G** 152r, **P** 146v.

inhering in it. But this cannot happen since the number of accidents of the same species is always the same as the number of the subjects of these accidents.[68]

10) Continuing along the same line of argumentation, one could finally object that such an accident could be separated from the moved thing if it were distinguishable. But then, once it has been separated, it could be moved (and, as it has been argued before, not by another motion).[69]

Thus, Legrand may finish his discussion by proposing that "it is better" not to distinguish between the local motion and the moveable.[70]

Concluding remarks

Jacques Legrand wrote, for the students of his Order, a metaphysical overview on natural philosophy. As it has been pointed out, the Augustinian mindset is at the base of the Christian-medieval encyclopedic project.[71] However, in Legrand's view, a treatment of the main texts of the Aristotelian corpus was a more essential part of the program. His *Compendium* is an encyclopedic work which, containing some remarks about the methods of acquiring knowledge, pays particular attention to the theoretical foundation of science.[72] This approach is surely not exceptional but, at the same time, not obvious. There are enough examples of well-done abbreviated texts on natural philosophy without any special discussion of the key theoretical notions involved in the text.[73] And this is

[68] "Item ponendo talem distinctionem sequitur quod si una res moveretur pluribus motibus tunc etiam haberet plura accidentia eiusdem speciei sibi inherentia, utputa si una res moveretur motu circulari et recto aut pluribus motibus circularibus superdiversis polis et tamen credendum est quod tale accidens – si poneretur – distinctum esset tamen eiusdem speciei atque perfectionis essentialis in omnibus. Quo posito sequitur quod non posset multiplicari in eodem subiecto, quia accidentia eiusdem speciei numerantur numero suorum subiectorum vel ergo per eundem motum res moveretur pluribus motibus vel tot essent accidentia quot essent motus," Legrand, *Compendium*, **G** 152r, **P** 146v.

[69] "Item si tale accidens distinguerentur tunc posset separari a re mota. Separatione autem facta tunc posset moveri et non per alium motum, ut primus arguebatur," Legrand, *Compendium*, **G** 152r, **P** 146v.

[70] "Igitur, videtur melius ut ponamus motum locale non distingui a re mobili," Legrand, *Compendium*, **G** 152r, **P** 146v.

[71] A thesis emphatically affirmed already by Michel de Boüard, "Encyclopédies médiévales. Sur la "Connaissance de la nature et du monde au moyen âge", *Revue des questions historiques* 112 (1930): 258-305, at 279 and 283 (following Augustine's *De doctrina christiana* 2.59).

[72] The methodological aspects of the philosophical encyclopaedies are emphasised by Mariateresa Beonio Brocchieri-Fumagalli, "Le enciclopedie", in *Lo spazio letterario del Medioevo. 1. Il Medioevo Latino. Volume I: La produzione del testo,* vol. 2, edited by G. Cavallo, C. Leonardi and E. Menestò (Rome: Salerno Editrice, 1995), 635-657.

[73] The *Compilatio de libris naturalibus Aristotelis et aliorum quorumdam philosophorum* in MS BnF, lat. 15879, ff. 125ra-176rb, for instance, is also fundamentally based on Aristotle and the Aristotelian text tradition but it contains more "empirical" material and less conceptual discussion. At least

what Legrand intended to do when approaching the Aristotelian doctrine: to prepare students for a theoretical understanding of the involved problems as they were under discussion in his time. Within the Aristotelian corpus, the *Physics* assumes a preeminent place, and in it, the concept of motion is pivotal. Legrand has carefully pondered how to integrate the substantial content of the Aristotelian *Physics* into his *Compendium* without excluding a critical analysis of other authors. Part IV of this work is structured on the basis of the Aristotelian types of transmutation and includes, of course, a special chapter on locomotion.

As previously observed, Jacques Legrand's reflections in this chapter are about what motion is not, rather than about what it is. In principle, we have no reason to attribute to him another understanding of the concept of motion than the more traditional one, the *forma fluens* as previously reformulated by Ockham. This is a significant feature of the *Compendium*. Legrand's thinking is not oriented to the trendy streams of "Neo-Albertism" or "Neo-Thomism," but to nominalism.

The discussion strategy in the chapter on local motion is plain: The *Fu* supporter must find cases where motion seems to be something added to the moving body; Legrand, supporting *Fa*, seeks for refutation or questioning of the adduced cases. As we could

according to this manuscript, this compilation is made up of three main parts, the first part being only on theology and natural philosophy and the others on moral philosophy. To avoid confusion, it is useful to note that Michel de Boüard, who probably pointed to this work for the first time, usually referred to it as "*Compendium*" or "*Compendium philosophiae*" (See De Boüard, "Encyclopédies médiévales", at 259, 266, 268, 300, 302-4; the manuscript 15879, which he follows, contains "*compilatio...*" at the beginning, but "compendium" at the end). De Boüard knew no author for this work but he declares to have identified seven copies from which the already mentioned would be the best one (291, fn. 2). There are, however, some inconsistencies regarding the dating and authorship of this text which deserve a more detailed and updated study. For, the above-mentioned copy is anonymous, but *MIRABILE. Archivio digitale della cultura medieval. Digital Archives for Medieval Culture* mentions a master "Philippus de Vitriaco" (fl. 1240 ca.) as author and lists almost forty manuscripts of it (http://sip.mirabileweb.it/manuscript/paris--bibliothèque--nationale--de--france--lat--15879--manuscript/148010). The date for this so far unknown author (not fitting the famous musician, certainly, who lived almost a hundred years later) is not compatible with De Boüard's remark, according to which "Le *Compendium Philosophiae* a été compose après la condemnation portée en 1277 par l'evêque de Paris" (De Boüard, "Encyclopédies médiévales", 293, fn. 2). This might be correct, but De Boüard was also of the opinion that this is a work which belonged to the "École de Strasbourg", Hugues de Strasbourg being the best candidate for its authorship (something which seems hardly acceptable since Hugues died before 1277). Ventura, refers to this work as anonymous (Ventura, "On Philosophical Encyclopaedism", 42). For an edition of the prologue, selected passages and the list of chapters according to the MS BnF Lat. 15879, see Michel De Boüard, *Une nouvelle encyclopédie médiévale: le* Compendium philosophiae (Paris: E. De Boccard, 1936), 121-206. For an updated study on the transmission of this text see Emmanuelle Kuhry, "La tradition textuelle du Compendium philosophie: une illustration des échanges culturels dans le monde monastique et scolaire anglaise", *Tabularia "Études"* 14 (2014): 235-270.

answer the main questions and get on without such a "superadded predicate," it is better, i.e., more economic, to simply renounce it. At the basis of the discussion a fundamental incompatibility, between (local) motion as a predicate and motion as a successive entity, is hidden. That is why a part of the discussion – above all regarding the first argument – can make the impression of an odd and empty disagreement about words. Buridan had already made it clear that the "*moveri*" in his concept of motion as "aliter et aliter se habere" is intended with a general meaning, including locomotion. As Anneliese Maier has pointed out, this is not an omission but an indication of the most central aspect of the *fluxus formae* theory.[74] Moreover, she has expressed the opinion that *fluxus formae*, particularly in the shape it received by Buridan and Albert of Saxony, was rather the theory on the nature of motion which late medieval philosophy thought transferred to early modern philosophy and science as an ontological pre-construct of the modern concept of inertia.[75] Legrand's discussion of the topic suggests now a critical revision of Maier's historical reconstruction. Further research work should determine whether Legrand's nominalism was an isolated case or – what I in fact presume – a widely supported doctrine, at least within some determined circles.

The sources of Legrand are not completely evident, yet. It is perfectly possible that Legrand's nominalism be connected with Gregory of Rimini rather than with Ockham himself, as Gregory of Rimini was probably the most outstanding philosophical figure within the same order to which Legrand belonged and within which he was intending to progress academically. It seems that the philosophical orientation of the Order experienced an important change of direction with Gregory of Rimini.[76] In any case, some texts *before* Gregory are anti-Ockhamist, not only in general regarding language, knowledge and theological matters, but specifically regarding the nature of motion.[77] On

[74] Maier, *Zwischen Philosophie und Mechanik*, 122.

[75] Maier, *Zwischen Philosophie und Mechanik*, 132, 143 (with special reference to Blaius of Parma). Sarnowsky (*Die aristotelisch-scholastische Theorie der* Bewegung, 148-49) has uttered some doubts about Maier's hypothesis.

[76] Founded in 1256, the Order of Hermits of Saint Augustine resolved in the General Chapter of Florence (1287) to follow the doctrinal line of Giles of Rome for the sake of doctrinal unity within the Order. Zumkeller indicates that this is still clearly evident in Gregory's predecessor, Thomas of Strasburg (Adolar Zumkeller, "Die Augustinerschule des Mittelalters: Vertreter und philosophisch-theologische Lehre (Übersicht nach dem heutigen Stand der Forschung)", *Analecta Augustiniana* 27 (1964): 166-262. For the adoption of Aegidius' doctrine, 168-170; on Thomas of Strasburg, 212-214. Occasionally, it can be noticed that Jacques Legrand is mentioned only very briefly in this paper and without reference to his *Compendium*, 244). Trapp held the view that Gregory's nominalism goes back to Augustine himself: "Gregory is the authentic follower of Augustine, the doctor gratiae, and of Augustine, the nominalist," Damasus Trapp, "Notes on the Tübingen Edition of Gregory of Rimini II", *Augustiniana* 30 (1980): 46-57, at 46.

[77] There is enough documentation substantiating anti-Ockhamism within the Order in the generation before Gregory, as for instance in Michael of Massa's discussion of the question "Utrum motus sit realiter ipsummet mobile quod movetur"; see William J. Courtenay, *Ockham and Ockhamism. Studies in the Dissemination and Impact of His Thought*, Studien und Texte zur Geistesgeschichte des Mittelalters 99 (Leiden: Brill, 2008), 285-346, ed. of the question at 339-346.

the contrary, some other texts belonging to the Order of the Augustinians Hermits, which are datable *after* Gregory's death, indicate that Gregory's philosophy was still alive in the next generations. Franz Ehrle, for instance, mentions the Augustinian Hermit, Bonsembiante Badoer, who in 1362/3 held lectures in Paris on the *Sentences* according to the doctrines of Ockham and Gregory (rather than of Thomas of Strasburg).[78] And despite all the nuances we cannot go into here, it seems evident to me that Hugolino of Orvieto is following Ockham's and Gregory of Rimini's approach at assuming the *forma fluens* theory.[79] Consequently, I think that the impact of Gregory's doctrine upon his own Order is a question which deserves more attention and, given the extraordinary significance that the treatment of physical questions occupies in Gregory's main work, the focus for the appreciation of his influence should not lie alone on theology, as it seems to be the case until now.

Finally, I would like to open the spectrum of reflections to questions which are beyond the punctual determination of the essence of motion, of its understanding as a *forma fluens* or a *fluxus formae* and of the pure theoretical implications of a minimal ontology. As we accept that we are trying to reconstruct lines of thought considering its adequate framework of reference, as we do approach the problems recognizing the existence and the role of institutions like universities and religious orders, I think that it is a fact hardly to deny that the socio-political factors are able to have a bearing on the development and transformation of ideas. Thus, it can be useful for the understanding of this particular case, to mention the change of the philosophical-political scene at the turn of the century, which could have influenced Legrand's tendency to nominalism. For, after a period of critical reception, nominalism was gaining more and more terrain to the point of becoming a politically more comfortable philosophical position, especially with regard to Council of Constance (1414-18), where the doctrine of the extreme-realist Augustinian John Wycliff – and

[78] Franz Ehrle, *Der Sentenzenkommentar Peters von Candia des Pisaner Papstes Alexanders V. Ein Beitrag zur Scheidung der Schulen in der Scholastik des vierzehnten Jahrhunderts und zur Geschichte des Wegestreites*, Franziskanische Studien, Beiheft 9 (Münster: Aschendorff, 1925), 51-55, at 55-56. Unfortunately, Ehrle's remarks are only linked to the doctrine of the "complexum significabile." For a comprehensive and up-to-date study on Gregory of Rimini focusing on philosophy of language and theology, see Pascale Bermon, *L'assentiment et son objet chez Grégoire de Rimini*, Études Philosophie Médiévale (Paris: Vrin, 2007). By the way, Ehrle characterized the period as "nominalist," a characterization that, from his Thomistic point of view, did not mean anything necessarily good (see Courtenay, *Ockham and Ockhamism*, 8).

[79] "Circa tertium articulum breviter pono tres conclusiones. Prima est quod motus localis non est accidens existens in mobili subiective. Secunda est quod motus localis non est fluxus mobilis existens in mobile subiective. Tertia est quod moveri est accidens predicabile de mobile tamquam de subiecto," Caroti, "Hugolinus ab Urbeveteri, 'Questiones super Physicam'", 114-115,601-606. The "moveri" as a predicable accident is valid for the other types of motion, not for locomotion: "motus localis non est in subiecto nec per consequens in mobile subiective, sicu plurimi opinantur" (116,658-659).

his followers – was condemned. Far from being only a general remark, this circumstance touches upon the immediate circle of intellectuals around Legrand. The famous nominalist philosophers Pierre d'Ailly and John Gerson (both, like Legrand, advocates of the Armagnac cause) belonged to the most visible personalities among the conciliarist movement and were not only committed to limit the Pope's power and to unify the Church, but also to the ideological repression and violent persecution of realism in theology and philosophy.[80] Yet – I wish to make clear – I do not hold it as proved that this background be the specific motivation for Legrand's nominalism. However, I consider it significant and likely enough as to be mentioned. A longer way of research is still to be traversed before we can arrive at safer knowledge. In the meantime, I think that this line of research deserves more attention. For, supposed that the facts I am speaking of were approximately as I have described them, it would have been too much of a coincidence to be *only* facts. I do not see any use in being aware of such a fitting context and, at the same time, dismissing its significance. After all, historians of the Augustinian Hermits have plentifully documented how active their order was in combatting the "heresies" of Wycliff and Hus during the Council of Constance, a historical event of the highest significance, for which the concept of

[80] Kaluza has pointed out that Gerson's criticism of the Scotist "formalizantes" is based on Ockham (Zénon Kaluza, "Gerson et les querelles doctrinales", in *Les querelles doctrinales à Paris. Nominalistes et réalistes aux confins du XIVe et du XVe siècle*, edited by Z. Kaluza (Bergamo: Pierluigi Lubrina Editore, 1988), 35-86, at 64). The issue has been studied again by Hoenen, who shows the extent to which Gerson was involved in the condemnation of the "formalizantes" as supporters of the heretical realism, especially with his *Sermo Prosperum iter* from 1415 (Marteen J. F. Hoenen, "'Modus loquendi platonicorum'. Johannes Gerson und seine Kritik an Platon und den Platonisten", in *The Platonic Tradition in the Middle Ages. A Doxographic Approach*, edited by S. Gersch and M. J. F. Hoenen, with the assistance of P. Th. van Wingerden (Berlin and New York: Walter de Gruyter, 2002), 325-343). Nevertheless, Hoenen leaves open the question about whether Ockham is indeed the main source of Gerson (at 336) and underlines the fact that Gerson had never characterized himself as a defender of nominalism. This would have rather been a position attributed to him in the midst of the "nominalism/realism" debate of the 15th century. Gerson's nominalism was incorporated into the classical approach by Gerhard Ritter, *Studien zur Spätscholastik, II, Via antiqua und via moderna auf den deutschen Universitäten des XV. Jahrhunderts*, Sitzungsberichte der Heidelberger Akademie der Wissenschaften, Phil-Hist. Klasse 7 (Heidelberg: C. Winter, 1922), 25. As for Pierre D'Ailly, see his intervention in Hus's trial as reported by the Taborist Peter of Mladoňovic in Matthew Spinka, *John Hus and the Council of Constance*, translated from the Latin and the Czech with Notes and Introduction (New York and London: Columbia University Press, 1965), 160. McGrade has pointed to a series of "political Ockhamism (still not sufficiently investigated, though) going from Ockham through Peter of Ailly, John Gerson, James Almain, and John Major even until John Locke," Arthur Stephen McGrade, "Rights, natural rights, and the philosophy of law", in *The Cambridge History of Renaissance Philosophy*, edited by Ch. B. Schmitt, Q. Skinner, E. Kessler and J. Kraye (Cambridge: Cambridge University Press, 1992), 738-756, at 745. See also Heiko Oberman, *The Harvest of Medieval Theology: Gabriel Biel and Late Medieval Nominalism*, revised ed. (Grand Rapids, MI: Baker, 2001).

motion itself might have been secondary, but its metaphysical background, menacing.[81]

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[81] Damasus Trapp, "Clm 27034: Unchristened Nominalism and Wycliffite Realism at Prague in 1381", *Recherches de théologie ancienne et médiévale* 24 (1957): 320-360; Francis Roth, "The Great Schism and the Augustinian Order", *Augustiniana* 8, 3 (1958): 281-298; and especially Adolar Zumkeller, "The Augustinians at the Councils of Constance and Basle", in *Theology and History of the Augustinian School in the Middle Ages*, edited by J. E. Rotelle O.S.A. (Villanova, PA: Augustinian Press, 1996), ch. IV, 155-186.

