Johannes Rudbeckius's Arguments against the Eternity of the World

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Abstract
In two interdependent dissertations published in 1611 and 1621, the Swedish theologian and bishop Johannes Rudbeckius (1581–1646) takes up the question of whether the world is eternal. He formulates a number of alternative philosophical arguments in order to justify a negative answer. Without noticing this, he employs two mutually independent notions of eternity. I comment on five of Rudbeckius's arguments from a systematic point of view. The arguments make use of explicit reasoning about infinite cardinalities, including the use of explicit assumptions regarding arithmetic operations applied to infinite quantities. It is observed that each argument has its origin in medieval scholastic philosophy or is adapted from texts written by Roman authors. The affinity of Rudbeckius's approach to the scholastic tradition gets highlighted: he is convinced that reason and revelation are not mutually exclusive sources of knowledge: certain theologically relevant propositions can even be proven by philosophical arguments.

1. Introduction

Johannes Rudbeckius (1581–1646) was among the foremost church leaders in 17th century Sweden. He held various roles: professor of mathematics, Hebrew, and dogmatics at Uppsala University; court chaplain to King Gustav II Adolf (1594–1632); and bishop of Västerås. He was extremely active in different areas from church and university politics via pedagogy to book printing and population registration. In 1610 he opened a private collegium in connection with the University. He founded Sweden's first upper secondary school [*gymnasium*] in Västerås in 1623.

Rudbeckius published two series of dissertations on articles of faith. In these publications he followed the structure of the work *Loci theologici* of the

German Lutheran theologian Matthias Hafenreffer (1561–1619).[1] The first series consists of 24 dissertations debated at Rudbeckius's private collegium in Uppsala between February 1611 and May 1613; at that time Rudbeckius was professor of dogmatics at the University [*locorum theologicorum professor*].[2] The second series, in turn, comprises 17 synodal dissertations from the years 1619–1639, debated in the Diocese of Västerås during Rudbeckius's time as bishop. The two series are strongly interrelated: each synodal dissertation is obtained from a corresponding private collegium dissertation by providing a more detailed discussion of certain issues and adding supplementary references to the literature.

The dissertations relevant to the present paper are: *Disputatio ordinaria theologica III. de mundo* (1611, respondent: Jonas Petri Linnerius) and *Propositiones de mundo, seu mundi creatione* (162l, respondents: Magnus Olai and Ericus Matthiae).[3] Both of these dissertations correspond to *locus de creatione* in the structure of Hafenreffer's *Loci* (bk. I, *locus* II), but while Hafenreffer concentrates on the act of creation (in particular its agent, matter, order, and goal), Rudbeckius has specific interest in the result of this act—the world. Notably he takes up the question of the eternity of the world, phrased as the question of whether the world once began to exist instead of having "always existed"—having "existed from eternity".[4]

Rudbeckius formulates eight *philosophical* arguments in order to demonstrate that the world indeed has a beginning. They are meant to

[1] Rudbeckius employed the third edition: Matthias Hafenreffer, *Loci theologici certa methodo ac ratione in tres libros tributi* (Tübingen, 1606); the first edition was published in 1600.

[2] The dissertation concerning sin and the bondage of the will was, according to its title page, debated publicly (i.e., at the University). An account on the activities of the private collegium suggests that it was debated at the collegium. See Johannes Rudbeckius / Petrus Petri Enstadius, *Disputatio ordinaria theologica X. de peccato et servo arbitrio* (Stockholm, 1612); Johannes Rudbeckius, *Acta, hoc est lectiones, declamationes, disputationes et alia exercitia anni MDCXI, in collegio privato…M[agistri] Johannis Rudbeckii…ab ejusdem collegij notarijs annotata et descripta* (Stockholm, 1613), p. A4r; cf. Bror Rudolf Hall (ed.), *Till Johannes Rudbeckii karakteristik* (Lund, 1924), p. 71.

[3] Jonas Petri Linnerius (1588–1641) became vicar in Härnösand in 1628, see Leonard Bygdén, *Hernösands stifts herdaminne, vol. 1* (Uppsala, 1923), pp. 344–5. Magnus Olai Asteropherus († 1647) and Ericus Matthiae Arosiensis (1589/90–1664) had become vicars respectively in Västerfärnebo around 1613 and in Tillberga in 1616; see Gunnar Ekström, *Västerås stifts herdaminne, vol. 2:1* (Västerås, 1971), pp. 627–9 *resp.* pp. 271–2.

