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Rheticus, Realism and Scripture. An Analytical Assessment

Rheticus was the only formal and personal disciple of Copernicus. In his recently rediscovered tract on science and religion, he claims that certain non-literal interpretations of some biblical texts that deal with the natural world are preferable, considering that their writers used popular knowledge when speaking about that realm. In this contribution, I specify the main tenets of Rheticus' insights, together with a discussion on his position towards realism. Furthermore, I explicate how his accommodative approach, nursed by realism (might) affect the exegetical task. This helps to explain an important contradiction with his own rules on the part of Rheticus.

Keywords: accommodation, Copernicanism, hermeneutics, Hooykaas, instrumentalism, Osiander, realism, Rheticus, Roelants.

1. Introduction

In 1618 the Polish astronomer Joannes Broscius (1585–1652) published the first three of several letters about Copernicus that he planned to make public.[1] For unknown reasons the complete publication did not take place. One of those three letters was written by the then bishop of Kulm, Tiedemann Giese (1480–1550), and addressed to the only formal and personal disciple of Copernicus, Georg Joachim (von Lauchen) Rheticus (1514–1576).[2] It is dated July 26th, 1543, two months after Copernicus' death, and it gives information about two writings penned by Rheticus.

Apparently Rheticus himself had sent two copies of *De Revolutionibus* to-

1 See Chroboczek, J. 'Jan Brozek: Mathematician, Astronomer and Biographer of Copernicus (1585–1652)', *The Polish Review* (2010) 55, 169–193; and Chroboczek, J. 'Three Letters on Copernicus published by Joannes Broscius in 1618', *Sudhoffs Archiv* (2013) 97, 1–20.

2 For biographical reconstructions, see Burmeister, K. *Georg Joachim Rhetikus 1514-1574.* 3 vols., Wiesbaden: Pressler Verlag (1967) and Danielson, D. *The First Copernican: Georg Joachim Rheticus and the Rise of the Copernican Revolution*, New York: Walker & Company (2006). Westman introduces a novel interpretation of the academic relationship between Rheticus and Copernicus (Westman, R. *The Copernican Question: Prognostication, Skepticism, and Celestial Order*, Los Angeles: University of California Press, (2011)), and Goddu follows their mutual influences (Goddu, A. *Copernicus and the Aristotelian Tradition. Education, Reading, and Philosophy in Copernicus's Path to Heliocentrism*, Leiden: Brill (2010)). Rheticus' life, his achievements in math, cartography, and other realms, and his personal matters (which include a licentious -- according to some accusations, criminal -- lifestyle) are not part of my concerns.

gether with a (lost) letter to Giese, a close friend of both him and Copernicus. Giese read the documents and decided to write back to him. As we can tell from the content of Giese's reply, Rheticus was indignant. Showing solidarity, Giese was also shocked and plainly upset both by the tone of the "To the reader concerning the hypotheses of this work" (*Ad lectorem de hypothesibus huius operis*, which I shall call, "[the] *Ad lectorem*") and for what he considered to be the disrespectful omission of not mentioning Rheticus in the preface of the volume. In his letter, Giese urged the Lutheran to publish a new edition of the work with two *addenda* he knew Rheticus had already produced: (1) a biography of Copernicus and (2) a tract on science and religion.[3]

The suggestion was not followed. For many years, no further references nor traces in the literature occurred, except for these meager lines about the two texts mentioned by Giese.[4] Copernicus biography is lost. However, that is not the case for Rheticus' treatise on science and religion (which I shall call RT[5]), which was accidentally discovered by Reijer Hooykaas in 1972 and published by the mid-1980s.[6] This publication is a critical edition and includes the reproduction of the entire original Latin manuscript together with an English translation and a well-organized and detailed additional study on its authorship and content.

In this contribution, I deal with the content of RT in a rather unexplored fashion. I offer an explication of the philosophical issues that are behind Rheticus' approach to science, and how it affects an understanding of the Bible. Though the author is sometimes ambiguous in his treatment of the subject, one can clearly see his eagerness to show it is possible to remain a believer in Judeo-Christian revelation, even when one adopts what we now call "Copernicanism". Rheticus' main apologetic tenet is accommodation, which is the Augustinian perspective[7] that claims the Bible was written by men who often used common knowledge or traditional beliefs of their time and place when dealing with

3 Lamont, R. 'A Few Things About Copernicus', Popular Astronomy (1932) 40, 2–9; cf. Rosen, E. 'The Exposure of the Fraudulent Address to the Reader in Copernicus' Revolutions', Sixteenth Century Journal (1983) 14, 283–291

4 Cf. Rosen, E. Three Copernican Treatises. The Commentariolus of Copernicus; The Letter against Werner; The Narratio Prima of Rheticus, New York: Dover (1959), pp. 5, 7–28.

5 The original title is unknown. Westman (2011 op. cit., (2), p. 131), following Hooykaas, suggests "*Opusculum quo a Sacrarum Scripturarum dissidentia Telluris Motus vindicatur*". When quoting portions of RT, the references follow the English translation and enumeration of paragraphs provided by Hooykaas.

6 Hooykaas, R. *G. J. Rheticus' Treatise on Holy Scripture and the Motion of the Earth,* Amsterdam: North-Holland (1984a); *Fact, Faith and Fiction in the Development of Science*, Boston: Springer (1999), p. 150; cf. Higgins, S. 'G. J. Rheticus and the Authorship of the Anonymous *Epistola de Terrae Motu*', *Master Thesis*, Dalhousie University, Halifa, Nova Scotia (2013)https://dalspace.library.dal.ca/handle/10222/34639, last accessed August 10, 2021.

7 Augustine. *The Literal Meaning of Genesis,* New York: Newman (1982).

nature, so that their sayings in that realm need not be read literally. Using the accommodation perspective, accepting the movement of the Earth is innocuous, even in the face of biblical texts that says the opposite.