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RESEÑAS DE LIBROS/BOOK REVIEWS

Gretchen Reydams-Schils. *Calcidius on Plato's Timaeus: Greek Philosophy, Latin Reception, and Christian Contexts*. Cambridge: Cambridge University Press, 2020. 232 p. ISBN: 9781108420563. Cloth: £ 74.99

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La historia de la recepción de Platón y sus obras tiene en su haber un hito insoslayable, que a menudo no es reconocido con toda la fuerza que merece. Se trata de la traducción que del *Timeo* hizo Calcidio en el siglo IV d. C., y a partir de la cual la Antigüedad Tardía y la Edad Media entraron en contacto con las obras platónicas. Existía ya previamente la versión parcial que había realizado Cicerón, pero no parece haber contado con una circulación muy extendida para el momento que nos ocupa.[1] A su vez Calcidio, quizá respondiendo a una necesidad de su época, no se conformó sólo con traducir, sino que adjuntó un comentario, con la convicción de que la mera traducción no era suficiente para la comprensión de la obra platónica: "sola translatione contentus non fui ratus obscuri minimeque inlustris exempli simulacrum sine interpretatione translatum in eiusdem aut etiam maioris obscuritatis vitio futurum. Et ea quae mihi visa sunt in aliqua difficultate sic interpretatus sum (...)."[2] Esta traducción y su comentario se transformaron en los pilares de la especulación filosófica platónica durante la Antigüedad Tardía y la Edad Media. Incluido a veces en el conjunto de textos enciclopédicos tardoantiguos, a veces en el de textos filosóficos, el *Comentario* de Calcidio ha comenzado a recibir en las últimas décadas la atención que merece, no sólo como eslabón cultural en la transmisión de la filosofía platónica, sino también como fenómeno discursivo en sí mismo.[3]

Si hay una persona adecuada para llevar a cabo la tarea de estudiar el texto de Calcidio desde esta perspectiva, es sin duda Gretchen Reydams-Schils. Profesora en el Programa de Estudios Liberales y *Fellow* en el Medieval Institute de la Universidad de Notre Dame, tanto sus campos de especialización (las tradiciones del Platonismo y del Estoicismo), como sus publicaciones previas en el área (*Demiurge and Providence: Stoic and Platonist Readings of Plato's*

[1] Sobre la recepción del *Timeo* en la tradición latina, véase Béatrice Bakhouche, y Alain Galonnier, *Lectures médiévales et renaissantes du* Timée *de Platón* (Lovaina: Peeters, 2016).

[2] Calcidio, *In Tim.* 1.4: "no estuve satisfecho solamente con la traducción, pensando que la representación de un modelo oscuro y poco claro, traducido sin interpretación, resultaría en un defecto de igual o incluso mayor oscuridad que la del modelo, y así, expliqué las cosas que me parecieron de alguna dificultad." El texto latino es el de Waszink (1962) y la traducción es mía. Véase Jan Hendrik Waszink, *Timaeus a Calcidio translatus commentarioque instructus* (Corpus Platonicum Medii Aevi, Plato Latinus 4, Leiden and London: Brill, 1962; version revisada 1975).

[3] Stephen Gersh, *Middle Platonism and Neoplatonism. The Latin Tradition* (Notre Dame-Indiana: University of Notre Dame Press, 1986).

Timaeus, 1999; *The Roman Stoics: Self, Responsibility, and Affection,* 2005; *Plato's Timaeus as Cultural Icon* (ed.) 2003; *Thinking Through Excerpts: Studies on Stobaeus* (ed.) 2011; y *Pouvoir et puissances chez Philon d'Alexandrie* (ed.) 2016) evidencian no solo lo especializado de su formación, sino también la perspectiva de sus investigaciones, que favorecen una mirada profunda sobre el *Comentario* calcidiano. Para la autora, el texto de Calcidio constituye, junto con la *Consolación de la Filosofía* de Boecio, el *Comentario al Sueño de Escipión* de Macrobio, y *Las nupcias de Filología y Mercurio* de Marciano Capela, uno de los textos centrales del período (Introduction, 1). Su acercamiento al texto, que combina tanto la lectura filosófica como el enfoque discusivo, el diálogo con la tradición y la relación con el contexto, queda clara cuando enuncia su objetivo principal: "My main purpose, therefore, is to give Calcidius' commentary the attention it is due in its own right, and to examine the commentary's relation both to the preceding traditions and to contemporaneous currents of thought." (Introduction, 1-2). Lejos estamos de la idea que dominó el estudio de los comentarios en décadas anteriores, según la cual estos son repositorios pasivos de saberes previos y citas, producto de operaciones de copiado y pegado de quienes los escribieron, cuya voz se diluye entre las palabras de los *auctores* consagrados de la tradición.

El libro *Calcidius on Plato's Timaeus: Greek Philosophy, Latin Reception, and Christian Contexts* – producto de intereses muy tempranos de su autora, y sostenidos a lo largo de muchos años, como se señala en la sección "Acknowledgements"– anuncia desde su título la intención de combinar dos aspectos centrales en el estudio del *Comentario* de Calcidio. Por un lado, su especificidad, ya que el libro se encuentra por entero dedicado al estudio de esta obra. Por otro lado, la inserción del *Comentario* de Calcidio en las coordenadas en que debe ser leído: la Filosofía griega, la recepción latina tardía, y el contexto cristiano en que se produce. Esta mirada promete un análisis profundo, necesario, y relevante de la obra (y el lector no quedará decepcionado).

La autora propone tres secciones para desarrollar su análisis: la primera se centra en el examen de la voz autorial del comentarista y en el propósito general de la obra; la segunda proporciona un panorama de los temas centrales allí expuestos; y finalmente la tercera analiza las relaciones que el *Comentario* establece con sus posibles fuentes y con la tradición cristiana con la que convive. Esta organización favorece un movimiento dialéctico entre autor, texto y contextos, que nos anticipa lo comprehensivo y exhaustivo del trabajo de Reydams-Schils.

En la sección "Introduction" se retoman de manera precisa algunos problemas relacionados con el autor y la interpretación de su obra, tomando como hito la publicación de la edición de Waszink (1962) – cuyo texto latino sigue la autora –, a partir de la cual se produce un cambio de perspectiva sobre el estudio de Calcidio y su obra.[4] Para empezar, se modifica la datación de Calcidio, situándolo a fines del siglo IV o principios del V, y no a principios del siglo IV como era la *communis opinio* anterior (datación que, no obstante, la autora preferirá descartar, para volver a una datación más temprana, luego de un análisis

[4] Véase Jan Hendrik Waszink, *Timaeus a Calcidio translatus.*

minucioso de los conceptos filosóficos sostenidos por Calcidio a lo largo del texto). En segundo lugar, la idea del *Comentario* de Calcidio como mero eslabón en la transmisión de la filosofía platónica es revertida también, para dar lugar a una mirada más comprehensiva acerca del fenómeno genérico-discursivo del comentario, que contribuya a un entendimiento más profundo de la obra y sus propuestas filosóficas.

En la primera parte del libro, Reydams-Schils analiza la voz autorial de Calcidio en el *Comentario*. Para la autora, en la búsqueda de la construcción de su autoridad discursiva, Calcidio utiliza el tema de la oscuridad de los textos filosóficos para definir su posición como traductor y comentarista, y decide compartir y explicar este conjunto de conocimientos, yendo quizá en contra de una práctica establecida en las escuelas filosóficas. Asimismo, la figura de Platón, tal como es presentada por Calcidio, parece requerir una operación de "rescate", para deshacer el daño que han causado en su lectura no solo los filósofos que representan otras corrientes de pensamiento, sino también aquellos que afirman haber sido sus seguidores dentro de la propia tradición platónica. Así, la figura de Calcidio como comentarista se vuelve indispensable, y sigue manteniendo el equilibrio con la *auctoritas* platónica, que simplemente está ahora más lejana, pero no por ello es menos verdadera.

Poco más adelante, teniendo en cuenta esta construcción autorial, Reydams-Schils busca establecer una serie de propósitos del *Comentario*, con el objetivo de establecer un plan de lectura de la obra. A través de un minucioso análisis, la autora nota que la lista de temas en el Prefacio anuncia un tratamiento temático de los contenidos del *Timeo*, y la división de las diferentes ramas de la filosofía en el capítulo 264 proporciona información sobre la estructura general del *Comentario*. De este análisis surge que, contrariamente a lo que ocurre con otros autores neoplatónicos, Calcidio avala una hermenéutica de lectura secuencial del *Timeo*, un enfoque que, para la autora, se refleja en su visión de la estructura de la realidad. Esta analogía entre la construcción discursiva y la perspectiva filosófica refuerza el abordaje integral del *Comentario* que el libro propone. Asimismo, para Reydams-Schils el ordenamiento temático del *Timeo*, lejos de ser un simple esquema de contenidos, es un primer estadio calcidiano de interpretación de Platón, quizá tomado de otra fuente previa, quizá de su propia mano que ha abrevado de varias, pero igualmente original: "In sum, then, the list of headings already reflects an attempt to structure broader thematic treatments of issues raised by the Timaeus and an intervention to systematize the account. Even if Calcidius had found the list ready-made in another work, it does not necessarily follow that there is a single, primary source behind the commentary. On the contrary, the discrepancies between the list and the commentary may well be indicative of Calcidius' own hand in the overall structuring of his material." (37). Queda claro, entonces, que la voz del comentarista selecciona y organiza los contenidos, y se aleja drásticamente de esa figura desdibujada y servil a las fuentes con la que se lo identificó durante mucho tiempo.

Finalmente, la autora señala que Calcidio prefiere un nivel ordenado de lectura e interpretación, frente a una lectura más sinóptica – y más esperable en el contexto del neoplatonismo de la época –: "We can hardly miss the point that Calcidius prefers a sequential reading of the Timaeus to a synoptic approach. A Neoplatonist reader would

bring the entire Timaeus to bear on any given section. For Calcidius, by contrast, when one talks about body, or even more specifically, the four elements, one focuses on issues pertaining to that topic, and when one discusses the soul, returning to a previous level of discourse would be a sign of confusion." (35).

En la segunda parte la autora analiza los conceptos que Calcidio aborda, trazando de alguna manera una analogía entre estos y la organización discursiva estudiada en la primera parte. Así, no solo son analizadas las tradiciones que Calcidio pone en diálogo, sino también la *forma* en que estas son presentadas por el comentarista, otorgándole una clara relevancia a la construcción del texto y de la argumentación.

En cuanto a la postura filosófica de Calcidio, Reydams-Schils sostiene que el punto de vista que recorre todo el comentario presenta un dualismo mínimo en un mundo eternamente existente: en el lado divino de la realidad, encontramos (1) un dios más elevado, (2) un segundo dios y una primera mente, que representa la voluntad del primer dios, y (3) un alma noética supracósmica (que no está incluida en la jerarquía explícita de niveles divinos de Calcidio en los caps. 176-177 y 188). En la mayoría de los casos, el Demiurgo de Platón parece representar al primer y segundo dios tomados juntos, pero con énfasis en el segundo. En el otro extremo del espectro, encontramos (1) una materia completamente neutra, que coexiste eternamente con los agentes divinos, (2) rastros de los elementos que introducen movimiento en la materia pero que no son cuerpos completos, y (3) un alma inferior, una fuerza vital que es la compañera inseparable de los cuerpos. Por otro lado, la noción de Providencia es central para el concepto de Calcidio del universo ordenado, pero sin que ello socave, a través de los edictos del destino, la libertad moral humana.

Por último, un ejemplo del abordaje de la autora en esta sección es la lectura que realiza del sub-tratado sobre la materia, al que Calcidio dedica un tercio de su *Comentario*, y cuya relevancia Reydams-Schils explica de la siguiente manera: "In light of the educational program he has set for himself, the topic of this sub-treatise represents the most advanced level in theoretical philosophy within the commentary (..)." (118). Esta sección resulta interesante en el análisis de Reydams-Schils porque es presentada como una micro-puesta en escena de la mecánica del *Comentario*, y nos ilumina acerca de su método de lectura y análisis. Como ha hecho a lo largo de todo su texto, Calcidio comienza el sub-tratado sobre la materia con un breve resumen de lo que considera la posición de Platón; revisa todos los componentes que forman parte de la definición de la materia y su función como un principio que coexiste con Dios y con la realidad inteligible; y en el pasaje final, propone su posición y retoma para ello elementos que ha ido deslizando a lo largo de los capítulos previos, mostrando, en opinión de la autora, que la organización del material persigue un objetivo preciso, tanto en el uso de las fuentes como en su *dispositio* retórica.

Considerando el lugar de privilegio que Calcidio otorga a Platón, Reydams-Schils observa en la tercera parte del libro que el autor aprueba a Aristóteles cuando los puntos de vista de este último pueden interpretarse como acuerdos con los de Platón, y es crítico cuando esto no es posible. Aristóteles termina ocupando así un término medio no infrecuente en la tradición platónica (no hay más que recordar la figura de Aristóteles en el

Comentario al Sueño de Escipión de Macrobio). Por otro lado, el uso de Calcidio del material estoico, que parece conocer bastante bien, es más complejo: a pesar de su aparente crítica, Calcidio (o la fuente en la que se basa) toma principios estoicos para desarrollar y justificar sus propios puntos de vista. Finalmente, el último tercio del comentario, el sub-tratado sobre la materia, presenta un fuerte acuerdo sobre el estado y el papel de la materia entre Pitágoras, Platón, Aristóteles y los estoicos. La autora concluye que Calcidio representa una corriente del siglo IV de comentarios filosóficos en latín que *no* está dominada por la recepción de Porfirio, y que incluso la fuerte presencia numeniana no es definitoria en el *Comentario*, sino que Calcidio incluso se aleja de las interpretaciones de Numenio sobre Platón y se muestra como un pensador más independiente de lo que la crítica siempre ha creído. Así, en lugar de intentar encontrar el menor número posible de fuentes para justificar cada una de las afirmaciones o propuestas de Calcidio, el estudio de Reydams-Schils destaca la propia mano del comentarista como artífice de su texto, no solo en la línea consistente de interpretación que propone, sino también en su estructuración del material.

Todo este recorrido culmina en el capítulo "Who is Calcidius?", conclusión y cierre del libro, donde se muestra claramente la interesante apuesta de la autora. Los conceptos filosóficos, las estrategias discursivas, los diálogos con autores e ideas, todos estos elementos que Reydams-Schils ha desplegado nos conducen a la construcción de un Calcidio comentarista-filósofo, y su figura, previamente un tanto desdibujada, se delinea claramente a partir de este recorrido exhaustivo de su texto. Calcidio es, entonces, un autor con una conciencia fuerte y segura de su papel como transmisor de un legado filosófico griego a través de su traducción y comentario al *Timeo* de Platón.