[4] Johannes Rudbeckius / Magnus Olai & Ericus Matthiae, *Propositiones de mundo, seu mundi creatione* (Stockholm, 1621), ch. 2; cf. Johannes Rudbeckius / Jonas Petri Linnerius, *Disputatio ordinaria theologica III. de mundo* (Stockholm, 1611), thesis 2. Henceforth, I refer to these two dissertations as "Rudbeckius, *De mundo* 1621" and "Rudbeckius, *De mundo* 1611", respectively. Hafenreffer takes it that a reference to the Bible (Genesis 1:1) suffices for refuting philosophical arguments according to which the world has no beginning in time (*Loci*, p. 81).

constitute reason-based proofs for the intended conclusion, whence their premises must according to him be "naturally" true, so that their truth can be recognized without resorting to revelation. After having presented these arguments, Rudbeckius offers alternative *theological* arguments; he wants to prove the conclusion even by reference to the Bible [*ex Sancta Scriptura*; *ex ore Dei*].[5]

For comparison, it may be noted that the influential Lutheran theologians Martin Chemnitz (1522–1586), Leonhard Hutter (1563–1616), and Johann Gerhard (1582–1637), when discussing *locus de creatione*, show no interest for philosophical arguments against the eternity of the world. Chemnitz refers to Aristotle as having argued for the eternity of the world, but does not take up philosophical counterarguments. The three arguments that Hutter mentions against the eternity of the world explicitly utilize theological premises. Gerhard takes God's will as revealed in the Scriptures as a starting point, and takes it for granted that the world has a beginning in time, as decided by God in eternity.[6] By contrast, the Lutheran theologian Balthasar Meisner (1587–1626), in his book *Philosophia sobria*, expressly discusses the question of whether the creation of the world in time can be established on philosophical grounds. He notes that certain Reformed theologians—notably Clemens Timpler (1563–1624), Bartholomaeus Keckermann († 1609), and Hieronymus Zanchius (1516–1590)—had argued for an affirmative answer, and enumerates nine arguments proposed to that effect. Meisner's own view is that the world having a beginning in time is an article of faith that cannot be proved by reason; one does not come to believe it because one understands it, but understands it through belief.[7]

2. Remarks about the concepts employed

Before proceeding to discuss Rudbeckius's arguments, I point out that the notion of "eternity of the world", as Rudbeckius uses it, is ambiguous between two readings. Further, I call attention to what it takes for a *valid* argument to

[5] Rudbeckius, *De mundo* 1621, ch. 3, end of ch. 2; Rudbeckius, *De mundo* 1611, theses 4–5.

[6] Martin Chemnitz, *Loci theologici, vol. 1* (Frankfurt am Main, 1591), p. 131r; Leonhard Hutter, *Loci communes theologici* (Wittenberg, 1619/1661), p. 199; Johann Gerhard, *Loci theologici, vol. 2* (Frankfurt & Hamburg, 1611/1657), p. 1.

[7] Balthasar Meisner, *Philosophia sobria, vol. 1* (Wittenberg, 1611), ch. 3, q. 1, pp. 762–5 (arguments of the Reformed thinkers), p. 776 (Meisner's own view): "[C]oncludo…quod creatio mundi in tempore articulus sit fidei, non rationis, adeoq[ue] non intelligendo credatur, sed credendo intelligatur"; Clemens Timpler, *Physicae seu philosophiae naturalis systema methodium* (Hanau, 1605), pp. 24–6; Bartholomaeus Keckermann, *Systema physicum* (Hanau, 1610/1623), pp. 839–43; Hieronymus Zanchius, *De operibus Dei intra spacium sex dierum creatis opus* (Neustadt an der Haardt, 1591), pp. 19–21.

be *successful*. Finally, I indicate that in one way or another, Rudbeckius's arguments all depend on the notion of infinity.