Surely the best-known studies on this subject are Galileo's letters several decades later in favor of non-literalist readings of the Bible. After 1616 (the date of his first trial and the inclusion of *De Revolutionibus* in the *Index expurgatorius*, "until corrected"[8]) writings regarding the compatibility between the Earth's mobility and Scripture were almost commonplace.[9] Remarkably, if Hooykaas is right about dating RT to the beginning of the 1540s,[10] we now have the introduction of the same ideas decades before Galileo forcefully delved into this topic.

The content is organized as follows: Firstly (section 2), I explain what Rheticus says about how the new ideas in astronomy might impact hermeneutics and theology. I also emphasize the main tenets of the tract together with the linking arguments the author makes between them in the middle of numerous biblical quotes. Secondly (section 3), I take a stand on the alleged realism of Rheticus, which I think strengthen his accommodation perspective. In this section, I discuss the arguments introduced by Roelants[11] that favor an instrumentalist reading of Rheticus' work, which I contend by analyzing some textual and contextual evidence. Thirdly (section 4), I provide an analytical study regarding accommodation and the question of who is legitimately responsible for the task of accommodation. Importantly, I try to explain Rheticus' main inconsistency with his own rules which, I argue, probably originates from his commitment to realism. Finally, I offer conclusions.

8 See Wolters, G. 'The Silence of the Wolves, Or, Why It Took the Holy Inquisition Seventy-Three Years to Ban Copernicanism', In Neuber, W., T. Rahn and C. Zittle (eds.) *The Making of Copernicus. Early Modern Transformations of the Scientist and his Science*, Leiden: Brill (2014), 42–63. The entire collection of Rheticus' works was also included in the *Index*, but much earlier around 1550. This explains why so many of his original writings were and are so hard to find (see De Morgan, A. 'Rheticus', *Penny Cyclopaedia of the Society for the Diffusion of Useful Knowledge*. London: Charles Knight & Co., Vol. 19, 448–449 (1841); De Morgan, A. 'On the almost total disappearance of the earliest Trigonometrical Canon', *Monthly Notices of the Royal Astronomical Society* (1845) 6, 221–228; Archibald, R. 'Rheticus, with special reference to his *Opus Palatinum*', *Math. Comp*. (1949) 3, 552-561).

9 Hooykaas, R. 'Rheticus's Lost Treatise on Holy Scripture and the Motion of the Earth', *J. Hist. Astron*. (1984b) 15, 77–80.

10 As Westman claims, the date of the work "affects what we make of it" (*op. cit*., Westman (2), p. 131). The same goes for its authorship.

11 Roelants, N. 'The Physical Status of Astronomical Models Before the 1570's: The Curious Case of Lutheran Astronomer Georg Joachim Rheticus', Theology and Science (2012) 10, 367–390.

2. Explication of the Content of RT

2.1 Science and the Interpretations of the Bible in RT: A Reconstruction

Given that Rheticus' approach is not entirely consistent; his position is not easy to sum up. Here, we shall see what I identify as his main claims, saving the summary for the next subsection.

Repeatedly, Rheticus says that the objectives of the Bible have nothing to do with the objectives of science. The Bible's goals are to (1) keep us worshiping the creator, not the creation, and (2) bring the knowledge of salvation to humanity. Thus, as the guide to redemption, it is a work that not always "seek[s] exactness in the manner of the Philosophers" (RT, #39), because it has an entirely higher purpose:

…we do not study the passages about nature as if Scripture were a philosophical textbook, but rather as books in which the Holy Spirit desired to teach us something necessary for our salvation […] the Holy Spirit has not wished to compose a course of Physics, but rather a rule of life, and to teach how we may be made children of God. (RT, #12, 47)

By contrast, physics deals with nature, something completely unrelated to spiritual matters. It is this contrast in the two agendas that directly led Rheticus to suggest both the erection of a barrier between two different kinds of knowledge and the accommodation perspective:

…it is clear that the Holy Spirit does not want to speak of them [the things of nature] in the manner of the Philosophers, but in another way, and that He keeps in view the main purpose of Scripture (RT, #4, cf. #5-6).

And,

…it is too well-known to need further proof, that Holy Scripture uses common and received forms and figures of speech. (RT, #59)

If this is correct, we should not expect accuracy regarding natural matters in the Bible, and it should not be quoted as an authority on natural phenomena. Instead, we can know about them thanks to natural philosophy (RT, #28).

However, there is an exception. We can (and must) follow Scripture if it speaks about some facets that philosophy/science cannot reach, even though they are natural. For example, the problem of the eternity or finitude of the world is not something we can know empirically. Thus, if the Holy Writings say something on the topic (as they do), we should accept it, rejecting every speculative doctrine or hypothesis that goes against it. That is why we can confidently turn down the Greek teaching (not based on empirical enquiry) that

denies creation (RT, #7).[12]

In every other respect regarding nature, knowledge must be obtained from science (RT, #29). When that knowledge is in conflict with the Bible, it should turn our attention to the context within which the inspired writer was thinking. This might lead us to a different set of interpretations,[13] the literal being only one of them:

…Scripture borrows a style of discourse, and idiom of speech or a method of teaching from popular usage, *so that it may also fully accommodate itself to the people's understanding, and not conform to the wisdom of this world*. Therefore […], texts of Scripture dealing with natural things receive different interpretations, inasmuch as they have not been handed down by the Holy Spirit with the same care as those on which our salvation depends. (RT, #8-9, emphasis in the original, cf. #36, 38-39)

Finally, Rheticus attacks his "literalism" rival in its own arena, something that Galileo will do later, but by focusing on a different point. Rheticus says that in practical terms, all his contemporaries were reading portions of the Bible about natural phenomena in a non-literal manner. For example, for a kernel of wheat to bear fruit, it should not previously die, as John 12:24 (literally) asserts. Importantly, nobody would dare claim that not reading texts like this literally is the equivalent of not taking them seriously: "the authority of Holy Scripture, then, is not thereby damaged" (RT, #40), nor is this the case with faith (RT, #11). Rheticus suggests that we should proceed likewise with other passages. For example, the Bible sometimes speaks of the "earth" referring to the whole globe of earth and water, as in Isaiah 37 or Psalm 23 (RT, #19). Also, if the stars do move and the Earth is immobile, as tradition claims, why do we speak of *firm*ament, if it moves? (RT, #16-17, quoting many biblical texts). Furthermore, if we should believe in the stability of the Earth because we find texts that speak about its "foundation", then we should conclude the same when similar expressions are applied to the moon, the stars and the heavens (Psalms 104:5; RT, #49-52).