Sobre la base de su análisis, Reydams-Schils cuestiona también el supuesto cristianismo de Calcidio. Aboga – coincidiendo con parte de la crítica – por una datación más temprana, ya que considera que tiene más sentido colocar a Calcidio en una era en la que el cristianismo estaba ganando terreno, pero aún no se había vuelto tan dominante como para que comentar el *Timeo* de Platón fuera una tarea complicada (o incluso peligrosa).[5] Tampoco hay rastro en el comentario de ninguno de los debates sobre las doctrinas de la Trinidad y la creación, o de la controversia sobre Orígenes, y la obra parece reflejar una capa de platonismo anterior a Plotino y Porfirio. En este sentido, entonces, sería engañoso agrupar a Calcidio con el neoplatonismo cristiano latino. Para Calcidio, el *Timeo* y Platón constituyen el último marco de referencia, pero a través de Osio, destinatario de la obra, Calcidio también busca llegar a una audiencia cristiana. Como suele ser el destino de los buenos comentaristas, en la tradición posterior la voz de Calcidio llegó a confundirse con la del propio Platón, y a representar, sin mediaciones, su punto de vista.

El libro de Reydams-Schils se completa con una extensa bibliografía (seguida de un *Index locorum*) tanto específica como general, que contempla títulos actualizados y también

[5] John M. Dillon, *The Middle Platonists, 80 BC to AD 220* (Ithaca, NY: Cornell University Press, 1977), 402; Claudio Moreschini, "Calcidius between *creatio ex nihilo* and Platonism", in *Light on Creation: Ancient Commentators in Dialogue and Debate on the Origin of the World,* edited by G. Roskam and J. Verheyden (Tübingen: Mohr Siebeck, 2017), 259–276.

"clásicos" sobre la materia, a los cuales la autora pone en diálogo con su propia perspectiva. Como un ladrillo más en la infinita construcción hermenéutica que desencadena la recepción de los textos, el libro de Gretchen Reydams-Schils se suma como un recorrido ineludible para los estudios sobre la tradición platónica y el *Timeo*. *Calcidius on Plato's Timaeus* no sólo enriquece nuestra lectura de la obra de Calcidio, sino que también se deja construir, a través de este *Timeo* tardoantiguo que nos devela, como un espacio textual de diálogo y encuentro entre Platón, Calcidio y nosotros, sus lectores.

Mark Edwards, Dimitrios Pallis, and Georgios Steiris. Eds. *The Oxford Handbook on Dionysius the Areopagite*. Oxford: Oxford University Press, 2022. 729 p. ISBN: 9780198810797. Cloth: $ 145.00

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La mayoría de los artículos del volumen que nos ocupa proceden de una conferencia organizada por el erudito dionisiano Dimitrios Pallis con el apoyo de las universidades de Oxford y Atenas. Este evento académico se llevó a cabo en Oxford hace unos años. El resultado final del volumen combina esas contribuciones con artículos adicionales de ciertos académicos que fueron invitados a unirse a este proyecto, que fue publicado por Oxford University Press. Ciertamente, esta obra es el volumen más completo y extenso sobre la creación del *Corpus Dionysiacum* y sus recepciones en diferentes tradiciones, que ha aparecido en inglés hasta el momento.[1]

De entre los numerosos y variados méritos que puede atribuírsele a esta obra, es necesario señalar como primero el título de la misma. Como nombre para el Manual, no han escogido el título mismo de la conferencia, sino el apelativo que el autor del corpus se dio a sí mismo. En este sentido, ya era hora de hacer lugar a la opinión de reconocidos académicos que han insistido en dejar de lado el peyorativo "pseudo" para designar al autor del *Corpus*. Como los mismos editores lo explican en la Introducción: no habiendo escritos del homónimo de Atenas en el siglo I, no es necesario distinguirlo como autor del siglo VI y es muy oportuno concederle el nombre que se dio a sí mismo.

Mientras en este volumen se da tratamiento a algunas de las muy distantes hipótesis de identidad y filiación estratégica del autor del *Corpus*, y a pesar de una clara evolución en la hermenéutica dionisiana, la enigmática figura de Dionisio permanece elusiva para sus lectores. Nada mal para un doctor en la doble negación trascendental.

El Capítulo I que sirve de Introducción de los tres editores (Edwards, Pallis y Steiris) hace una muy interesante presentación del libro comentando el aporte de valor de cada uno de los artículos, coincidencias y divergencias entre las apreciaciones o interpretaciones de algunos autores junto con diferentes hipótesis interpretativas que hacen a la riqueza del legado dionisiano.

La organización de los cuarenta capítulos del volumen se realiza en cuatro secciones que se corresponden, en cierto sentido, con el origen fundacional y despliegue temporo-espacial de las recepciones del *Corpus*. Se atienden inicialmente algunas de las fuentes paganas y cristianas más centrales a la conformación del crisol dionisiano donde hallan

[1] Puede hallarse más información y una discusión útil sobre el razonamiento del proyecto en la Introducción del volumen (1-10).

presentes Filón y Clemente; Orígenes y Evagrio; Gregorio de Nisa; y por supuesto, Jámblico y Proclo.

Al seguir el orden propuesto de lectura se viaja junto a Dionisio del oriente griego al occidente latino; de las traducciones – siríaca incluida – y glosas tempranas, al Eriúgena del renacimiento carolingio; de Bizancio a París y a los variados comentarios de la alta edad media, con la aristotelización de la lectura de Dionisio o quizás, mejor dicho, la dionisación de la recepción aristotélica. se proporciona.

Pueden encontrarse, en estos capítulos centrales del volumen, elaboraciones de los especialistas sobre instancias que han dado en llamarse como los episodios más luminosos de la filosofía y teología medievales. De la pluma de Alejandro de Hales y Hugo de San Víctor; Buenaventura y Grosseteste; Alberto Magno y Tomás de Aquino; se configura así con ellos el ordenamiento teológico del *exitus* al *reditus*, el apofatismo y la teología de la luz.

No faltan en estos análisis del influjo dionisiano las diversas formas receptivas que surgen en el contexto luterano; las denominadas "intelectual" y "afectiva"; la dependencia de los místicos renanos; la presencia fundamental en el Cusano y los humanistas del renacimiento, sin que deje de mencionarse esa maravillosa síntesis teológica de la época llamada *Divina Comedia*.

Cabe resaltar que estas nominaciones específicas, ya sea en las referencias a las fuentes directas e indirectas de Dionisio o las de sus distintas recepciones, se corresponden con la forma en que parece pensado y curado este volumen. En su desarrollo puede apreciarse que la propuesta de "navegación" no es tanto por las corrientes de pensamiento previas y posteriores al Areopagita, sino por los filósofos y teólogos concretos – cuidadosamente seleccionados – presentados como exponentes de esas corrientes.

Puede tomarse aquí el caso de Pletón. Si bien la mayoría de los estudiosos de este pensador bizantino tienden a enfatizar sus deudas con el neoplatonismo, Georgios Steiris sostiene que una cuidadosa lectura de su programa de interpretación política revela afinidades ontológicas y teológicas con Dionisio que, hasta ahora – más allá de la raíz común con Proclo –, no habrían sido suficientemente desarrolladas.

Por otra parte, al promediar la lectura de la obra se percibe que el espíritu colaborativo de las contribuciones y el mérito de la composición editorial refleja la amplitud temática del cosmos dionisiano. Y, por tanto, refleja también, los acentos y omisiones con que fue leído muchas veces el legado del Areopagita. Desde una mirada espiritual del *coram Deo* en ámbitos de la reforma protestante; la supresión de las referencias a las Escrituras en el *Corpus*; una exageración de su teología simbólica, así como también una anulación de la misma; un misticismo menos místico y más hermético o gnóstico; y de igual manera, puede hallarse una apropiación en ascetas y contemplativos, obispos y eruditos, platónicos, hegelianos y posmodernos.

Este estudio pormenorizado llega incluso hasta algunas de las recepciones contemporáneas. Por ejemplo, el principal punto de discordia entre Derrida y Marion en lo

que se refiere a la relación entre la deconstrucción y la teología negativa. En la discusión entre ambos franceses surgen dos cuestiones clave de interpretación de las *Areopagíticas*: si la doble negación dionisiana y la oración en Dionisio hacen lugar a un Dios supraesencial determinado, o si conducen más allá de todas las determinaciones y predicaciones del ser. Sin embargo, ambos coinciden en un silenciamiento de las jerarquías dionisianas y su función en la mediación con lo divino.

Quince siglos separan al Areopagita de sus lectores en el siglo XX, pero como bien se expresa en algún lugar de la obra, hay – salvando las distancias – elementos que Dionisio comparte con Homero y otros clásicos que ratifican su enorme vigor a través del tiempo.

Es así como Mark Edwards analiza, en uno de los capítulos, la llegada de Dionisio a tres teólogos del siglo veinte. Inge quien, de acuerdo con sus propios intereses, trata a Dionisio principalmente como místico, y uno a quien encuentra tanto menos de su gusto cuanto más se ve obligado a admitir su influencia en la tradición posterior. Lossky es más amable con su apofatismo, pero, a pesar de su propio deseo de revigorizar el pensamiento ortodoxo a partir de fuentes patrísticas, apenas es más consciente que Inge del escenario litúrgico del ascenso de la ignorancia al desconocimiento voluntario. Y von Balthasar, por el contrario, para quien el término "liturgia" abarca la ordenación armoniosa de cada elemento del cosmos para el bien de sus habitantes y la gloria de su Creador. No son sólo los ortodoxos los que afirman el papel cardinal de las jerarquías en el sistema dionisíaco, sino los eruditos y teólogos de toda tradición que leen el *Corpus* como un todo y sin ningún concepto limitativo de lo místico.

Varios autores a lo largo del volumen discuten si, de alguna forma, la integración de neoplatonismo y cristianismo de Dionisio hace justicia a todo Platón y todo Aristóteles, pero también a todo Pablo, Orígenes, Clemente, Evagrio y Gregorio. Una discusión más que interesante de proseguir. Lo que sí puede afirmarse es que este Manual sobre Dionisio el Areopagita ciertamente le hace justicia. Y, sin dejar de mencionar positivamente el evento y volumen que le dedicara la SIEPM a la tradición dionisiana en el 2019,[2] contribuye a expandir el legado del Areopagita en el siglo XXI.

Huelga aquí poner de manifiesto la reputación que precede a los especialistas que se han dado cita para esta obra. Autoridades largamente reconocidas en Dionisio Areopagita, el neoplatonismo tardo-antiguo, sus fuentes y sus recepciones. Es claro que, por la relevancia de los nombres e importancia de los tópicos visitados, este volumen se constituye en una excelente síntesis dionisiana, sea como nuevo material de consulta o como referencia obligada para quienes busquen profundizar en estos temas de permanente vigencia.

[2] Georgi Kapriev (ed.), *The Dionysian Traditions. 24th Annual Colloquium of the SIEPM, September 9-11, 2019, Varna, Bulgaria* (Rencontres de Philosophie Médiévale 23, Turnhout: Brepols 2021).

Daniel D. De Haan. *Necessary Existence and the Doctrine of Being in Avicenna's* Metaphysics of the Healing. Investigating Medieval Philosophy 15. Leiden/Boston: Brill, 2020. xvi + 426 p. ISBN: 9789004430372. Cloth: € 138/$ 166

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De Haan's book is a revised doctoral dissertation written as a *cotutelle de thèse* between the University of St. Thomas, Houston (Texas) and the Katholieke Universiteit Leuven. Its 426 pages spread over ten chapters, an introduction, a conclusion, a bibliography, and an *index rerum et nominum*. The ten chapters themselves are distributed over four parts, each comprising two chapters, with the exception of part three, which contains four chapters, thus making for one third of the book.

The introduction describes the *Metaphysics* of Avicenna's most detailed and longest work *al-Šifāʾ* as an "Aristotelian metaphysical science whose subject is being *qua* being", which "eventually culminates in an aitiological and theological investigation into the existence and true-nature of the necessary existence in itself" (2). This, De Haan writes, conjures the "problematic" of how and why Avicenna proceeded from the one to the other, i.e., from ontology to theology. Suggesting that a fresh investigation of the scientific principles of Avicenna's philosophy will shed some light on these questions, De Haan recommends a thorough examination especially of book I of Avicenna's *Metaphysics* to describe the scientific backbone of metaphysics as conceived and put into words by Avicenna.

Even though the first book of Avicenna's *Metaphysics* of *al-Šifāʾ* has perhaps received more attention than any other so far, other areas within the history of philosophy, e.g., the study of the Presocratics or of Plato and Aristotle, have shown repeatedly that even a renewed investigation of better-known parts of a philosopher's oeuvre can be very fruitful – and at any rate, we are still only wading knee-deep through the profound waters of "Lake Avicenna". In that sense, De Haan's decision to revisit the foundational chapters of a monumental work is surely justified. Unfortunately, the result is somewhat less gainful than expected.

In Part One, comprising the first two chapters (13-92), De Haan trots by and large known paths, and so one quickly detects in the book's pages an overall strong reliance on earlier publications by Riccardo Strobino, Deborah Black, Asad Ahmed, and Jon McGinnis. Not displaying any active, critical, or innovative engagement with their interpretations, De Haan produces a synthesis which is overall not wrong but which does not bring anything significantly new to the table either. Readers well or semi-well versed in Avicenna might prefer to skip the first part *in toto*, while readers less familiar with Avicenna might profit from the De Haan's informed introduction into Avicennian logic, metaphysics, and

modality. The materials which De Haan presents at length in the first part would surely be justified if he was to return to them and to integrate them into his later analysis. However, apart from sporadic references, the materials on the first eighty pages remain strangely unconnected with the rest.

Somewhat disconcertingly, Part Two, comprising chapters three and four (95-179), starts similarly. De Haan explicitly announces – or: admits – that he will be "presenting a condensed digest of the historical and philosophical conclusions arrived at in Amos Bertolacci's *The Reception of Aristotle's Metaphysics in Avicenna's* Kitāb al-Šifāʾ" (96). This "digest" includes *inter alia* even a table of contents and a basic structural overview of Aristotle's *Metaphysics*, and describes the various interpretations of the theme of Aristotle's *Metaphysics* as prevalent among Avicenna's predecessors. This is followed by a long account of the old – but admittedly still exciting – theme of Avicenna's analysis of the subject-matter of metaphysics on the basis of a close reading of large portions of the first book of Avicenna's *Metaphysics*, filling the remainder of chapter three, but proceeding with neither surprises nor relevant new insights. De Haan's overall noticeably repetitive report of Bertolacci's analysis remains very close to the original from 2006, which in turn was partially based on earlier articles. What this means, in effect, is that De Haan's account of the structure of metaphysics relies in part on insights from 2002.

The book becomes more stimulating on page 152 – in the fourth chapter – when De Haan finally engages critically with secondary literature and provides a new reading – or rather reinforces an older interpretation by Ed Houser from 1981 that he thinks deserves closer attention. This is worthwhile and contains valuable moments, even if the central idea of this chapter was already developed in one of De Haan's earlier publications, focusing on the question whether or not the first book of Avicenna's *Metaphysics* contains a proof for God's existence (some of his ideas from that earlier article also enrich the subsequent fifth chapter of his book, esp. 202-214). In 2016, when the article appeared, De Haan's answer was "no", and it was based on the argument – now further developed in his monograph – that the second half of the first book of Avicenna's *Metaphysics* (i.e., chapters I.5-8) is concerned with "providing us with insights into the proper first principles of metaphysics"[1]. This being so, I found the concise and succinct exposition in De Haan's article more compelling than the volatile meanderings in chapter four of his book. Admittedly, some of these meanderings have become necessary, because De Haan apparently realised that the concise, clear-cut answer he gave in 2016 is not entirely without its own tensions once it is more fully articulated, and so in his book, De Haan is now trying to argue for his view also by responding to and integrating some of the problematic points. While chapter four is by no means uninteresting, it is repetitive in a way that seems to actively confuse the reader who wonders whether De Haan's changes of pace and direction within his narrative are accompanied by new bits of information or merely by new formulations. It is a peculiar mix of old and new, of relevant and not-so-relevant, that makes it difficult to see where De Haan

[1] Daniel D. De Haan, "Where Does Avicenna Demonstrate the Existence of God?", *Arabic Sciences and Philosophy* 26 (2016): 97–128, here 104.

is actually headed and what he has to offer. (Additionally, this makes his book also a difficult read for the beginner student of Avicenna's philosophy, who may have enjoyed the book's first part.)