One last example comes from key verses in Joshua 10. Rheticus cleverly affirms that nobody takes literally the part where Joshua told the Sun "not to

12 Cf. *op. cit*., Hooykaas 1984a (6), pp. 78, 119 –121.

13 *op. cit*., Hooykaas (1984a (6), pp. 28–38) mentions allegorical interpretation and accommodation as the main alternatives to literalism (cf. Westman, R. 'The Copernicans and the Churches', In Lindberg, D. and R. Numbers (eds.) God & Nature. Historical Essays on the Encounter between Christianity and Science. Los Angeles: University of California (1986), 76–113). One additional resource is to preserve literalism, but, in any case, change it (I thank Aecio Caïrus for making me note this). For a modern example of this last option on a key text, see Humphreys, C. and G. Waddington. 'Solar Eclipse of 1207 BC helps to date Pharaohs', Astronomy & Geophysics (2017) 58, 539–542; and Vainstub, D., H. Yizhag and U. Avner. 'The Miracle of the Sun and Moon in Joshua 10 as a Solar Eclipse', Vetus Testamentum (2020) 70, 1–30.

across Gibeon" and the Moon "not to move across the valley of Ajalon". That is because the Sun never really moves across Gibeon and the Moon never was in the valley of Ajalon. Joshua's command is based on his perception from his specific location. If Joshua had seen the miracle from a different location, the command would have been different too. "Therefore, it is clear that he does not speak as a mathematician/astronomer, and that Scripture does not depart from ordinary speech." (RT, #60)

Decidedly, accommodation is not an approach that can be rejected *a priori*.

2.2 The Main Tenets of the Work

In the dialogue between scriptural and (what we now call) scientific discourses, I think that Rheticus' mainstay is focused on these four aspects:

(Tenet 1) that science ("natural philosophy") helps us to discover -- or at least helps us to get us closer to -- what there is in the world and/or how it works;

(Tenet 2) that God provided the human race with sacred texts mainly to assist them in finding knowledge that can lead them to salvation (cf. 2 Timothy 3:15) and to direct their worship of the creator (so that it is incontestable in this realm), and not to help them to know how nature works;

(Tenet 3) that the writers of Scripture, when speaking about nature (or about any other domain apart from soteriological topics), often use the language of the time, i.e., the accommodation perspective;

(Tenet 4) that the Bible, when speaking about nature, i.e., what there is in the world and/or how it works, should not always be understood literally, but admits other interpretations.

Many relationships can be found between these four tenets. They can be seen as starting points, but it is also possible to derive some of them from others. For instance, one can conclude (although not deductively) tenet 4 using different paths, including the former three points. Also, Rheticus affirms tenets 3 and 4 relying repeatedly on St. Augustine's authority (cf. RT, #1, 2, 8, 10–11, 14, 16, 28, 39, 41, 47, 59). (However, we shall see that Rheticus, clashing with his own Augustinian prescriptions, contradicts himself regarding what the reliable source is for biblical interpretation.) Within RT, the virtually omnipresent link is between tenets 2 and 3, but on many occasions, he includes tenet 4 as a natural consequence of 3.

3.0 Was Rheticus a Realist?

3.1 Objections to Rheticus' Realism

By 1601 Johannes Kepler (1571–1630) debunked Andreas Osiander (1498–1552) as the author of the (for Rheticus and Giese, infamous) *Ad lectorem*.[14] This was done in his crusade for his master Tycho Brahe's, *Apologia pro Tychonis contra Ursum* and later (1609) in his book on Mars, *Astronomia Nova*. Osiander's preference for fictionalism is well known, thanks not only to this writing, but also to a couple of earlier letters he sent both to Rheticus and Copernicus. These letters regarded the approach they should follow in the latter's work in order to circumvent avoidable objections. They should defend astronomical hypotheses, not as if they were truths of nature, but by instrumentalism, so that no questions would arise either from Aristotelians (who claimed bodies can have only one proper motion) or from Theologians (with texts that literally support the stationary Earth). Most historians agree that neither of them were willing to do so, i.e., Rheticus and Copernicus were genuine realists.

Nienke Roelants, in a well-informed work worth reading, disputed Rheticus' realism, bringing his position closer to that of Osiander. Briefly, she introduces a twofold justification for this conclusion:

(1) Textual evidence. In RT, some expressions deny that science can reach complete knowledge about nature, but only hypotheses that are nearer the truth (RT, #14; I shall return to this very paragraph later, cf. #31, 64). Additionally, in *Narratio Prima*, the author speaks of Copernicanism not as a true hypothesis, but as a "most true" one.[15] In any case, if there are certainties, they are about mathematical truths, not about physical ones.

(2) Theological context. She mentions that Lutheran theology stressed the limited knowledge available to humans in a postlapsarian reality.[16] We,

14 See *op. cit.*, Rosen 1983 (3) and Jardine, N. *The birth of history and philosophy of science. Kepler's A defense of Tycho against Ursus with essays on its provenance and significance*. Cambridge: Cambridge University (1984), pp. 150–154. Kepler possessed a copy of *De Revolutionibus* that previously belonged to Hieronymus Schreiber, and had the name of Osiander added under the Letter (*op. cit.*, Jardine (14), p. 150; Gingerich, O. *An Annotated Census of Copernicus's De Revolutionibus (Nuremberg, 1543 and Basel, 1566)*. Boston: Brill (2002)). Kepler's copy was certainly not the only one with that addenda (see Zinner, E. *Entstehung und Ausbreitung der Copernicanischen Lehre*, Munich: Beck (1998). It is very probable that Rheticus was well aware that Osiander was its real author and/or had something to do with its inclusion. However, apparently he did not mention that in his communication to Giese, as far as Giese speaks of Petreius, the final editor, but not of Osiander, in his reply.