In chapter five, the first of four constituting the book's long third part (183-336), De Haan is back to repeating and restating earlier research. This time, he relies heavily on common knowledge about the well-known four senses of being in Aristotle's metaphysics and, especially, on Stephen Menn's analysis of it in al-Fārābī as a forerunner of Avicenna (and in Averroes as a critic of him) as well as Bertolacci's investigation of how themes from Aristotle's *Metaphysics* reappear in Avicenna's work. The reader is not informed about why De Haan decided to provide only these three selective spotlights – one each on Aristotle, al-Fārābī, and Avicenna – and, thus, why he left the rest of the history of philosophy in the dark, even though other studies have already shown that our understanding of Avicenna profits greatly from a broader and more inclusive analysis of the pre-Avicennian Arabic philosophical tradition (not to speak of late ancient Greek thought). In fact, broadening his analysis here would have been a convenient opportunity for De Haan also to go beyond the secondary literature he summarises so extensively and, effectively, to add to it. (In this regard, it is off the point that De Haan in the conclusion of chapter six refers to the "complex and diverse spectrum of metaphysical doctrines" prior to Avicenna (268); he is surely right about the diverse spectrum, but his study did not make use of it.) However, selective even as it is, De Haan quickly switches off that one spotlight on al-Fārābī and, having presented his views on being, does not integrate them into the subsequent analysis of Avicenna beyond a few isolated remarks. One of them, for example, is De Haan's assertion that al-Fārābī takes *wuǧūd* in the sense of "to be", whereas Avicenna takes it in the sense of "to exist" (202). No explanation is given as to what this shift means or entails, nor what would have motivated it for Avicenna. Of course, it is related to Menn's analysis of al-Fārābī's ontology which reappears in De Haan under the label "essentialism" (contrasted to Avicenna's "existentialism"), but the presentation of the view barely scratches the surface. (De Haan comes closest to an explanation more than thirty pages later in chapter 6.2, as far as I could see.)

Even more problematic from a reader's perspective, though, is De Haan's choice to translate Avicenna's *mawǧūd* as "being": if it is so pivotal that Avicenna shifts from "to be" to "to exist", then why is Avicenna in De Haan's preferred terminology concerned with "the being" and not with "the existent"? On the other hand, De Haan immediately states that "absolute being signifies *existence*" (203) anyway, and then talks about Avicenna's metaphysics being concerned with "absolute being", thus avoiding the notion of "existence". (The worry could be expanded to the second half of De Haan's book, where he occasionally seems forced to avoid his own preferred terminology and to write about "the existent" or about "being or the existent" as a translation for *mawǧūd*.) As it is, De Haan claims to contextualise Avicenna's innovations, but the result remains, again, disconnected.

Regarding De Haan's interesting interpretation – known already from the above-mentioned article – that Avicenna's investigation of the necessary and the possible in

Metaphysics I.6-7 is meant to integrate into his account of principles Aristotle's sense of being as potency and actuality (206-211), De Haan reserves more space for a rather subtle clarification concerning the translation of *bi-ʿaynihī* in a sentence of Avicenna's *Metaphysics* I.4, §1 (alongside the implications of that translation), than for the, in my opinion, much more important – and for De Haan's overall interpretation potentially problematic – question whether "the investigation of potentiality and actuality" is analogous (a) to the account of the possible or (b) to that of *both* the necessary and the possible. Syntactically the Arabic may lean rather towards (a) than towards (b), especially because if (b) was the correct reading, then there is no reason why all the other accounts listed in the first half of the entirely paratactic sentence would not also belong to that same investigation of potentiality and actuality. On a doctrinal level, it remains unclear why the investigation of potentiality and actuality should be connected also with *Metaphysics* I.7, which covers the unity of that which is *necessarily* existing through itself (and the lack of unity of what is possible). Instead, it would make more sense to read the passage in light of option (a) – of which De Haan seems unaware – and, thus, to consider the investigation of potentiality and actuality as tantamount to the investigation only of the possible, i.e., of that which is possible in itself (and necessary through another). While this investigation could, then, indeed correspond to *Metaphysics* I.6, it could pose a threat to De Haan's overall reading – and perhaps even a danger to his in many ways convincing view that the first book of the *Metaphysics* does not contain a modal proof of the Necessary Existent.[2]

In chapter six, De Haan trots, again, well known paths about "primary notions". Among his main claims is that Avicenna's (four) primary notions being, thing, one and necessary in Avicenna are co-extensional in such a way that they all together – and not alone being – are absolutely prior to any further "notional constriction" and also to categorical being. Dissent with earlier interpretation is stored away in footnotes (e.g., fn. 11 and 67), even though it could have been a major theme of his discussion had it been promoted to the main text. Admittedly, though, De Haan's remarks on the co-extensionality of the primary notions receive their reprise later in the context of chapters nine and ten, which are, then, concerned with the question whether the primary notions are also co-intensional (again with discussions of other views from the literature in footnotes). Be this as it may, chapter six evolves into an investigation of being and existence and gives some more context to earlier discussions from chapter five. This contextualisation – both doctrinal and historical – is welcome and was needed, even though it mainly relies, again, on earlier analyses by Stephen Menn, Robert Wisnovsky, Thérèse-Anne Druart, and others.

In particular, the (short) accounts of the primary notions "one" and "necessary" are wanting. Both would have constituted good opportunities for historical and/or philosophical analyses beyond the state-of-the-art in the secondary literature used. The notion of "one", for example is one of the richest notions in the history of philosophy, and Avicenna's stance towards, and the extent of his awareness of, Neoplatonic accounts of "the

[2] Indeed, later in the book, De Haan states explicitly: "Necessary existence in itself alone is *entirely separate from or stripped of any association with potentiality* and possibility", 284, my emphasis.

one" is still an open question. The "necessary", on the other hand, is simply accepted by De Haan along the lines of a "temporal frequency model" (see "permanence of existence" on 260) and there is no attempt to explore whether there is more to Avicenna's conception nor an awareness about the philosophical limitations a "temporal frequency model" could impose upon Avicenna's modal ontology. Moreover, De Haan states that "existence … is convertible with *necessity*, and so all beings that exist are necessary and their existence is necessary", (262f.) without realising the implications that this view – and the way he put it into words – may have for questions about causal determination, for which the literature on Avicenna is not unanimous. All these would have been apt explorations for a book called "Necessary Existence and the Doctrine of Being". Instead, De Haan reiterates, among other things, Avicenna's household statements that "necessary", "possible", and "impossible" can only be defined in a circular way and that "necessary" nonetheless enjoys primacy. Other than that, De Haan starts in chapter six and continues in chapter seven to apply features of the necessary existent in itself invariably also to the necessary existent through another. Hence, for him, every existent is necessary, invariant in terms of existence (*taʾakkud al-wuǧūd*), and even permanent (*dawām al-wuǧūd*; 264, 266); indeed, he writes – without qualification – that "possible existents are necessary" (273) – but there surely are possible existents that are not necessary (yet). Of course, De Haan understood what Avicenna meant, but he appears to be rather careless in his use of terms when he is talking about possible and necessary existents. In fact, one wonders whether he is careless or rather makes an interpretive move here – especially because his remarks about his preferred translation of *taʾakkud al-wuǧūd* as "invariance of existence" may indeed suggest such a move.

Chapter seven continues with this and provides a by and large superficial exposition of basic sentences in Avicenna's work, whose meaning are neither surprising nor demanding to the reader.[3] Restating various points from his earlier chapters, De Haan speaks about "Avicenna's identification of the 'invariance of existence through another' and the 'necessity of existence through another'" (288), even though Avicenna never used the expression "invariance of existence through another" as far as I am aware (and I am sceptical whether he would; and if he does, then this could cast doubt on De Haan's suggestion to translate *taʾakkud* as "invariance"; cf. 263f.).

The last chapter of the book's third part – chapter eight – takes on the topic of how existence is predicated of things and, hence, delves into issues of univocal, equivocal, and analogical predication. Rightly noting that there are various diverging interpretations of Avicenna, De Haan once more explicitly states that he wants to abstain from any engagement with these – by now a constant theme of his book – and instead to present his "own interpretation" (295). Arguing that for Avicenna existence is predicated analogically, De Haan collects various passages – especially from Avicenna's *Categories* and *Metaphysics* – in support of his view. While all of these passages have been discussed in previous literature already, De Haan successfully adds some nice quotations from Avicenna's *Physics*, which

[3] E.g.: "Said otherwise, unlike the *intrinsically* necessary existence in itself, all possible existents are *extrinsically* necessary existence [sic!], insofar as they exist necessarily through another", 278.

have so far been overlooked by interpreters. Less successful is his attempt to integrate chapter I.4 of Avicenna's *Physics* into his analysis as he overlooks the doxographical character of this chapter, which is borne out by structural comparison with Aristotle's *Physics* as well as the introductory statement of the chapter itself. While this could still be an instance of mere scholarly disagreement between reviewer and author on how this chapter as a whole ought to be read, De Haan – taking the chapter at face value and convinced that it contributes something to our understanding of Avicenna's views on being – actively interpolates a parenthesis into his long quotation which gives a wrong impression and is not justified by the context (307): the "conclusion" Avicenna is talking about in the quotation's sixth paragraph is *not* "that existence *qua* existence is different, for example, from what humanity is *qua* humanity" (as De Haan makes his readers believe) but that Parmenides' and Melissus' "foolish nonsense" is incorrect – and their "foolish nonsense" is the literal meaning of their statement that "being is one and unmovable" to which Avicenna claims to be compelled after his two attempts to interpret their statement failed.

The final part of chapter eight forms an interesting analysis of accidentality and various ways of accidental predication. In particular, De Haan is arguing that if we want to understand how existence is predicated to essence, we should consider it as either a "*per aliud* accident" or a "nonconstitutive accident" (or somehow both; 327). A repeated statement by De Haan is that "existence is inseparable and a concomitant of quiddity." I find this confusing in light of Avicenna's famous essence-existence-distinction, which precisely establishes that quiddity is different from existence (culminating in the famous line that "in itself, horseness is nothing but horseness"). Most of the time the reader may simply take this as a matter of loose speech on De Haan's part, because clearly what he must be talking about are what Avicenna calls *things*, i.e., existing essences – and yes, existence is a concomitant of existing essences. However towards the end of chapter eight, De Haan really does make the alignment "between being and thing, and so between existence and essence" (327). It is unclear, now, if this is still loose speech or whether it has been a new interpretation all along.

These results pave the way for the two final chapters – nine and ten – which together make up the book's fourth part (339-386). The main question De Haan wants to raise and answer is: "is there any priority among the primary notions themselves?" (342). There is no doubt that these two chapters are the most interesting chapters of the book, esp. the arguments that "one" and "thing" are subordinated to "being" in chapter nine (343-348 and 348-359, respectively), and that "being", in turn, is subordinated to "necessary" in chapter ten, making the latter the *primus inter pares* of all the primary notions (362-368). This conclusion is finally followed by De Haan's consideration of what has been described as "the primary aim of this study" many pages ago: "to identify and present the central argument of Avicenna's *Ilāhiyyāt* of his *Kitāb al-Šifā'*" (95, similar statement on 8). Clearly, these pages may form the *heart* of what De Haan meant to present, but they are not literally the *culmination*, as the latter term would imply that there has been a consistent built-up, step by step leading up to the culmination. To be sure, this is probably what De Haan aimed at when he designed the book with eight chapters before the purported culmination. However,

rather than contextualising or preparing the argument of chapters nine and ten, the preceding chapters are verbose and distract from an otherwise stimulating finale.

Before closing, I would like to emphasise two earlier points in a slightly more detailed manner: the first is that, occasionally, De Haan' analysis is a mixture of both error and obfuscation. One example of this is his analysis of the objection raised by Avicenna in *Metaphysics* I.2, §14 (131-139). De Haan quotes this objection from Marmura's translation but fails to mention that he was imposing his own terminology on Marmura's original wording. Either deliberately or by accident, De Haan's rendering of the passage also fails to reproduce the plural of *mawǧūdāt* (which, in my mind, helps a great deal in comprehending Avicenna's objection). For someone who does not strictly follow De Haan's personal preference to reserve "existence" for *wuǧūd* and "being" for *mawǧūd*, the resulting translation is already an obstacle for understanding what used to be a clear objection and a straightforward answer in Avicenna's text. De Haan not only clouds the former through his translation but also the latter through six pages of analysis which mix correct materials (whenever he paraphrases passages from Avicenna's own answer) with De Haan's own ideas about other materials that he deems indispensable for grasping the subtleties of the text. These ideas include a twofold division of principles into "scientific principles" and "causal principles", which De Haan labels an "important equivocation" and imports from Avicenna's *Physics*. Few pages later, this explicitly *twofold* division is suddenly an explicitly *threefold* division into "scientific principles", other "scientific principles" (*à propos* "equivocation"), and "causal principles", so that attentive readers who surely remember that the division was just said to be twofold may now doubt whether they have missed something important. Moreover, readers may continue to wonder when "notional amplifications" are suddenly referred to as "notional constrictions". (Is an amplification not the opposite of a constriction? Later on, De Haan will frequently refer to "notional amplifications *and* constrictions" or even to "notional amplifications *or* constrictions"; my emphasis.) Finally, readers are actively misled when De Haan inserts the word "causal" as the purported fruit of his idea to use the distinction between "scientific principles" and "causal principles" into Avicenna's wording of his very own answer, which is then quoted as the "theoretical enquiry into the {causal} principles is also research (*baḥṯ*) into the things that occur as accidents to this subject", which not only changes the meaning of Avicenna's own answer but furthermore prepares the bigger confusion entailed in De Haan's analysis: while Avicenna's initial objection was concerned with the science of metaphysics and *its* subject-matter of being *qua* being (the existent in so far as it is existent), De Haan suddenly sees other theoretical disciplines in its purview. The simple question raised by Avicenna's objection in *Metaphysics* I.2, §14 whether "the principles of being" (i.e., "the principles of the existents") are or are not established in metaphysics is now answered by De Haan as if Avicenna wanted to say: *some* are – namely those that are not principles of being but only principles of "caused beings". The main error in De Haan's train of thought, then, is that he is now clearly no longer speaking about the subject-matter of metaphysics – being *qua* being (the existent in so far as it is existent) – but about "being *qua* caused being". Hence, he has effectively left the purview of Avicenna's initial objection and conveys to his readers the impression as if the key claim that "no

science demonstrates its own principles" is only partially true for Avicenna, precisely because of the above-mentioned "important equivocation in the meaning of the term 'principle'": as De Haan describes it, a science may surely demonstrates *some* of its own principles. What De Haan fails to observe, however, is that whatever principles a science may demonstrate, they are simply not *its own* principles.

This was just a necessarily brief sketch of a puzzling section of the book, but it is one of those sections where error, idiosyncratic terminology, misunderstanding, misrepresentation, the incomplete development of ideas, and a penchant for decorative expressions cloud the reader's comprehension. To be sure, I am not claiming that the "important equivocation" of the term "principle" and its division into "scientific principles" and "causal principles" may not be important, nor am I claiming that it could not be used perhaps to elucidate Avicenna's objection from *Metaphysics* I.2, §14. Instead, what I am trying to convey here in the limited space of a review is that an actually new idea by De Haan – namely, to use that material from the *Physics* and apply it here in the *Metaphysics* – is left insufficiently worked out: De Haan simply *asserts* that this "important equivocation" is relevant, but neither does he demonstrate it nor does he develop his thoughts – and this is one running feature of De Haan's book: he surely mentions and presents a great and even impressive quantity of materials, but in those crucial moments when some of these materials are finally combined in a potentially new form with the unmistakable aim of producing a new insight, he stops short of processing and refining them.

The second point is that most of what De Haan presents throughout the book has already been known. Among the best researched aspects of Avicenna's metaphysics is precisely the subject-matter of metaphysics. One reason for why that is so is that it is closely related to the question about the best place for demonstrating the existence of God and the well-known disagreement between Avicenna and Averroes on this – a subject of discussion both after and before Herbert Davidson's masterpiece on the *Proofs for Eternity, Creation, and the Existence of God* (1987). However, even without a direct relation to the question about the proof for God's existence, the systematically important question about the structure of metaphysics as a science has long aroused the interest of scholars both after and before Albert Zimmermann's *Ontologie oder Metaphysik?* (1965). De Haan now reinvestigates both Avicenna's views on the subject-matter of metaphysics and its relation to Avicenna's views about the proof for God's existence. Considerable parts of the table of contents of the resultant monograph correspond to themes pursued, for instance, by Tiana Koutzarova in her book *Das Transzendentale bei Ibn Sīnā* (2009), whose subtitle brings out very well the thematic connection between her investigation and De Haan's: "Zur Metaphysik als Wissenschaft erster Begriffs- und Urteilsprinzipien." Koutzarova's book is not mentioned once, not even where both De Haan and Koutzarova address the same questions (such as Avicenna's objection from *Metaphysics* I.2, §14, mentioned above) and, in fact, it does not show up in De Haan's otherwise impressively long bibliography (which lists of course Davidson and Zimmermann). Now, Koutzarova's book received its own critical review by Taneli Kukkonen, who – already in 2013 – passed the following verdict:

> Long sections merely repeat information that is found elsewhere or restate interpretations that have become standard in the scholarly literature without adding much that would be of note (or, if they do, they add grace notes or offer translations that seem questionable). As a result, passages that would be of genuine novelty and interest are buried under verbiage.[4]

Reading and reviewing De Haan's monograph eleven fruitful years of Avicenna scholarship after Koutzarova's book (and seven after Kukkonen's review of it), I was reminded of these words again. If De Haan's book was clearer written, less distracting and misleading, one could recommend it to students and beginners who want to get up-to-date on scholarship about the fundamentals of Avicenna's metaphysics and theory of science. As it is, however, it seems to be safer to direct them to the many articles and monographs that clearly formed the basis of De Haan's book and which, apparently, have aged well. On that basis, readers are fully equipped to enjoy the two interesting final chapters nine and ten, and evaluate De Haan's interpretation (without taking a detour through the 336 preceding pages).

All in all, this recent addition to Brills series "Investigating Medieval Philosophy" contains some useful sections and summarises good portions about Avicenna's theory of science and his approach to metaphysics, with occasional sparkles of new insights, but it remains underdeveloped and reads, over many pages, as a polished summary of the author's private notes that he composed for himself in preparation for research and, above all, for then formulating the argument in the two final chapters of the book. It should be noted that there is certainly no serious harm in the way De Haan proceeds, and surely some good books may proceed that way. However, in terms of expectations, such a procedure might limit the number of new insights a book may provide. In that sense, De Haan's book clearly and visibly cannot compete with the density of analysis and depth of insight found in other recent monographs on Avicenna, such as Alpina's *Subject, Definition, Activity: Framing Avicenna's Science of the Soul* (2021), Benevich's *Essentialität und Notwendigkeit: Avicenna und die aristotelische Tradition* (2018), or Kalbarczyk's *Predication and Ontology: Studies and Texts on Avicennian and Post-Avicennian Readings* (2018).

Among minor complaints are the repeated misspellings of Arabic words (especially in the first half of the book): e.g., *išarāt* for the correct *išārāt*, *maʿqāla* for *maʿqūla*, *mabsāṭatan* for *mabsūṭatan*, *ḥakama* (a verb) for *ḥukm* (a noun, as explicitly indicated by the article *al-*), *tawaṣṣal* for *tawaṣṣul*, *naūʿ* for *nawʿ*, *ḍarūrī* for *ḍarūriyya*, *musullamāt* for *musallamāt, rabbamā* for *rubbamā*, and *muṭlaqā* for *muṭlaqan*, among others.

A constant confusion pertains to the transliteration of Arabic words that contain the letters *ǧīm* and *ġayn*, concerning which De Haan is apparently uncertain on a graphic basis, for we get *ǧālib* for *ġālib* or *aǧrāḍ* for *aġrāḍ* alongside *asjar* for *aṣġar* and even *mujhāliṭī* for *muġāliṭī*, to give only few examples. These are not merely due to alternative transliteration systems but constitute a puzzling mix of available systems in overtly incompatible ways.

[4] Taneli Kukkonen, "Tiana Koutzarova: *Das Transzendentale bei Ibn Sīnā. Zur Metaphysik als Wissenschaft erster Begriffs- und Urteilsprinzipien*", (book review), *Journal of Islamic Studies* 24/2 (2013): 203.

Unless this was due to an unfortunate last minute "search and replace" mishap right before submitting the manuscript to the presses, I cannot imagine how these came about. On the other hand, even *cum grano salis* the transliterations system is inconsistent (using *j* alongside *š*, *ġ*, *ḏ*, etc.; *-ā* alongside *-á;* and ‘ or ’ alongside ʿ or ʾ), provides an uneven handling of the article's assimilation to so-called "sun letters", and uses an incorrect character (*ẖ*) for *ḥ/kh* throughout. These mistakes are as difficult to bear for the Arabist as De Haan's spelling of ἐπιστήμη is for the Classicist (επιστεμε, 74).

Finally, De Haan (and/or the editorial team responsible at Brill) might like to revisit their understanding of the use and merit of different dashes and hyphens as punctuation marks in academic prose, and rethink the overload of used brackets: (), [], {}, and even «».

As a *post scriptum* note: Brill seems to have started to use a paper that will disappoint readers who like to avail themselves of highlighter pens, whose yellow ink is likely to shine or even soak through to the other page. Admittedly, other publishers started to do the same (and even worse), but that does not make it okay. (The worst example in my possession is, in fact, a Brill print-on-demand hardback for 165€.) Books are there to be used; if they can no longer be put to their appropriate use, then why should they be bought for 138€ or $166, instead of being downloaded (and printed out on *proper* paper)?

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According to a widely accepted conception, that goes back at least to the nineteenth century, the works of Abū Ḥāmid al-Ghazālī (d. 1111), particularly his "Incoherence of the Philosophers" (*Tahāfut al-falāsifa*), led to the end of philosophy in the Islamic world. This conception still resounds today, even among specialists in Islamic philosophy. Indeed, in a recent article "Avicenna and After", Dimitri Gutas argues that after Avicenna, i.e., in the "post-classical" period, there was no philosophy really, but what he coins as "para-philosophy", which means: "doing what appears to be philosophy/ science in order to divert attention from, subvert, and substitute for philosophy/ science, and as a result avoid doing philosophy/ science."[1]

Griffel's outstanding study wishes to rewrite the standards of these accounts. At the heart of his critique stands the assumption that philosophy is a *discursive tradition* which "requires a volitional act to be part of that tradition... [i.e., a rationalist thinker] has to want to make a contribution to the tradition of philosophy by engaging with its past iterations" (p. 569). Concretely, philosophy which was practiced in the eastern parts of the Islamic world during the twelfth century, was not only *falsafa* but it also included other important traditions which positioned themselves vis-à-vis Avicenna's philosophy. One such tradition, which constitutes the center of Griffel's book, and which is explained through the two early compendia of Fakhr al-Dīn al-Rāzī (d. 1210), namely, The *Eastern Investigations* (*al-Mabāḥith al-mashriqiyya*) and *The Compendium on Philosophy* (*al-Mulakhkhaṣ fī al-ḥikma wa-l-manṭiq*), is the tradition called *ḥikma* which replaced that which was known as *falsafa* or Avicennism.

Griffel expounds this shift in the first chapter of the first part arguing that it was the result of al-Ghazālī's legal condemnation, (*fatwā*) in the aforementioned *The Incoherence of the Philosophers*, where he condemned three teachings of the philosophers (*al-falāsifa*), mainly Avicenna, as constituting unbelief and apostasy from Islam: (1) the pre-eternity of the world, (2) that God knows only universals, and (3) the rejection of bodily resurrection in the afterlife. This *fatwā*, reasons Griffel, motivated philosophers such as Abū al-Barakāt al-Baghdādī (d.1165) and Yaḥya al-Suhrawardī (d.1192,) to avoid the labels *falsafa* (philosophy) and *faylasūf* (philosopher) and to borrow the terms *ḥikma* and *ḥukamā'* instead.

[1] Dimitri Gutas, "Avicenna and After: The Development of Paraphilosophy. A History of Science Approach", in *Islamic Philosophy from the 12th to the 14th Century*, edited by A. Al Ghouz (Bonn: Bonn University Press, 2018), 19-71, 43.

The other two chapters of the first part problematize two widespread claims. The first is that the eastern Islamic world, particularly the Iranian province Khorasan, had witnessed a decline in scholarly activity during the twelfth century. The second claim is connected to al-Ghazālī's *fatwā*. However, through a meticulous exposition of primary sources, Griffel casts doubts on the execution of this *fatwā*, contending that the existence of two such cases in one century (the execution of 'Ayn al-Quḍāt al-Hamadhānī (d.1131) in Hamadan and Yaḥya al-Suhrawardī in Aleppo, where political and social reasons played roles also) "do not make a war *against philosophers* or a campaign of persecution" (p. 158, referring to a phrase used by Ernest Renan). However, despite the lack of historical evidence that al-Ghazālī's *fatwā* was executed, it is important to emphasize, perhaps against Griffel's thrust of argumentation, that this by no means devaluates or alleviates al-Ghazālī's *fatwā*: it is and remains an intellectually serious condemnation.

Drawing mainly on the corpus of *The Cabinet of Wisdom* (*Ṣiwān al-ḥikma*)[2] in the second part of his study, Griffel provides a vivid and contextualized depiction of philosophers' lives and sets up a corpus of their writings. In the background, the *Tahāfut al-falāsifa* plays a significant role as it prepares the ground for two opposing camps: the Avicennan proponents, on one side, and the Ghazālian followers as their adversaries, on the other. In the Avicennan camp, attention is given to ʿUmar al-Khayyām (d. 1123-24) and to Abū al-ʿAbbās al-Lawkarī (d. after 1109-10). Among the Ghazālian followers and critiques of Avicenna, Ibn Ghayalān al-Balkhī and Sharaf al-Dīn al-Masʿūdī (both d. c. 1194) are brought to the fore.

The first chapter of the third part, which constitutes the fundamental part of this study, discusses mainly the character of philosophical works written in the twelfth century. Griffel highlights primarily al-Rāzī's two compendia which the latter refers to as *ḥikma* works – *al-Mabāḥith al-mashriqiyya* and *al-Mulakhkhaṣ fī al-ḥikma wa-l-manṭiq*. Here lies the core of Griffel's argument of this study: these compendia neither teach nor defend Ashʿarism, nor do they only report Avicenna's teachings, but they also improve and correct them, resulting consequently in two significant "Rāzīan innovations" in philosophy: one in epistemology the other in ontology.

As for epistemology, al-Rāzī deviates from Avicenna's understanding of the theory of knowledge. According to the latter, knowledge implies the impression (*inṭibāʿ* or *irtisām*) of the form (*ṣūra*) of the object of knowledge (*al-maʿlūm*) in the knower (*al-ʿārif*). Al-Rāzī, however – influenced heavily by Abū al-Barakāt al-Baghdādī's (d. c. 1165) understanding of knowledge as a "relational attribute", (*ṣifa muḍāfa*) and drawing on Sharaf al-Dīn al-Masuʿdī, al-Ghazālī, and Avicenna himself – argues that knowledge is a relational state (*ḥala iḍāfiyya*), i.e., a relation between the knower and the object of knowledge. Griffel argues that at least two important points follow from al-Rāzī's theory. The first concerns the acquisition of knowledge, where al-Rāzī responds to Meno's paradox and reasons that the thing sought is

[2] Which is considered to be the most comprehensive Arabic doxography of philosophers who wrote in Arabic and Greek.

a relation between the knower and the object of knowledge. The second point, which is coupled with the first, is about the circular nature of definitions and what Griffel describes as "epistemic phenomenalism". Although these might indeed be significant innovations, as Griffel contends, one could question the real motivation underlying al-Rāzī's theory of knowledge. In fact, in her dissertation, Nora Jacobsen Ben Hammed recently argued that al-Rāzī's theory of knowledge has theological concerns which are embodied in the need of defending God's capability of knowing particulars. This, Ben Hammed adds, is an Ashʿarite view which is also discernable in al-Ghazālī's thirteenth discussion of the *Tahāfut al-falāsifa*.[3]

As to the innovations in the field of ontology, which bear significant implications on theology, Griffel holds that this results from al-Rāzī's opposition to Avicenna's concept of God as a necessary existent, the essence of which is identical with its existence. Al-Rāzī, however, objects that God's existence is distinct from His essence and that the latter is more fundamental than the former, i.e., that His existence is a concomitant (*lāzim*) to His essence. Griffel points out, this view results in a number of philosophical problems and leads to certain corrections of Avicenna's teachings. For instance, the content of God's knowledge is understood as His positive attributes, which does not entail multiplicity in God, and thus, does not affect His unity. This, however, raises once more the question about al-Rāzī's motivation to "correct" Avicenna as argued by Griffel, and it seems to be more likely that al-Rāzī asserts the priority of God's essence over His existence in order to defend a theological doctrine, namely, the creation of the world.[4]

The second chapter gives a detailed attention to al-Ghazālī's *Doctrines of the Philosophers* (*Maqāṣid al-falāsifa*) which, as Griffel tells us, evoked confusion among al-Ghazālī's followers with its "sympathetic" attitude towards the philosophers. Griffel argues also, that authors in the twelfth century wrote two genres of books, one is philosophical (*ḥikma*) the other is theological (*kalām*) which may different opposing teachings, as is the case with al-Rāzī. Griffel notices, that while in his philosophical works, at least in his two compendia (*Mabāḥith* and *Mulakhkhaṣ*) al-Rāzī teaches that the world is pre-eternal and that God acts out of His necessity; however, in his *kalām* works, such as *The Utmost Reach of Rational Knowledge in Theology* (*Nihāyat* al-ʿ*Uqūl fī dirāyat al-uṣūl*), he teaches the creation of the world and that God has a free will to choose between alternatives. To explain this inconsistency, Griffel borrows Thomas Bauer's conception of ambiguity and applies it to authors of the twelfth century

[3] See Nora Jacobsen Ben Hammed, *Knowledge and Felicity of the Sou in Fakhr al-Dīn a*-Rāzī (Dissertation, Chicago: University of Chicago, 2018), 126-27.

[4] This is because: were God's essence to be equal to His existence, then every concomitant (*lāzim*) of His essence – among which is His eternity – would also occur to every other existent, as every other existent participates in God's existence by simply existing. This would entail that every other existent is eternal. However, this is invalid. See Fakhr al-Dīn al-Rāzī, *al-Arbaʿīn fī uṣul al-dīn*, edited by Aḥmad Ḥujāzī al-Saqāʾ (Cairo: Maktabat al-kuliyyāt al-azhariyya, 1986), pp. 147-48. See also, Yasin Ceylan, *Theology and Tafīr in the Major Works of Fakhr al-Dīn al-Rāzī* (PhD dissertation, University of Edinburgh), pp. 128-29; Toby Mayer, "Faḫr al-Dīn al-Rāzī's Critique of Ibn Sīnā's Argument for the Unity of God in the *Išārāt*, and Naṣīr ad-Dīn aṭ-Ṭūsī's Defence", in *After Avicenna: Proceedings of the First Conference of the Avicenna Study Group,* edited by D. C. Reisman and A. H. Al-Rahim (Leiden and Boston: Brill, 2003), 199-218, 208-09.

contending that scholars experienced a "crisis of ambiguity", as they could not decide whether they should follow Avicenna's approach or al-Ghazālī's. Thus, they fashioned "two different discourses", both of which ought to be mastered (as for example al-Rāzī did).

Although Griffel is right that al-Rāzī had written two types of books with incongruent teachings, an exception to the twofold perspective might be the puzzling nature of al-Rāzī's late work *The Exalted Requirements in the Divine Knowledge* (*al-Maṭālib al-ʿāliyya mina al-ʿilm al-ilāhī*, hereafter, *Maṭālib*), which does not escape Griffel's attention. This book cannot be easily classified as a work of *ḥikma*, as Griffel observes, because al-Rāzī concedes of revelation as evidence to undergird his views in many cases, while it cannot also be classified as a *kalām* work either, because al-Rāzī articulates views in psychology and prophecy, for instance, which go against Ashʿarite theology. Accordingly, Griffel raises the hypothesis that "Maybe this is the book [i.e., *Maṭālib*] in which al-Rāzī wished to put down his final assessment of those subjects that are disputed between *ḥikma* and *kalām*" (p. 546). To my mind and substantiating Griffel's hypothesis, this is conspicuous, at the very least, in the case of psychology. Since indeed, al-Rāzī does outline his final evaluation on this subject in *Maṭālib*, after he was wavering between his *kalām* and *ḥikma* works concerning the quiddity of the human soul for instance. Thus, "ambiguity" borrowed from Bauer to describe the hesitation between positions, is unnecessary or is overcome by al-Rāzī who eventually asserts his final opinion in a work he authored late in his life.