15 *op. cit.*, Roelants (11), pp. 372–373; cf. *op. cit.*, Rosen 1959 (4), pp. 142, 167.

16 See Harrison, P. *The Fall of Man and the Foundations of Science*, Cambridge: Cambridge University (2007), ch. 3.

as fallen beings, are not able to know facts about the world with certainty. It is simply not possible for us -- in our provisional state of imperfection -- to know ultimate physical truths about nature (see RT, #29). We should be satisfied in developing better hypotheses with time, stepping back from certainty to philosophical probability. As a disciple of Philip Melanchthon (1497–1560), Roelants says, Rheticus likely followed this very approach.

However, she recognizes one difference. For Osiander, "all astronomical hypotheses are equally fictitious", while, for Rheticus, "the hypotheses of the motion of the earth provide in fact the best fit between theory and observation and therefore, is most true".[17] But, given their identical theological background, both Rheticus and Osiander should have shared approximately the same fictionalist (or at least non-realist) point of view.

3.2 Realism and Instrumentalism then and now

I think that two important preliminary comments must be specified. The first comment is about the use of terms such as "realism" and "instrumentalism". Applying those labels -- presently loaded with refinements conceived during the re-ignition of the debate on scientific realism that took place during the last decades -- to ideas of people who lived centuries ago might result in anachronisms.[18] However, for the matters I analyze here, it makes no difference what kind of instrumentalism we attribute to Osiander or (especially) what kind of realism we attribute to Rheticus for us to infer the same conclusions.[19]

The second comment concerns the use of the term "hypothesis", which is prone to be vague, to say the least. A "hypothesis" meant anywhere from being no more than a fictitious guess or invention in one extreme to a conjecture able to "graduate" into a "demonstrated truth" (a reality) in the other.[20] More

17 *op. cit*., Roelants (11), pp. 383–384.

18 Machamer, P. 'Commentary: Fictionalism and Realism in 16th Century Astronomy', In Westman, R. *The Copernican Achievement*, Los Angeles: University of California (1975), 346–353; Barker, P. and B. Goldstein. 'Realism and Instrumentalism in Sixteenth Century Astronomy: A Reappraisal', *Perspectives on Science* (1998) 6, 232–258; *op. cit*., Westman (2).

19 I am not saying that this kind of clarification would be unnecessary in every context. Note that Osiander cannot be considered an instrumentalist regarding his eschatological beliefs (I thank an anonymous referee for pointing this). This goes for Swerdlow's conclusion on Osiander with which I will deal in section 3.3.

20 In astronomy, the problem seems to be the worst. Greek astronomers used to call their models "hypotheses". This custom was apparently kept for centuries. The famous offer by Petrus Ramus (1515–1572, in a letter to Rheticus) of his own position to the person who could produce an "astronomy without hypotheses" provides an example of that (see Gingerich, O. 'From Copernicus to Kepler: Heliocentrism as Model and as Reality', *Proceedings of the American Philosophical Society* (1973) 117, 513–522; *op. cit*. Jardine (14), p. 153; Westman, R. 'Kepler's Theory of Hypothesis and the 'Realist Dilemma'', *Studies in History and Philosophy of Science* (1972)

specifically, RT was written before Kepler clarified the distinction between a geometrical device for predictions, i.e., a mathematical hypothesis, and a new astronomy, i.e., a physical hypothesis that deals with actual celestial bodies.[21] Even though the first extreme was the one that usually fit the use of the term in astronomy for centuries, I shall show that Rheticus is leaning towards the second end of these multiple options.

3.3 Intra-textual, Inter-textual and Contextual Evidence for Rheticus' Realism

Surely, Roelants is right in there being some expressions in RT that seem not to agree with the never-hesitating realism championed, for example, by Galileo or Kepler years later. Furthermore, it is also true that for some decades, many Lutheran astronomers used Copernicus' works from a non-realist point of view.[22] However, I find Roelants' claim unconvincing. I think that there is considerable textual evidence that helps us to acknowledge a significant distance between Osiander and Rheticus.

Let us return to paragraph #14 of RT:

We have sufficiently explained elsewhere how the hypotheses concerning the earth's motion agree so strongly with observed facts that they may be identified with them as a good definition with what it defines. For reason cannot produce any other hypotheses nearer the truth [...] therefore, *the motion of the earth may be considered as demonstrated truth* ("*cum itaque pro comperta veritate terrae mobilitas habeatur*", RT, #14-15, my emphasis; cf. #23-24, 27)

We find no such confidence in scientific achievements in any of Osiander's texts, where he advocated for the use of any predictive tool as long as it proves to be successful.[23] Rheticus is not even close to saying that the appearances had

3, 233–264; Schofield, C. 'The Geoheliocentric Mathematical Hypothesis in Sixteenth-Century Planetary Theory', *The British Journal for the History of Science* (1965) 2, 291–296).

21 *op. cit*., Jardine (14); *op. cit*. Westman 1972 (20); Westman, R. 'Kepler's Theory of Hypothesis', Vistas in Astronomy (1975a) 18, 713–720.

22 Robert Westman sees Rheticus as an exception, one who followed a "strong realist interpretation" of Copernicanism (Westman, R. 'The Melanchthon Circle, Rheticus, and the Wittenberg Interpretation of Copernican Theory', *Isis* (1975b) 66, 165–193; Westman, R. 'Three Responses to the Copernican Theory: Johannes Praetorius, Tycho Brahe, and Michael Maestlin' In Westman, R. (ed.) *The Copernican Achievement*, Los Angeles: University of California (1975c), 285–345; *op. cit*., Westman 1986 (13), pp. 81-85; and also *op cit*., Machamer (18); *op. cit*., Goddu (2), pp. 404-405; Omodeo, P. *Copernicus in the Cultural Debates of the Renaissance. Reception, Legacy, Transformation.* Leiden: Brill (2014), pp. 92-94, 274-278, 319; Bienias, B. 'The Place of Edward Gresham's *Astrostereon* (1603) in the Discussion on Cosmology and the Bible in the Early Modern Period', *The British Journal for the History of Science* (2020) 53, 417–442).

23 *op. cit*., Barker and Goldstein (18) for a different interpretation of Osiander's instrumental-

to be saved no matter the cost. On the contrary, he believes that Copernicanism is demonstrated. Were that not the case, why does he bother to look for a reason for the parts of the Earth to move in a circle (RT, #45)?

Also, note the first words of the tract (written partially in Greek):

It is mathematically certain that to obtain a consistent explanation of the phenomena of the heavenly bodies, the mobility of the earth should be assumed. What, however, should be laid concerning this matter according to Holy Scripture? (RT, #1)

Why does he bother to write about Scripture if his moving Earth was but an arbitrary model with no ontological commitment? The very task of writing this work indicates a bias towards realism by this author. There is almost no place for this kind of text if Rheticus belonged to the instrumentalist camp.

Furthermore, the same view can be found in *Narratio Prima* (with a clearer emphasis, as far as I am concerned), where Rheticus speaks about the new "hypothesis", but at the same time considers the Earth as an actual planet with multiple motions. Rheticus claims that Copernicus not only demonstrated that the Earth moves, but also demonstrated all that is related to those movements. Literally: "what has been said thus far regarding the motion of the Earth has been demonstrated by my teacher" ("*his itaque, quae de terrae motu hactenus dicta sunt, a Domino praeceptore meo confirmatis*").[24]

However, the portions quoted by Roelants do exist, leave the reader with a sensation of ambiguity, and should be explained. Those very texts were a topic of discussion by other authors. Even when they do not reject Rheticus' realism, they do recognize some hesitations. Hooykaas, for example, takes a stance on a simple explanation for these discrepancies: they were the consequences of a "wavering mind" on the part of an instable person.[25] Swerdlow claims that the variants on this between *Narratio Prima* and RT are so important that they might lead people to think they are from two different authors.[26] But, as he also affirms, this could be the result of these two texts having different goals and of them being produced with different audiences in mind: *Narratio Prima* for astronomers and RT (which has not even a single reference to astronomical

ism.

24 Rheticus, G. *Narratio prima.* Gedani: Per Franciscum Rhodum (1540). (First edition, printed anonymously.) See *op. cit*., Rosen 1959 (4), p. 168; see also pp., 131, 135–137, 140, 143, 144, 148; cf. Dinis, A. 'G. J. Rheticus on Copernicanism and the Bible', *Revista Portuguesa de Filosofía* (1996) 52, 299–314, pp. 309–310;

25 *op. cit*., Hooykaas 1984a (6), pp. 19, 142, 149; cf. p. 36.

26 Swerdlow, N. '(Review of) *G. J. Rheticus' Treatise on Holy Scripture and the Motion of the Earth*: with translation, annotations, commentary and additional chapters on Ramus-Rheticus and the development of the problem before 1650. Amsterdam: North-Holland', *J. Hist. Astron*. (1986) 17, 133–136.

technicalities) for devout people that were not necessarily knowledgeable in astronomy. Perhaps, when writing RT, Rheticus decided to partially introduce himself -- for the political reason of not stirring things up with theologians -- as a non-supporter of a die-hard/intransigent realism, which could make some conclude that in these *scarce passages* he is actually sympathizing with instrumentalism.[27]

Another important point has to do with Osiander. We could moderate our understanding of his instrumentalism too, and from two different angles. On the one hand, his non-realist position might be a mere skepticism for (in)surmountable reasons, and not necessarily an anti-realist one. On the other hand, perhaps he was advising Copernicus and Rheticus to pragmatically adopt instrumentalism for policy and protection, but not from conviction. Swerdlow[28] reminds us that Osiander in his letters was suggesting to Copernicus and Rheticus what they should say to the readers, not what their position on realism should intrinsically be. Swerdlow's remark emphasizes that the political correctness factor in an intolerant environment should not be underestimated when authors introduce polemic views openly.[29] As far as I know, Kepler was the first to stress this last interpretation:

It […] should be remarked on that Osiander seems to have written insincerely and not from personal conviction. […] For since he feared for Copernicus at the hands of the herd of philosophers, in case readers should be scared away from his most excellent work by the absurdity of the hypotheses, he wanted to put these things of his in a preface in order, so to speak, to sugar the pill of Copernicus' work.[30]

27 As an anonymous referee mentioned, if RT was written after Rheticus returned to Wittenberg, and not while he was living with Copernicus, these hesitations might be intended to please his mentor, Melanchthon, who did not advocate for realism with Copernicanism. This might also help to explain why RT was not published.

28 *op. cit*., Swerdlow (26), p. 136.

29 The political environment might well explain the omission of mentioning Rheticus -- a Lutheran -- by Copernicus (see *op. cit*., Gingerich 1973 (20), pp. 514-515). Westman (*op. cit*., 2011 (2), p. 110), on his part, thinks that this, together with the non-mention of the pope in *Narratio Prima*, have to do with a dual strategy by both astronomers to boost the reception of Heliocentrism. Many attribute the survival of *De Revolutionibus* despite the growing intolerance on the matter to the *Ad lectorem* (Wrightsman, B. 'Andreas Osiander's contribution to the Copernican achievement', In Westman, R. (ed.) *The Copernican Achievement*, Los Angeles: University of California (1975), pp. 213–243, pp. 237–243). This is perhaps correct in so far, as a referee noted, a fictionalist approach would prevent any change in the order of disciplines. Blumenthal is among those who offer additional reasons (Blumenthal, G. 'Diplomacy, Patronage, and the Preface of *De Revolutionibus*', *Journal for the History of Astronomy* (2013) 44, 75–92; Blumenthal, G. 'Copernicus's Publication Strategy in the Contexts of Imperial and Papal Censorship and of Warmian Diplomatic Precedents', *Science in Context* (2016) 29, 151–178.).