The third chapter explores the methods of philosophical books in the twelfth century. Griffel holds that, Abū al-Barakat's method of *Careful Consideration* (*iʿtibār*) – which considers an exhaustive list of relevant positions and ultimately selects the most compelling – plays a substantive role in the development of new philosophical methods in post-classical period. Griffel highlights that this method paves the way for al-Rāzī's approach both of *apprehension* (*taḥṣīl*) and of *probing and dividing* (*sabr wa-taqsīm*). These methods, which Griffel calls "dialectical", are significant since they could replace demonstrations (*barāhīn*) – particularly after al-Ghazālī's attack – at least for authors such as al-Rāzī who are occasionally unable to provide a demonstration, in which case, a set of less convincing arguments (which usually called "compelling proofs" *dalāʾil iqnāʿiyya*) might still be enough for determining a firm position.

Without doubt, Griffel's extensive study is an inspiring and thought-provoking contribution to our understanding of the post-classical era. His careful analysis and contextualization of the corpus of authors who were active in the sixth/twelfth century, especially of Fakhr al-Dīn al-Rāzī and Abū al-Barakāt, make a robust case of our reconceptualization of Islamic philosophy in general, and for reinterpreting philosophy as a discourse developing within a certain tradition in particular. However, we still need to reconsider the agenda or the motivation which underlies philosophy as a specific discourse, vis-à-vis the classical-pedantic understanding of philosophy as a pure rational and universal activity. In other words, were "philosophy" to be motivated by defending a specific tradition – as it might be argued in the case of al-Rāzī's epistemology – then its vindication as a philosophy, in the strictest sense of the word, shall be questioned.

***Thomae Eboracensis Sapientiale. Liber III. Cap. 1-20*. A cura di Antonio Punzi. Presentazione di Fiorella Retucci. Firenze: SISMEL – Edizioni del Galluzzo, 2020. Union Académique Internationale e Unione Accademica Nazionale. Corpus Philosophorum Medii Aevi: Testi e Studi XXV. xl + 318 p. ISBN: 9788884508362. Paperback: € 56,00**

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Thomas of York has a crucial place in the history of the first establishment of the Friars Minor within the European intellectual milieu of the central decades of the thirteenth century. Born around 1220, he joined the order founded by Francis of Assisi around 1245 starting a career of studying and teaching which leaded him to the function of regent *lector* at the Minorite *studium generale* in Oxford. Thomas was the fourth friar to hold this position in Oxford, giving his inception lecture on the 14th of March 1253, in the midst of the clash over the conferral of the degree of university master to members of mendicant orders. He directly took part in this political and religious conflict, composing in 1256 his *Manus quae contra omnipotentem extenditur*, a defence of the rights of the Minor Friars and more generally of the mendicants with respect to the access to the university career. Thus, Thomas of York was among the protagonists of the implantation of the Friars Minor in the cultural framework of the English kingdom, being not only involved in the activity of the Order in the universities of Oxford and Cambridge, but also in the peculiar relation of the Minorites with Robert Grosseteste bishop of Lincoln, whose episcopal *curia* he joined for a certain period. Within such an articulated network of religious and intellectual relations, dominated by figures such as Grosseteste himself and Adam of Marsh, Thomas refined a vast culture not only in the theological field. Both Grosseteste's cultural network and the university context of Oxford, with the university colleges and the *studium generale* of the Friars Minor, represent the framework within which Thomas may have built up a fine philosophical culture. His writings show a clear mastery of texts such as the Aristotelian *Nicomachean Ethics* or the *Posterior Analytics* as well as of writings of the Arab-Latin tradition.

Among the works of the master, the *Sapientiale* represents the largest preserved writing and starting from a study by Martin Grabmann of 1913 it has been at the centre of the interests of historians of medieval philosophy. Already the German scholar judged the text as the first significant exposition of the "metaphysical system" of the Scholastic age. This judgment was reiterated by De Wulf, Longpré and Puillon, in studies that have offered a preliminary examination of the contents of the work and a discussion of its structure and complex manuscript tradition. A first editorial initiative aimed at the publication of a critical edition of the text was announced by the Frati

Editori Quaracchi in the 1920s. A second project was instead carried out by the scholars of the Pontifical Institute of Medieval Studies in Toronto in the 1950s, producing an edition which was never never published but it is still preserved in the archives of the Institute. Antonio Puzi and Fioralla Retucci, with the volume they edit, offer the first critical edition of a relevant part of the *Sapientiale*, namely of book III.

It is a work that that directly deals with the results achieved by the Toronto équipe, but carefully reconsiders the nature of the text, the manuscript tradition, the structure of the work and the evolution that have characterized the composition of the *Sapientiale*. A careful examination of the features of the three known manuscripts of the work (F – Firenze, Biblioteca Nazionale Centrale, Conv. Soppr. A. VI. 437; R – Città del Vaticano, Biblioteca Apostolica Vaticana, Vat. lat. 6771; V – Città del Vaticano, Biblioteca Apostolica Vaticana, Vat. lat. 4301) allows the editors to shed light on the history of the drafting of the text, its accomplishment according to a specific systematic order, and its diversified circulation. The relationship that links the three manuscripts witnesses the sequence of different editorial stages: that of the drafting of the text, that of the organization of the material, and the final revision of the work which nevertheless appears incomplete, as shown by the state in which the text is preserved. In the first place it emerges how the *Sapientiale* is linked to another writing by Thomas of York, the *Comparatio sensibilium*, which represents a first formulation of the contents which are then the subject of the more detailed discussion in the major work. The *Comparatio* is therefore a sort of primitive redaction of the *Sapientiale*, whose first version is attested by the codex R. V, on the other hand, contains a more mature and complete redaction of the writing. F represents an intermediate stage; in fact, it contains a version of the text that is close to R for what concerns the structure, while from the philological point of view it is halfway between R and V. Furthermore, a set of marginal annotations revise both the structure and the text of the *Sapientiale* and tend to standardize F to the most advanced drafting of the work, that is the one attested by V.

The existence of at least four editorial stages appears consistent with what emerges regarding the evolution of the structure of the *Sapientiale*. The text, which is presented as a treatise on metaphysics, adopts a tripartite argumentative sequence: the existence of God, his nature and his properties are the theme of the first part, followed by a discussion on the concept of being with respect to the creation and by a third section devoted to the being considered *in speciali*. With respect to this division, the manuscripts return a number of seven books, arranged in a different order in F and R than in V. The section of the text concerning the discussion of the division of being according to substance and accident constitutes book III in R and F, while it occupies the book IV, cc. 1-32, in V and in the marginal indications of F. Similarly, what in R and F is the fifth book, becomes the third book in V, while the third and fourth books of R and F are merged together in what in V is the fourth book of the *Sapientiale*. The observations of Punzi and Retucci makes clear that Thomas was responsible for a

profound revision of the structure of the text, which involved a reorganization of the material much more coherent with the argumentative program of the author.

Linking the philological analysis and the results of the study of the three manuscripts with those concerning the evolution of the structure of the *Sapientiale*, it is possible to draw a picture of Thomas of York's project. After the composition of the *Comparatio*, the master would have elaborated the idea of a larger and more systematic work, proceeding with the drafting of its various parts. The thematic order of the text, chosen by the author, does not coincide with the order of composition of the different parts of the text: therefore, Thomas worked on different doctrinal matters, collecting the composite material. From this phase of compilation of the work, a first version emerges, that is the one preserved in R and F. It reflects a state of the work that does not yet collect the material in the thematic order established by Thomas. It is in a subsequent phase, the one attested by the marginal notes of F and V, that he accomplished a redistribution of the material according to the order he had chosen.

In this way, the study of the two editors also highlights the method followed by the author to work on the *Sapientiale:* in his writing he didn't follow the thematic order, but rather he collected material, written at different times, perhaps also in relation to the teaching activity. The absence of chapter 7 in Book III confirms this state of things. According to the index of the work and the notes written by Thomas York himself, the chapter in question was intended to offer a discussion of the notions of divisible and indivisible, mutable and immutable, corruptible and incorruptible being. However, chapter 7 was never written, as an annotation of the manuscript tradition also attests (see p. 92). The absence of this chapter reflects the incompleteness of the work: after having rearranged the materials according to the established thematic index, Thomas did not complete the missing parts of the work which he had foreseen.

The ecdotical work carried out to create this edition of Book III of the work of Thomas of York clarfies some elements of the intellectual biography of this master on which historiography has been debating for a long time. The *Sapientiale* emerges from this critical edition work as the result of an articulated philosophical project. Thomas's intention seems the building of a systematic exposition of metaphysics, rooted on an accurate analysis of the notion of being in its various articulations. In this sense, the text gathers the fruits of an extensive reception of the major philosophical works which, in the central decades of the thirteenth century, made the content of metaphysics available in Latin: the Aristotelian texts and the texts of Arab philosophers. Among the latter, Avicenna and the Avicennian tradition have a prominent role: this is attested, for example, by the copious citations from the Avicennian *Metaphysics* and from that of Algazel, which is considered as the major expositor of the Persian master's thought.

With respect to this project, the study of the manuscript tradition offered by Punzi and Retucci sheds light on a long and complex editorial history. The *Sapientiale* developed along an extended chronological span, within which Thomas composed the

texts that he intended to collect in the work, revised them and arranged and rearranged them over time. The three manuscripts that hand down the work bear witness to this long process and its phases. In a certain sense, this critical edition offers to scholars the opportunity to grasp how the *Sapientiale* is truly the work of a lifetime, a text that marks the intellectual biography of its author. For this reason, the contribution of Punzi and Retucci is a valuable tool both for the study of the structuring of metaphysics as a discipline in the framework of medieval philosophical culture, and for the examination of Thomas of York's doctrinal engagement. In addition, this edition enlightens the evolution of the intellectual and religious contexts to which the *Sapientiale* belongs: the kingdom of England in the central decades of the thirteenth century and the order of Friars Minor with its complex relationship with culture.

Nikolaus Egel. Ed. *Roger Bacon, Opus Tertium*. Philosophische Bibliothek 718. Hamburg, Felix Meiner Verlag, 2019. cxxvi + 1091 p. ISBN: 9783787336241. Cloth: € 168

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Roger Bacon (1214/16–1292/94) was a prolific writer whose philosophical work spans a remarkably long period during a century that saw much intellectual, cultural, religious and political upheaval in Europe and beyond. His own path in life bears witness to these changes: he was an English noble by birth, Master of Arts at the young University of Paris in the 1240s, a Franciscan friar (1257), a tenacious researcher, an acerbic critic of university life, a visionary, and an outcast. His interests also reflect the varied philosophical and theological debates and controversies that occupied thirteenth century scholars. His later writings cover a wide range of topics, including philosophy of language, natural and moral philosophy as well as optics and astronomy. In addition, Bacon's *Opus tertium*, the last of three works composed at the behest of Pope Clement IV between 1266-1268 (the other two being *Opus maius* and *Opus minus*), records many of Bacon's ideas and arguments on these issues, which is why an updated Latin edition has long been a desideratum in modern Bacon scholarship.

The table of contents and opening diagram (p. XXXVIIf.) of Nikolaus Egel's edition provide readers with a helpful overview of the different sections of Bacon's *Opus tertium*, while simultaneously giving a helpful impression of the structure and comprehensiveness of his impressive editorial effort. Beginning with Pope Clement's letter to "Brother Roger" there follow 114 chapters divided into two parts. Readers familiar with John Brewer's 1859 edition of *Opus tertium* will notice that this number far exceeds Brewer's edition. Much to modern scholars' chagrin, Brewer's edition was based on an incomplete English tradition of four manuscripts ending in part IV of *Opus tertium*, thereby leaving Bacon's discussion of mathematics unfinished. By incorporating separate manuscript traditions preserving part IV and parts V-VII of *Opus tertium* – previously identified by Pierre Duhem (1909) and Andrew Little (1912) – Egel's edition restores Bacon's treatment of *perspectiva*, *scientia experimentalis* and *moralis philosophia* in *Opus tertium* in one unified edition, accompanied by a German translation. The new edition marks the difference in these manuscript traditions by dividing *Opus tertium* into parts I and II. Whereas Brewer's older edition of part I ends with chapter 75, Egel, retaining the chapter numbering used in Duhem's and Little's manuscript editions, continues part II with chapter 76, adding chapter titles helpful to the modern reader. Even though Bacon intended *Opus tertium* to be of a piece, Egel's division into parts, chapters, and numbered text segments corresponding in Latin and German (part I, chapters 1-75, §§ 1-517, part II, chapters 76-114, §§ 1-361) will aid the modern reader by providing a text with an exceptionally clear visual structure. In addition, the reader will

benefit from a diligently prepared critical apparatus, informative endnotes (pp. 973-1029), and a well-organized bibliography listing Bacon's later works in chronological order, in addition to his sources and relevant secondary literature. Egel's fluent and readable German translation occasionally includes Bacon's original choice of terminology in the German text, thereby showing respect for stylistic idiosyncrasies and the multifaceted nature of medieval Latin technical terminology. Egel's translation vividly conveys Bacon's enthusiasm about the utility of the sciences, and his introduction situates *Opus tertium* in the context of the second half of Bacon's life and provides the reader with an overview of the core themes and main disciplines Bacon discusses. Moreover, Egel's extensive introduction provides much helpful historical information by giving the reader an appreciation for the relations between *Opus maius*, *minus*, and *tertium* as well as Bacon's intellectual and cultural context and personal situation: why he wrote *Opus maius*, *Opus minus*, and *Opus tertium*, noting, for instance, that Bacon wrote *Opus tertium* not only as a summary of materials already presented but used it to further develop important arguments. Egel's introduction conveys Bacon's sincere concerns for the state of education in a time of social strife, as well as his difficulties in completing the work requested by the Pope in a timely manner for reasons of limited funds and censorship. As a result, Egel makes a compelling case as to why these three works stand out among thirteenth century philosophical writings: Together with *Opus minus* and *Opus maius*, parts of which Nikolaus translated in a separate volume, *Opus tertium* represents, on one hand, a powerful appeal to the Head of Christendom to take note of the dire need for comprehensive reform of study and society and, on the other hand, an attempt to persuade him to take up Bacon's systematic reform program. The reader also learns that not only Asteroid no. 69312 bears Bacon's name but so does a crater on the moon.

As Egel makes clear, *Opus tertium* shares with *Opus maius* and *Opus minus* much zeal for scientific, academic, and social reform. After all, the intended recipient was not an academic audience or Bacon's Franciscan confreres. As the letters at the beginning of the work convey, the addressee was nobody less than Clement IV, Pope from 1265-1268, at whose request Bacon composed these three works in the short space of only two years. All three works were intended less as academic and more as rhetorical pieces aiming at persuading Clement IV of what Bacon considered to be much needed social and academic reform to remedy certain grievances, alleviate suffering, and improve life. Bacon, Egel emphasizes, was motivated by what the late Camille Bérubé called *scientific messianism* ("wissenschaftlicher Messianismus"), a project aiming at reforming scientific content and methods in the service of the well-being of all humankind. Bacon calls on the Pope to purge academia of its sins, to reinstate proper scriptural exegesis and foster the study of language as well as optics and music to restore salutary but neglected wisdom and to advance Christian moral ideals. He advocates methods anchored in mathematics and experimental science while always emphasizing the harmony between Christian theology and pagan philosophy. Here Egel provides important nuance to some traditional characterizations of Bacon's reform program as variations on the late ancient theme of *philosophia ancilla theologiae*. Bacon emphasizes the unity and common origin of all sciences and disciplines in divine revelation and illumination, but there is a twist: Even though theology formally rules all sciences, she

cannot do her work without the philosophical sciences. With this interpretation, Egel not only follows Bérubé's thesis of scientific messianism but further radicalizes it in the light of a 1957 study of Roger Bacon's thought by Franco Alessio. According to Egel, the focal point of Bacon's messianism is not otherworldly but secular, and Bacon's reform project advocates for a *secular* science avant la lettre, rooted in scientific optimism and an uncritical belief in the power of *human*. This interesting and controversial thesis would have benefited from more corroboration in the form of textual evidence and from a critical discussion of Bacon's remarks on divine illumination and the divine origin of all wisdom prominent in *Opus maius* and *Opus tertium*.