30 *FIDE op. cit*. Jardine, (14), p. 152.

One additional piece of circumstantial evidence has to do with the anger Rheticus unquestionably expressed in his letter to Giese. Perhaps Rheticus thought that many readers would conclude that it was Copernicus or even himself who wrote the unsigned *Ad lectorem*.[31] If his convictions were so close to its content, why the outrage? It seems more probable that Giese was allying himself with Rheticus' position (and, surely that of Copernicus) than introducing a new, different perspective.

Furthermore, if all Copernicus' astronomy is fiction, or at least a non-realist model, why all the fuss? Why not directly show some explicit and more transparent instrumentalism to evade the potential dangers once and for all? My answer is that there is no concession to Osiander's advice on the part of Rheticus. If the new astronomy was nothing more than mathematics of a non-existent reality, no reason is needed to look for a safe place for the proposal. But, if Copernicanism ventured into the truths of nature, all this commotion makes complete sense.[32]

Blumenthal adds that if Copernicus or Rheticus followed Osiander, the new theory would be at a disadvantage in relation to Ptolemy's *Almagest*, as long as it "saved the appearances and was not contrary to scripture".[33]

Moreover, some of the explicit references in RT to the influence the Fall might have had on our capacities for knowledge are quoted either to defend accommodation (rather than mark a limit to our knowledge of the truth about nature) or to justify the gift of the Bible (RT, #2–4). The Fall affected both our knowledge about God (hence our need of Scripture) and about nature (whose knowledge is achievable through science), but neither are related to realism.[34]

Finally, note that one thing is to recognize that our scientific theories might be wrong, and another to deductively conclude from that some sort of skepticism towards realism, as Roelants seems to claim.[35] Fallibilism is perfectly compatible with a strong commitment to realism.

4.0 Natural Philosophy and Hermeneutics: Analytical Assessment

31 *op. cit.*, De Morgan 1841 (8), p. 449; *op. cit.*, De Morgan 1845 (8), 221.

32 *op. cit.*, Gingerich 1973 (20), p. 520. The extensive work in astrology by Rheticus can be counted as another circumstantial reason to accept his realism. I thank an anonymous referee for this mention.

33 Blumenthal 2016, *op. cit.*, (29), p. 152; also Blumenthal 2013, *op. cit.*, (29), pp. 81–82.

34 *op. cit.*, Barker and Goldstein (18), pp. 248–250 for a non-religious explanation regarding the temporary narrowness of our astronomical knowledge.

35 *op. cit.*, Roelants (11), p. 374.

4.1 Accommodation and Scriptural Interpretation

The accommodation perspective demands that passages where the Bible apparently speaks about a stationary Earth (Isaiah 42:5; 44:24; 48:13; Psalms 102:25; 104:5; 119:90; Zechariah 12:1, RT, #47–52) can and should be read by adherents of Copernicanism within the context of how the Bible was produced. The same goes for texts that speak about the motion of the Sun and/or the Moon (Joshua 10:12-14; II Kings 20:8–11; Isaiah 38:8; Ecclesiasticus 48:26; Psalms 104:19; 136:7; Jeremiah 31:35; Baruch 6:59; Ecclesiastes 1:5–6), about which RT saves its last paragraphs (RT, #52-63). The answer, says Rheticus, "is not difficult" (RT, #55), because we ourselves "do not deny obvious experience" (RT, #56):

Everything that appears to move does so either because of the motion of the thing itself, or because of the movement of one's vision, or because of the movement of the object, as well as of the center of vision. Common speech, however, mostly follows the judgment of the senses. [… When] we sail from the harbor, we say that the land and the towns recede from us, and when navigating we say that the mountains and lands rise up out of the sea, and that the sun and the stars sink into it, and in our speech we do not distinguish between the truth from the appearances." (RT, #57-58)

Appearances tell us that the Sun moves. Astronomy tells us it does not. Biblical authors, as we all do even today, follow the appearances:

…many descriptions of the Sun's movement adduced from Scripture […] are to be understood as referring to its apparent motion […] Therefore the texts of Scripture concerning the Sun's movement, which seem to argue against us, will not turn out to be at variance with the best verified results of the recent restoration of astronomy. (RT, #59)

These relative/contextual perspectives are at the core of his erection of a barrier between spiritual and natural knowledge. Let theologians and scientists stick to what they are good at:

…from Holy Scripture we should seek in the first place only those things which are necessary to salvation. Let us borrow the philosophical matters from their authors and let us respectfully regard, according to the appropriate and received interpretations, what is said in Holy Scripture about nature. (RT, #13)

Accommodation made it rather simple for Rheticus to find compatibility between the Bible and the nascent astronomy. This can be extended more generally: the same relation with theology would result if we focus on *any other* successful scientific theory. One can support accommodation no matter what theory we believe in.

4.2 Who Does the Accommodation?

When RT was written, the accommodation perspective faced two related, but different hurdles. The first has to do with the perspective itself. Is it a sound option? Assuming a positive answer, the second is, who can use accommodation? Can anyone?