Nikolaus Egel's edition of Roger Bacon's *Opus tertium* is invaluable to German scholars in virtue of the clear and accessible translation, but the work will also appeal to an international audience of Bacon scholars and all those interested in Latin medieval intellectual history. In closing, Nikolaus Egel's work is praiseworthy in virtue not only of its thoroughness and comprehensiveness, but also because of the clarity of his style, the astuteness of his translation and the overall coherence and organization of his edition. His work will serve as a powerful aid to future generations of students and scholars in their inquiries into Bacon's work and its place in thirteenth century philosophy.

Monica Brînzei and Christopher D. Schabel. Eds. *Philosophical Psychology in Late-Medieval Commentaries on Peter Lombard's Sentences. Acts of the XIVth Annual Colloquium of the Société Internationale pour l'Étude de la Philosophie Médiévale, Radboud Universiteit, 28-30 October 2009*. Turnhout: Brepols, 2022. 467 p. ISBN: 9782503589091. Cloth: € 70,00

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The volume includes, with a few exceptions, the papers presented at *The XVIth Annual Colloquium of the Société Internationale pour l'Étude de la Philosophie Médiévale*, Radboud Universiteit, 28-30 October 2009, carefully curated and edited by Monica Brînzei and Christopher D. Schabel. The aim of the volume is to trace the manner in which the commentaries from the late Middle Ages on Peter Lombard's *Sentences* shaped the field of philosophical psychology (vii). Systematic topics such as hylomorphism, the faculties of the soul and the relationships between them, the limits and the different types of human cognition, beatific vision, and the free will are discussed in relation to lesser studied authors such as Alfonsus Vargas of Toledo, Hugolino of Orvieto, Pierre Ceffons, John of Mirecourt, Peter of Plaoul, Henry Totting of Oyta, Hymericus de Campo, Denys the Carthusian, John Capreolus, Peter of Candia, Guillaume de Vauroullion, Henry of Langenstein, as well as to more known authors such as Aquinas, Ockham, Scotus, Hervaeus Natalis, Henry of Ghent, Albert the Great, Pierre d'Ailly, Gregory of Rimini, or Gabriel Biel. We are thus offered a book focused not only on the conceptions of the major figures of the late Middle Ages, but also on those of minor figures; even more, the book often underlines the connections between minor and major figures, and offers comparative analyses. It is in this way, and many others, that the book enriches considerably the existing literature on the late Middle Ages.

The volume begins with a very helpful introduction by Monica Brînzei, which offers a detailed synopsis of the papers, and a "Note on the Vernacular Name of Richardus de Mediavilla: of 'Mennevile', not 'Middleton'" signed by Christopher Schabel. Then the bulk of the book follows a tripartite structure – *Human Cognition*, *Human Soul*, *Theological Issues* – and ends with an epilogue by Monica Brînzei, where she discusses some of the issues still in need to be addressed by scholars interested in the commentaries on the *Sentences* from the last decades of the 14th century. I will proceed by describing the papers from the three main sections of the book. The first section, *Human Cognition*, includes papers on topics such as intuitive knowledge and the cognoscibility of material substances authored by Amos Corbini, Aurélien Robert, and Jeffrey C. Witt. The second section, *The Human Soul*, touches on topics such as the essence and the potencies of the soul, the definition and the operations of the soul, and it contains the papers of Maarten J.F.M. Hoenen, Thomas Jeschke, William

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O. Duba and Oliver Ribordy, and Kent Emery Jr. The last section, *Theological Issues*, includes papers by John T. Slotmaker, Severin Kitanov, and Christopher Schabel, dealing with issues related to the Trinitarian theology, the nature of the freedom of the beatific enjoyment, and the human will and its relation with divine foreknowledge.

Amos Corbini's contribution, opening the section *Human Cognition*, is called "Notitia intuitiva and complexe significabile at Paris in the 1340s: From Alphonsus Vargas Toletanus to Peter Ceffons." It aims to ascertain one of Damasus Trapp's thesis from "A Round-Table Discussion of a Parisian OCist-Team and OESA-Team about AD 1350." Particularly, Corbini criticises Trapp's thesis according to which there are "striking similarities" between the five participants at the round table, the Cistercians John of Mirecourt and Peter Ceffons, and the Augustinians Gregory of Rimini, Alfonsus Vargas Toletanus, and Hugolinus of Orvieto. To test the thesis, Corbini compares the views of the five authors on topics such as intuitive and abstractive knowledge or the object of complex knowledge as they stem from their commentaries on the *Sentences*. By the end of the paper Corbini is able to convince the reader that Trapp's thesis is too strong, and in need of serious qualifications before being taken as credible.

In "The Possibility of Cognizing Material Substances. The Evolution of a Philosophical Problem in Late-Medieval Commentaries on the Sentences", Aurélien Robert notices that contemporary historians of philosophy are tempted to treat early modern philosophers such as Descartes and Locke as the fathers of the debate on the knowability of material substances. Robert challenges this line of thinking and offers an alternative approach of the topic. He is guided in his investigation by the following question: To what extent did modern philosophers rely on medieval texts when criticizing the knowability of material substances? To show the extent to which modern philosophers had access to medieval texts, Robert offers a historical analysis of: 1. the views of some late 13th century authors, known to modern philosophers through the works of Toletus and Suarez, Rubios and the Conimbricenses; 2. the views present in some 15th and 16th century doxographies; and 3. the positions on the topic as they stem from 14th and 15th century commentaries on the *Sentences*. Robert notices that, although the topic of knowability of material substance was continuously discussed from the 13th to the 17th century, its importance seems to diminish in the commentaries on the *Sentences* written after the middle of the 14th century. While early modern theologians were probably aware of the commentaries on the *Sentences*, early modern philosophers were most probably more influenced by the epistemologically laden Aristotelian commentaries on *De anima* and *Metaphysics*.

Jeffrey Witt writes the very engaging paper "Peter Plaoul and Intuitive Knowledge." As someone who is not familiar with the works of Plaoul, I would have appreciated if Witt would have gone into a bit more detail when explaining the way in which the concept represents the external object as the intersection between "the mode of the dispositions of the proximate causes concurring for its production" and "the mode of the motivity of the potency from the object and into the object." (96-97) For example, it would have been interesting to find out whether the dispositions of the proximate causes are offering

something like a perspectival aspect to the concept, if they are responsible for individuating my concept from the concept of another, or if they are just as objective as the actualized potencies of the object. Nonetheless, given that there is not much literature available on Plaoul and that the paper is not only very well written but it also includes a lot of in-depth textual analyses, the points I raised do not take away from the value of the paper.

The second section of the volume, *Human Soul*, begins with Maarten Hoenen's paper "Hymericus de Campo Reads Peter Lombard: Late Medieval Abbreviations of the *Libri Sententiarum*." The paper discusses a recently discovered manuscript attributed to Hymericus de Campo. The manuscript has two main parts, a commentary on the *Apocalypse*, deeply influenced by pseudo-Albert the Great's *In Apocalypsum luculenta expositio* (107), and a prologue consisting of a *Recommendatio sacrae scripturae* and summaries of the writings of Iunilius Africanus, Alaine of Lille, and Nicholas of Amiens, aimed at making clear the manner in which philosophy can aid theology. At the end of the prologue there is an abbreviation of the Lombard's *Sentences.* After discussing the manner in which the *Sentences* were abbreviated from the 13th to the 15th centuries, and how this changed according to the specific needs of students, Hoenen turns his attention to Hymericus' own abbreviation of the *Sentences*. The paper concludes with two appendixes, an edition of the Hymericus de Campo's *Super Sententias* lib. III, distinctions 5, 21, and 22, and a short note where Hoenen discusses the exceptional character of Hymericus' treatise.

Thomas Jeschke approaches the issue of whether the essence of the soul is different from its potencies in the paper "*Unum antiquum problema*: Denys the Carthusian and John Capreolus on the Question of Whether the Soul's Essence is Distinct from Its Potencies. A Late-Medieval Starting Point." His paper is probably the most polemic one of the entire volume. It starts with an overview of the secondary literature on the issue of the soul and its faculties in the Middle Ages, focusing on three texts by Peter King, Dominik Perler, and Sander de Boer, which allegedly are in need of corrections. Jeschke's goal is to fulfil such a need. He aims "to correct the limitations of the existing approaches by avoiding the modern prejudices and interests, and to use medieval texts as hermeneutical instruments." (158) Discussing King's text he points convincingly to some interpretative errors. However, Perler's text is discussed only in passing and described as "not attempting to give a history of the sources", and de Boer's is mainly criticised for choosing his sources in a curious way which fails to offer a representative image of his topic. At the end of his paper, after discussing Denys the Carthusian and Capreolus' conceptions of the soul and its potencies, Jeschke presents his own view on how the research on medieval philosophy should be conducted. He is advocating for a historical approach and considers it to have advantages over the more systematic approaches. Such an "account prevents one from generalizing before investigating more thoroughly the medieval sources." He then continues: "This does not mean that my medieval approach should replace other narratives [...]. Some modern narratives are valid and valuable, yet they must be supplemented and corrected so that we achieve a historical picture of the debate that is as precise and multifaceted as possible. Other narratives are only superficially historical, and should be replaced by truly historical approaches, or otherwise presented as systematic surveys, whatever purpose such surveys

might serve in the study of *medieval* philosophy." (195) It seems that what Jeschke wants to say is that de Boer's narrative must be supplemented with more references to primary sources, King's must be corrected, and Perler's should be replaced by a truly historical approach. If my reading is correct, I think his criticism of the superficially historical approach falls short for two reasons: he seems to be targeting only Perler's position, which is not necessarily the standard systematic survey, and he does not substantiate the claim that such an account serves no real purpose in the study of medieval philosophy. I take no issue with advocating for the historical method, but I also believe one should not dismiss alternative methods too easily.

William Duba and Olivier Ribordy co-author a detailed survey of some 14th century stances on the definition of the human soul. Their paper "The Human Soul: Definitions and *Differentiae* in Late-Medieval Commentaries on the *Sentences*" offers invaluable parallel textual analyses of 14th century authors and their sources: Pierre d'Ailly and John Buridan, Gabriel Biel and William Ockham, Peter of Candia and Averroes, Guillaume de Vaurouillon and Alexander Halensis, Aquinas and Averroes and Denys the Carthusian.

Kent Emery Jr. ends this section of the book with the paper "Denys the Carthusian's Sentential Teachings on the Nature and the Operations of the Soul." It begins with some historical information regarding the life and works of Denys and proceeds to offer an analysis of his conception of the soul by focusing on the *II Sentences* d.17, q.2. After identifying Albert the Great, Aquinas, Richard of Menneville, and Henry of Ghent as Denys' sources, Emery Jr. presents his conception of the soul and interprets it as a mixture of Aristotelian metaphysics and experimental sciences. The idea that the matter of the body has an incomplete form which is educed from it once the intellectual soul is infused, and that this incomplete form contains the accidental dispositions which remain present even after the death of the person, thus accounting for the subject's further accidental changes (244-245), is representative of the attempt to combine metaphysical tenets with the observations of experimental sciences. This point of Kent's reading is convincing. However, the claim that the metaphysics Denys adopts is Aristotelian needs qualifications, for at least pure Aristotelian theories did not speak of incomplete forms being educed from matter. This was a primarily Augustinian metaphysical tenet. Nonetheless, apart from this little point, Kent's paper does not seem to suffer from other limitations.

The last section, *Theological Issues*, begins with John T. Slotemaker's paper "Pierre d'Ailly and the *Imago Trinitatis*: The Sources of His Trinitarian Theology", which offers a historical analysis of Pierre's sources, going from Peter Lombard and Thomas Aquinas to William of Ockham and Gregory of Rimini. All of the sources are analysed according to the same dual structure: on the one hand, an investigation of where in the *Sentences* is the psychological analogy of the image of the Trinity in man discussed; on the other hand, what were their stances on the Augustinian triad of memory, intellect, and will, and if this triad bears or not any analogy with the Trinity. The conclusion reached by Slotemaker is that, among all of the historical sources available to Pierre, Ockham seems to have been the most important and influential for his position on Trinitarian theology.

Severin Kitanov signs the paper "Freedom in Heaven: Peter of Candia's Treatment of the Necessity or Contingency of Beatific Enjoyment." After discussing the origins of the necessity or contingency of beatific enjoyment and the relevance of Peter's position, Kitanov goes on to investigate three of Peter's opponents, Thomas Aquinas, Peter Auriol, and John of Ripa. As they champion arguments for the necessity thesis, this is a great way of finding out how and what exactly motivates Peter to take the opposite road. A careful analysis of Peter's arguments for the contingency thesis is offered in the paper, supplemented with lots of notes to primary texts. One very interesting aspect of Peter's position presented in Kitanov's paper is, in addition to the stance on the contingency of beatific enjoyment, the distinction between three types of necessity which shape his point of view.

The section ends with Christopher Schabel's paper "Henry of Langenstein, Henry Totting of Oyta, Nicholas Dinkelsbühl and the Vienna Group on Reconciling Human Free Will with Divine Foreknowledge". The paper traces the historical sources of the members of the Vienna Group to the writings of Scotus, Auriol, Rimini, Ockham, Woodeham, Kilvington, and Bradwardine, and shows that they tend to favour the position that there is no necessity involved in the workings of the human will. The paper ends with an invaluable critical edition of the Vienna Group's question on God's foreknowledge of future contingents from the commentary on the *Sentences*.

All in all, the collected volume is a treasure trove of information on the late Middle Ages commentaries on the *Sentences*, presented mostly in a historical manner, but also with a few more systematic essays, imbued with references to primary sources and solid textual analyses. Any scholar of medieval philosophy interested in how the commentaries on the *Sentences* developed in the late medieval period will benefit from reading it. Even for scholars interested in medieval philosophy in general the book can be very useful, as many of the texts approach their topics from a historical perspective that often looks back at the sources of the ideas. The massive editorial work of Monica Bînzei and Christopher Schabel has to be congratulated. The only issue one can take with this volume, is the fact that it was published eleven years after the initial conference, which lead to the unfortunate but understandable decision of leaving aside some of the papers because their material lost its relevance or was published somewhere else in the meantime.

Luis Bacigalupo. *Aristóteles en París. Ensayos sobre la filosofía cristiana en la Edad Media*, Lima: Fondo Editorial PUCP, 2022, 498 p. ISBN: 978-312-617-743-0. Cloth: PEN 100

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El libro de Bacigalupo no es una colección de nombres, fechas y datos del período histórico de la filosofía medieval. No es un abrumador listado de personajes ni de obras desconocidas y perdidas que hablan con un lenguaje fosilizado. Afortunadamente, el libro es todo lo contrario, pues, como afirma en el subtítulo, contiene una serie de ensayos sobre el desarrollo de la filosofía cristiana en la Edad Media. Y ante la buena producción de textos sobre filosofía medieval, cabe preguntarse ¿qué dice el libro de Bacigalupo que no digan los otros? Considero que son dos ejes primordiales sobre los cuales el autor teje una interesante interpretación del quehacer filosófico medieval y que responde a mi pregunta.

Por un lado, el eje simbólico-mítico propio de la religión cristiana y su espiritualidad emanada de la figura central y profética de Jesús que Bacigalupo denomina `el acontecimiento Cristo´ o "aquello que distingue a la filosofía cristiana de la Edad Media como su propiedad, que es su peculiar relación con el mito del Mesías" (37). El lenguaje y el ejercicio cognitivo para comprenderlo fue primordialmente simbólico, de modo que, su instrumento discursivo fue la retórica y la poética. Por otro lado, el eje lógico-analítico derivado propiamente de las obras filosóficas de Aristóteles, especialmente de los tratados de lógica contenidos en el *Órganon*, pues en estos se contiene una novedosa teoría de la ciencia y del conocimiento totalmente distinta al eje simbólico-mítico y que permitió el conocimiento natural de las cosas. Precisamente, uno de los aspectos que más sedujo a las mentes medievales fue esta perspectiva: la de un conocimiento natural expresado por medio de un lenguaje natural, de manera que, el conocimiento racional de la naturaleza sobrenatural de Dios era posible. Por tanto, Bacigalupo muestra que la historia de la filosofía en la Edad Media no fue una historia de etapas monolíticas, sino un complejo dinamismo de estas dos perspectivas (simbólico-mítico y lógico-analítico) en una dialéctica de tensiones, contradicciones y condenas.