Accommodation has always been available at least since St. Augustine, and in practical terms as Rheticus reminds us, everybody was using it for some texts. However, not just any theologian could introduce new interpretations. In the context of the Reformation, the interpretation of Scriptures was at stake. This was the point of discussion during the Council of Trent (though the case of Copernicus was not avowedly discussed), where they concluded "that only the Pope and Senior Catholics could 'accommodate' Scripture to new theories in natural knowledge".[36]

Possibly, it was pretending to block these reactions that Rheticus wrote:

And if, maybe through our imprudence anything which will be contrary to the Holy Church, to the Holy and Catholic faith and the authority of God's Word has escaped our notice, let it be annulled and condemned. Therefore, we leave the final decision on this our interpretation of Scripture to all devout, learned and skillful men, to whose opinions we shall readily defer. (RT, #16, cf. #32)

Note that he is willing to negotiate as to who is worthy of the task, but inescapably, the task is accommodation. This exclusive role of the hierarchy between theology and natural philosophy/science in determining interpretations,[37] together with a movement of Catholicism toward literalism in response to the reform,[38] explains why Copernicus made no allusions to accommodation in his dedication to the pope (written at the late date of 1542), and perhaps even why RT was not published once it was finished.[39]

But, Rheticus incurs a noteworthy contradiction. For him, the frontier between science and religion is not completely closed after all.

4.3 Realism and Scriptural Interpretation

Rheticus affirms that the Bible might speak about a moving Earth in its de-

36 *op. cit*., Blumenthal 2016 (29), p. 158, n. 12; cf. Ibid., 153–154; *op. cit*. Dinis (24), p. 300; *op. cit*., Hooykaas 1984a (6), pp. 20–27.

37 *op. cit*., Westman 1986 (13).

38 *op. cit*. Blumenthal 2013 (29), p. 76.

39 *op. cit*., Blumenthal 2016 (29), pp. 158, 169; cf. Kraai, J. 'Rheticus's Heliocentric Providence', PhD Dissertation, University of Notre Dame (2003), pp. 119-121, https://archiv.ub.uni-heidelberg.de/volltextserver/3254/, last accessed August 18, 2021; see *op. cit*., Blumenthal 2013, (29), p. 82 for a complementary explanation.

tails and identifies some instances discovered by his *Praeceptor* in the inspired text. For example, he interprets (RT, #18) the "foundations of the earth" in Job 38 as speaking about the threefold motion of the planet[40] and finds hidden biblical references to both the declination and daily rotation of the Earth (RT, #21, quoting Job 9:6 and Isaiah 51:6; cf. #61, quoting Psalms 73:17; #24-25, 27, quoting Psalms 74:17). Here, Rheticus is adapting his interpretation to the new science, giving up accommodation in the process.

This key move is flagrantly incompatible with the principle that he himself introduced regarding the Bible as its only interpreter: "true understanding of everything contained in Scripture is to be sought in Scripture, not elsewhere, either in reason, or in philosophy and the secular arts" (RT, #2; cf. 12). But here it is the new scientific hypothesis (not biblical verses) that leads the specific interpretation of certain texts. (By the way, this overwhelmingly refutes the thesis of Rheticus being an instrumentalist.)

The inconsistency was pointed by Hooykaas as follows:

Though Rheticus' main principle is that the Bible teaches the way of salvation and, when speaking about nature adapts itself to popular belief or naïve observation, he holds also that "under a veil" some scientific "truth" is hidden in it. [...] In such cases, Science may enable us to recognize it and thus to give some correct interpretations overlooked before such scientific truths had been discovered. [...]

Summarizing, we may conclude that Rheticus' procedure is first of all to interpret those texts that are adduced against the earth' mobility as accommodated to the common way of speech, and, secondly, to trace texts that in hindsight could be read in favor of this mobility.[41]

As we saw, the accommodation perspective helps to untie exegetes from literalism -- a negative heuristic, i.e., how the Bible should not be read. But now, Rheticus reads Scripture in the light of contemporary knowledge, arriving at interpretations that are more satisfactory in the sense that not only do they not conflict with his theory, but also affirm it -- a positive heuristic.

Rheticus reads some texts with his newly accepted/believed theory in mind to find its claims vindicated by the text itself. He sees in Scripture what he *knows* from science. As Kraai says, Rheticus fell "victim to what Augustine had admonished against: finding one's own opinions about the natural world in Scripture and fighting for them."[42] With this, he abandons the best advantage of staying in the accommodationist realm: while theories might come and go,

40 Cf. *op. cit.*, Hooykaas 1984a (6), pp. 113-114.

41 *op. cit.*, Hooykaas 1984a (6), pp. 118-119.

42 *op. cit.* Kraai (39), p. 124; cf. *op. cit.*, Dinis (24), p. 310.

our confidence in Scripture remains untouched. However, if theories and biblical interpretations interact, the possibility of misunderstandings and conflicts reappears. Rightfully, one may ask for an explanation of this flat contradiction.

I think it can be suggested that Rheticus took the bait that came from his own realism, and that it was this ontological commitment to Copernicanism that led him to fall into this inconsistency. Possibly, realism simply made the temptation to do so irresistible for him.

I think that these are the first traces of an asymmetry in the relationship between science and religion, one that changed the order for the hierarchy of disciplines. Science can guide and correct theology on texts that speak of the world (remember that Rheticus says we should reinterpret passages where the Bible speaks of an immobile Earth *thanks to Astronomy*; see RT, #49), but theology should not correct science. One of God's two books is subordinated to the other in some matters.[43] As Hooykaas wrote, "it is the physicist who decides whether such a text should be taken literally, allegorically, or as an adaptation to naïve observation".[44] Varying the readings of Scripture avoids the refutation of biblical contents by scientific theories. Scientific inquiry is autonomous regarding theology (the way to heaven is irrelevant to empirical inquiry), but exegesis with respect to science is not. This asymmetry will be very much clearer and mature in Galileo's letters, but I think that the very first step towards that direction can be recognized here in RT. It is undeniable that the progressive adoption of realism by scientists is a key move towards this change in the hierarchy of disciplines, something that surely would generate resistance. Certainly, as astronomers moved into the realm of physics and the