Bajo el marco interpretativo de estos dos ejes, el autor organiza su exposición del devenir del pensamiento filosófico a lo largo de la Baja Edad Media y Alta Edad Media, para ello, el texto está dividido en tres partes. La primera (67-199) tiene como eje central la definición, explicación y demostración de las tensiones y contradicciones ocurridas entre las perspectivas simbólico-mítica y lógico-analítica. Esta es la piedra angular de la propuesta de Bacigalupo, pues, sin el conocimiento del conflicto de estas perspectivas, no comprenderemos los movimientos intelectuales, los debates, las teorías y los libros producidos, y, sobre todo, no nos explicaríamos qué *razones* subyacen para que el medioevo siga fascinándonos en nuestros días. Es más, si quitásemos los ejes propuestos por el autor, este período de estudio resultaría nuevamente esa lista engorrosa de nombres y títulos. En

pocas palabras, Bacigalupo nos muestra a los actores principales en escena discutiendo en medio de las tensiones y conflictos desencadenados entre las dos perspectivas antes mencionadas, somos testigos de una titánica lucha de visiones del mundo y del hombre que, paradójicamente, parece no haber concluido.

La segunda parte del libro (207-317) continúa el desarrollo de la tesis del conflicto de perspectivas y de la secularización. Añade la tesis de la Edad Media como el útero de la modernidad, pues el paulatino conocimiento de las doctrinas aristotélicas, especialmente la lógica, generó una revolución científica con el cambio de la metodología simbólica a la analítica. Personajes como Anselmo de Canterbury o Pedro Abelardo fueron parte de este proceso, pues, ambos apelaron en sus disquisiciones dialécticas razonamientos analíticos. De modo que, con Abelardo, estos son empleados tanto en la teología como en la ética por medio de su célebre teoría de la *sermo*. El anhelo de los pensadores cristianos por clarificar el simbolismo generó la paradoja de la desnaturalización simbólica, o en todo caso, a mayor esfuerzo por clarificación del misterio cristiano mayor destrucción del mismo.

En la tercera parte del libro (325-470), se estudia al personaje principal de esta conflictiva historia: Aristóteles. Su llegada a París fue mediada por una dilatada campaña de traducción de sus obras proveniente de Oriente conocida hoy como la *translatio studiorum*, cuyos focos de irradiación fueron el sur de Italia y España. La tierra fértil a la cual alude Bacigalupo previamente a la llegada del Filósofo ha sido preparada no solo por el constante conflicto entre las perspectivas simbólica y la analítica, sino por una aproximación más cercana a la naturaleza por parte de los intelectuales cristianos de los siglos XII y XIII. Qué tanta influencia tuvo en este cambio de perspectiva las diversas herejías como la de los albigenses y los cátaros, es difícil de precisarlo, pero de aquello que estoy seguro es que la perspectiva más conciliadora de la naturaleza por parte de los cristianos jugó a favor de la recepción de las obras del Estagirita. No es casual que el testimonio de vida de San Francisco de Asís, el santo fundador de la Orden de Frailes Menores o franciscanos, haya sido el mejor ejemplo de una aproximación espiritual a la naturaleza creada por la divinidad y, por lo tanto, también *buena*. En efecto, las condiciones para que Aristóteles haya sido bien recibido en Europa no solo fueron teóricas y académicas, sino también de orden existencial y natural, sin embargo, junto al entusiasmo aristotélico ingresaba de la manera más inesperada la perspectiva que sería el factor determinante en el conflicto: el método lógico-analítico. En este sentido, es importante mencionar que las sucesivas condenas del pensamiento aristotélico fueron siempre mal dirigidas, ya que se restringía el estudio de sus textos físicos y metafísicos cuando en realidad los textos "más peligrosos" eran los lógicos, pues contenían la teoría científica lógico-analítica. El cristianismo universitario alentaba el estudio de la lógica, prohibía los físicos y metafísicos y sin saberlo iba corroyendo lo que pretendía defender: la estabilidad del mito del acontecimiento Cristo.

El rol desempeñado por las dos principales ordenes mendicantes, dominicos y franciscanos, fue crucial no solo por el juego político y eclesiástico que les permitió mediar en el asunto, sino porque el aristotelismo fue un factor decisivo en la configuración de su perspectiva intelectual. Mientras los dominicos, sostiene Bacigalupo por medio de la

metáfora del reloj "Aristóteles" desarmado y rearmado con piezas cristianizadas, se abocaron a una cristianización del pensamiento del Filósofo, los franciscanos, en cambio, por medio de la metáfora de los puntos topográficos de un terreno, tomaron la doctrina aristotélica y con ella configuraron las coordenadas sobre un mapa por el cual un filósofo cristiano podía trasladarse. Y a pesar de las advertencias hechas por San Buenaventura, la suerte del aristotelismo y su método lógico-analítico estaba echada a su favor. Así, el triunfo de la analítica sobre la poética se hizo evidente con mayor fuerza. La teología simbólica de los primeros siglos del medioevo giró hacia una teología analítica, cuya cúspide es la obra de Tomás de Aquino, de manera que Bacigalupo ensaya una sugerente idea en torno a al destino del pensamiento medieval si la perspectiva de San Agustín hubiese permanecido, pues conforme a los intereses de los Padres de la Iglesia, la clave para una comprensión del cristianismo no era una *gnosis*, sino una *epignosis*. Es decir, no el conocimiento de lo natural como lo plantearon los filósofos griegos, especialmente Aristóteles, sino el *sobreconocimiento* de lo *sobrenatural* de Dios.

La *lectio divina* del pensamiento simbólico cristiano fue reemplazada por una *ratio fidei* o el esfuerzo de una racionalización de la fe. Y ante esta teología analítica, la sutileza y genialidad de Juan Duns Escoto en las postrimerías de la Escolástica es precisamente demostrar que una teología no puede ser analítica completamente, es más, no siquiera es posible que la metafísica analítica sea en sí misma una ciencia. La postura escotista arraigada en la tradición agustiniana representó, sin duda, el inicio del fin del aristotelismo escolástico, cuya parte final fue, literalmente, cortada por Ockham.

En suma, el texto de Bacigalupo plantea una perspectiva interesante para interpretar y comprender el desarrollo del pensamiento medieval. Para ello, nuestro autor plantea el conflicto de las dos perspectivas o metodologías intelectuales tanto la simbólico-mítica como la lógico-analítica. Y sobre estas, como en un bastidor, teje las redes interpretativas medievales. De este modo, si comparamos el trabajo de Bacigalupo con el de otros autores, se puede apreciar notables diferencias que enriquecen el conocimiento del medioevo filosófico.

Finalmente, desde el *acontecimiento Cristo* como clave hermenéutica, Bacigalupo no solo reafirma la piedra angular del pensamiento medieval cristiano, sino también propone una interpretación distinta del medioevo filosófico, incluso sugeriría que dicho *acontecimiento* se leería en clave del *cristocentrismo* franciscano con la cual Bacigalupo nos ofrece una lectura novedosa de una Edad Media que aún nos cautiva y que a veces parece no haber culminado.

Thomas Murner. *El Juego de Cartas de Lógica*. Traducción, introducción y notas de Jorge Medina Delgadillo. Prólogo de Mauricio Beuchot. Ciudad de México: Notas Universitarias, 2017. 281 p. ISBN: 9786079706524. Cloth € 42

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Al afirmar que las *Súmulas logicales* de Pedro Hispano sirvieron como texto para la enseñanza de la lógica hasta bien entrado el siglo XVII no se debe pensar que se trata de un texto monolítico, sino que hay una tradición textual diferenciada. A ella pertenecen los intentos de sintetizar el célebre compendio, como el de Thomas Murner editado en Estrasburgo en 1509. El título de esta traducción traslada el principal de la obra: *Chartiludium logice*.

El franciscano Murner toma como base el comentario a Pedro Hispano de Tartareto, profesor escotista de la Universidad de París. Pero su gran novedad es que acompaña la explicación de una serie de dibujos que sirven como ardid mnemotécnico para retener fácilmente los contenidos. Esa serie se presenta como una baraja de 52 naipes. Si nuestras barajas corrientes tienen cuatro palos, la de Murner tiene dieciséis. Corresponden a los tratados o partes en que divide la obra y tienen sus símbolos propios: cascabel (enunciado), cangrejo de río (predicables), pez (predicamentos), bellota (silogismo), escorpión (lugares dialécticos), etc. Símbolos que figuran una o más veces en cada naipe según el orden que ocupe en la baraja. De esta manera se obtiene un ordenamiento del material lógico que, salvando criterios muy convencionales, diverge de la versión española más conocida de Pedro Hispano, así como de la que ofrece un colega de Murner, el cartujo Gregor Reisch, quien publica su propio compendio lógico en Friburgo, en 1502, como capítulo de su *Margarita Philosophica*.

Sin duda es la contemplación de los dibujos, leyendo la glosa que los acompaña, la que se promete rica en sugerencias. A veces se antoja un bestiario en el que lo mismo aparece un caballo con dos patas equinas, una de oso y otra de gallo, que un elefante con parejas extremidades. Para la historia de las matemáticas es interesante seguir la evolución de la numeración indoarábiga en Europa. Así, no puede extrañar que en los naipes alguna vez encontremos el cuatro representado como una especie de "clip de mariposa", que no es sino un ocho anguloso partido por encima de la mitad. El que todavía podemos ver en algunos sepulcros tardomedievales. O que el siete tenga forma pinzada. Entre lenguaje y lógica parece estar la razón por la que se ha representado el palo de los predicables con la efigie de un pez. Procede de que, al distinguir tipos de predicación, Murner ilustra la predicación equívoca con el término *canis* (perro). Este puede significar el animal doméstico, o una constelación, o el *canis marinus*. Este último, típico ejemplo de manual, era la foca. Era perro por la semejanza de su hocico con el de un can. Sin embargo, Murner no dice que *canis* se predica de *canis marinus*, sino "de pisce marino". Adopta la denominación genérica de pez para todo aquello que vive en el mar (como se hizo frecuentemente con la ballena de Jonás). Creo que lo hace para salvar la idea de que el objeto al que apunta *canis* es precisamente diverso tra-

tándose de un perro y de un animal marino, aun cuando fuera la foca. Con lo cual ha preferido resaltar la diferencia y no la semejanza. De esta manera es un pez, y no una foca, el que sirve como distintivo para todo el tratado de los predicamentos.

Las opciones pictóricas pueden resultarle al lector un tanto peregrinas. La representación del género por la paloma porque "genera mucho" es bizarra. Dado que la síntesis textual ha realizado un cribado de ejemplos que aparecían en Pedro Hispano, en ocasiones un ejemplo de allí se convierte en una imagen de la baraja, como la sonrisa para designar al propio (74). Pero muchos recursos icónicos no se corresponden con ejemplos tradicionales, y en ello vemos una singularidad del autor, para quien quizá pudieron ser útiles, pero dudamos de si alcanzarían el objetivo pedagógico que él dice pretender.

La filiación franciscana y escotista es constatada por el editor. Está ya en la imagen inaugural, la alegoría de la lógica conocida como *Typus logice* ("imagen de la lógica"). Esta ya había aparecido en la *Margarita Philosophica* de Reisch varios años antes. Pero en el libro de Murner exhibe leves variantes. Destaca que en la "selva de las opiniones" figurada al fondo, el árbol más frondoso es el de los escotistas, dejando pequeños a albertistas, tomistas y ockhamistas. El ilustrador de *Margarita Philosophica* ha sido el mismo que el del *Chartiludium logice*, acaso Beatus Murner, hermano del franciscano. También hay señas de franciscanismo en algunos recursos mnemotécnicos. Así, los antepredicamentos, previos al estudio de los predicamentos, se representan con el cordón franciscano, que es lo que recibe el novicio con el hábito al entrar en la orden (88). Pero al concluir el tratado de predicamentos, los postpredicamentos se asimilan a la tonsura (120), que se recibía como culminación tras años de formación en la vida religiosa y como distintivo de pertenencia al estado eclesiástico.

Otros motivos religiosos allende el linaje franciscano son las cuentas a modo de coronilla o rosario, que en varios naipes vemos colgadas de los belfos de un caballo, para hacer pensar en la oración como proposición que se expresa por la lengua. O la custodia con la eucaristía para figurar el accidente. La referencia a la eucaristía es característica de los tratados de lógica del siglo XVI.

La obra de Murner reproduce opciones lógicas de Pedro Hispano, como negar identidad a la cuarta figura del silogismo; y alguna vez se aparta de él, como cuando define al silogismo como un razonamiento hipotético ("oración hipotética", 131). Pretende incluir todo el material lógico en un solo volumen, y no en dos como comenzó a ser uso entre lógicos españoles de la época. Es llamativo que Murner dedica nada menos que ocho naipes a los predicamentos, que el tratado de las falacias de Pedro Hispano se ve bastante recortado, y que temas que podían recogerse genéricamente en un apartado de *parva logicalia* tienen cada uno su propio palo.

¿Qué desacuerdos puede suscitar esta edición? Vaya por delante que más que nada provoca entusiasmo. Pero hay algunos errores que me apresto a señalar. Hay un error de traducción en la p. 39, al tratar de la materia remota de la proposición. Debería decir: "La remota es *aquella* en la cual la relación de los extremos se da de la siguiente manera: uno no puede ser predicado de otro, a no ser *con* una nueva imposición mediante cópula no am-

pliada ni ampliativa" (pongo en cursiva lo que habría que añadir). Además, en la nota sobre la conversión simple Jorge Medina dice en la p. 42 que es una equipolencia, pero no es correcto. Para que fuera correcto tendría que jugar con la negación (idéntico error en la p. 45). En la p. 80 hay errata de exceso de texto al final.

Una perplejidad que queda es dónde ha sido redactada realmente la obra. Murner saluda al lector *ex academia friburgensis*, desde la Universidad de Friburgo. La edición es, no obstante, de Estrasburgo. Pero hay algo que no encaja. Normalmente el autor de este tipo de obras delata el lugar de su composición al tratar el tipo de argumento que se llamaba *exemplum*. Corresponde al *paradeigma* de Aristóteles, el ejemplo del cual sonaba así en *Analíticos primeros*: "Si la guerra de Tebas contra Fócida es mala por ser una guerra entre vecinos, entonces la guerra de Atenas contra Tebas será mala por ser una guerra entre vecinos". Ejemplo en el que aparece entre las ciudades mencionadas aquella en que ha sido compuesto el tratado: Atenas. Normalmente los lógicos medievales modificaban este ejemplo de *exemplum* para hacer constar el lugar desde donde escribían. Así, de Pedro Hispano sabemos por la tradición textual más asentada que escribe su *Tractatus* desde alguna zona del reino de León, por el caso de *exemplum* en que pone a los leoneses luchando contra los de Astorga (*asturicenses*), y a los de Astorga luchando contra los zamoranos. En este punto se confunde claramente Jorge Medina al decir que Pedro Hispano cita ciudades de Bélgica y Holanda (quizá lo suple por algún comentador). Reisch también hizo presente a Friburgo, la ciudad desde donde escribía. Pero Murner, sorprendentemente, pone lugares de Francia lejanos de su Estrasbrugo natal: que los parisinos peleen contra los de Ruán es malo; por tanto, que los de Turena peleen contra los de Poitiers también lo es (véase p. 148). ¿Desde dónde escribió originalmente el tratado? ¿O debemos suponer que ese era el ejemplo de *exemplum* que puso Tartareto y que Murner simplemente lo copió?

Regocijémonos viendo una obra como esta, largamente silenciada como decía la edición parisina del 1629, traducida a una lengua moderna. Que la tirada sea solo de cien ejemplares guarda escasa proporción con su interés en historia de la lógica.