43 Of course, to assume an inversion in the hierarchy of the two disciplines is not free of problems for hermeneutics. To assume realism, opens the door to all the criticisms one can level against it. Let us just mention the historical factor: with the passing of time many successful theories of the past have been found to be false. Thus, nothing prevents the same happening with the theories we presently believe (Laudan, L. 'A confutation of Convergent Realism', Philosophy of Science (1981) 48, 19-49). From there, consequences for hermeneutics follow: to read a biblical passage relying on currently accepted theories might run the same fate that face the theories that lie behind the interpretation. Rheticus intuited this when he said that if we think we found our opinions about nature from Scriptures, once truth taught us otherwise, we are compelled to retract, and admit that our previous beliefs were not contained in the Bible, but in our interpretation of it (RT, #10-11). Remember that Rheticus finds reasons that allegedly explain why the Scriptures do not mention two of the four basic elements we *know* exist. Similarly, this explains why the Bible mentions the Sun and Moon, but not other planets (RT, #39; cf. #50-51). Note that, before Keplerian ellipses, epicycles were still necessary for sun-centered hypotheses tied to circular orbits. In that context, this means that a realist position on Heliocentrism would have led one to defend epicycles as realities of nature! Decades later, Galileo would explicitly claim that ("eccentrics and epicycles undoubtedly exist") in his unpublished response to Bellarmino's position as shown in his letter to Foscarini (FIDE Finocchiaro, M. (ed.) Galileo Galilei. The Essential Galileo, Cambridge: Hackett (2008), p. 165).

44 *op. cit.*, Hooykaas 1984a, (6), p. 119.

realist perspective becomes clearer, confrontations would surely arise. Osiander, Rheticus and Copernicus were aware of that,[45] but of these three, it was only Osiander who explicitly took the stand for a clear instrumentalist point of view regarding the new astronomy in an attempt to minimize the attacks against *De Revolutionibus*.

Even when our knowledge might be fallible, science compels us to check Scriptural contents, and our interpretations are the piece to be replaced when (apparent) contradictions appear. The converse is not: "since the words of Scripture are concerned with sublime and totally different realities, they should not be alleged to censure the Philosophers" (RT, #41). Rheticus allows scientific theories to influence exegetes for they may find in Scripture what science has taught us. Accommodation builds a barrier; scientific realism makes it blurry.

Again, if scientific theories *discover* facts about the world, this might well be a compass for exegetes: for a believer that stands for realism, there is no question that science should influence the construction of religious knowledge, either by accommodation or by the discovery of "hidden truths" in the text. In any case, the desirable result will be a reading of the Bible that is not against what we *know* from the world thanks to scientific endeavors. If science reaches truths about nature, and they *seem* to be against some biblical verses, reread those verses in order to avoid conflicts: accommodation and alternative readings help us to dodge them all.

However, I admit that the aforementioned asymmetry does not necessarily stem only from a realist trigger. A less decisive position might also be a road to the same Rome. The debate between realists and anti-realists is not about what theory we should *accept*. It is possible that a fictionalist might agree with a realist regarding, for example, what theory has better empirical adequacy, but at the same time they keep their differences on what the world is like. Therefore, for any practical purpose, the consequence for hermeneutics is indistinguishable from what a realist would conclude. However, even when it would be perfectly possible to find a non-realist defending accommodation, the proposal to positively prefer a reading compatible with current scientific knowledge gains strength only once realism is granted.

Conclusions

Thanks to the discovery of RT we get glimpses of how Rheticus, the first official convert to the Copernican worldview, tried to make amends between a

45 In his dedication, Copernicus argues against those who attack his theory based on some passages of Scriptures (Copernicus, N. On the Revolutions, London: MacMillan ([1543] 1978); *op. cit*., Lamont.(3), pp. 6–7; cf. RT, #44).

moving Earth and stable Sun and some biblical texts that seem to claim otherwise. The result: the reader must consider that the initial recipients of the Bible were, for the most part, "uneducated" (RT, #39) people. That, together with the fact that the goals of the Holy Writings have to do with salvation and worship, and not with natural knowledge, helped him to conclude that the biblical sayings about the world are not apodictic. Contextually, accommodation appeared as a haven for Christians seduced by the new astronomy without equants. RT is the first attempt to apply this Augustinian approach to the new topography of the heavens. Generically, the same would be true for any other scientific theory that seemingly threatened some scriptural passages: no theory runs the risk of being rejected on a scriptural basis.

Even though Rheticus did not hesitate again and again to call his master's proposal a "hypothesis", he did believe it to be true. The Earth was really in motion. This explains the personal risks he took when he decided to publish *Narratio Prima*. In RT, some ambiguities are present. But, even when it is possible to find shades of fictionalism in some passages, Rheticus definitely cannot be legitimately equated with Osiander in this regard. On the other hand, it is misleading to identify the statements regarding fallibilism (scientific theories might be wrong, in the same manner that scriptural interpretations might be wrong) with a hostility towards realism.

Rheticus (and Copernicus) knew that if one is to read the plain letter of a biblical text on nature as authoritative, then Copernicanism had no future. Instrumentalism was a way out and would make a work on science and religion easier to produce, or even irrelevant. The very existence of a work like RT argues for a non-fictional perspective of its author.[46] Therefore, there is no reason to doubt the consensus that places Rheticus in the realist domain.

Regarding how science should affect theological thinking, I have identified four tenets the author of RT links to each other. The accommodation perspective is at the core of them, and it has the consequence that literalism is no longer a privileged approach for exegetes. Even more, Rheticus successfully attacked literalism in its own arena.

Furthermore, Rheticus implicitly accepts an asymmetry in the relationship between science and religion in an approach similar to what Galileo would put forward decades later: science can affect and correct theology (because some texts deal with nature), but theology should not affect nor correct scientific endeavors. I suggest that his commitment to realism is a possible explanation for his proposal -- which betrays his own tenets -- of finding in the Bible messages that go hand in hand with well-established scientific hypothesis.

As a corollary, the progressive adoption of realism by scientists was a key

46 See *op. cit.*, Hooykaas 1984a (6), pp. 102, 106, 134.

move towards the change in the hierarchy of disciplines. This approach came of age with Galileo, but I think that Rheticus' inconsistency is the first step towards that very direction in astronomy.

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