2.1. The notion of eternity of the world

Rudbeckius phrases his arguments as being about the question of whether "the world is eternal". In his intended terminology, "the world is eternal" [*mundus est aeternus*] means the same as "the world has existed from eternity" [*mundus fuit ab aeterno*], which he equates with the negation of the sentence "the world has had a beginning" [*mundus aliquando coepit*]. Therefore, we should be able to conclude that "the world is eternal" means for him the same as "there is no time point at which the world began to exist".[8] I will refer to this construal as *sense 1* of the sentence "the world is eternal". Thus construed, "the world is eternal" means: "the world exists now, and for every time point at which the world has existed, there is an earlier time point at which the world already existed".

Conceptually, the world being eternal in sense 1 does *not* entail that the world has existed for an *infinitely long time*—it entails merely that there are infinitely many past time points at which the world has existed.[9] This said, Rudbeckius implicitly assumes that if the world has not begun to exist, then the past is infinitely long—i.e., there is no finite length of time that would contain all past time points.

Besides, even if the world *had* existed for an infinitely long time, it would not follow that there are time points at an *infinite distance* from the present.

Example 1. Think of the negative integers ordered by magnitude:

$$\ldots < -3 < -2 < -1.$$

Their *number* is infinite, and furthermore, there is *no finite bound N* such that the distance between 0 and all these numbers would be smaller than *N*. Yet there is no single negative integer whose distance from 0 would be infinite. In the same way, the past can be infinitely long without there being a past time point at an infinite distance from the present.

[8] Even if the world had a beginning, according to normal language-use we would say it is eternal, provided that it never ceases to exist. However, Rudbeckius means by "eternity of the world" (according to the primary sense he adopts) that it has not begun to exist, but has existed *ab aeterno*. He speaks of a sort of eternity that would *already now* have become actualized.

[9] Suppose the temporal order has the structure of the set of positive rational numbers ordered by magnitude, and think of the number 1 as the present moment. There would, then, be infinitely many past time points, for example all fractions $1/n$ with $n \geq 2$, satisfying $0 < 1/n < 1$.Yet, the past of the time point 1 would have a *finite* duration; indeed, it would be equal to 1.

In some of his reasonings Rudbeckius nevertheless assumes that the eternity of the world would entail the existence of past time points infinitely far away from the present. In fact, by "the world is eternal" he intends on some occasions the following condition: "the world exists now, and there are past time points at an infinite distance from the present at which the world already existed". I will refer to this latter reading as *sense 2* of the sentence "the world is eternal".

Now, there are hardly any commonly occurring ways of representing the temporal flow according to which there would be such infinite distances. To be sure, mathematically it is possible to describe hypothetical temporal orders involving time points with an infinite distance between them.

Example 2. Let the set of time points be represented by the set of all integers, but instead of ordering them linearly by magnitude, order them linearly as follows: the order consists of two segments, the earlier containing all nonnegative integers in their order by magnitude (0, 1, 2, 3,…), while the later contains all negative integers in their order by magnitude (…, –3, –2, –1). The two segments are mutually related in such a way that every time point in the earlier segment temporally precedes every time point in the later segment. The result is the order

$$0 < 1 < 2 < 3 < \ldots < -3 < -2 < -1.$$

If, for example, the time point –2 is taken to be the present, there *are* past moments at an infinite distance from –2, for example the moment 2. Incidentally, this example shows—not only that past time points infinitely far away from the present are conceivable—but also that their existence does not guarantee that time fails to have a beginning. Namely, in the above order the time *has* a beginning (moment 0). That is, eternity in sense 2 does not entail eternity in sense 1.[10]

2.2. Valid versus successful arguments

I will use the word "argument" as a synonym for "inference" understood in the usual logical sense:[11] a (finite non-empty) sequence of sentences, the last of which in the order is termed *conclusion* and the eventual preceding ones

[10] Conversely, Example 1 allows us to see that eternity in sense 1 does not entail eternity in sense 2. The order of the example has no first member, but no matter which point is taken to be the present, there is no past moment at an infinite distance from it.

[11] The reader familiar with logic can skip the discussion regarding the definition of "valid argument".

premises. An inference is *valid* if there are no (factual or hypothetical) situations in which the premises are true and the conclusion is false; it is *not valid* if there are (factual or hypothetical) situations in which each of the premises is true but the conclusion is false. Validity and non-validity are *formal* properties of inference. In order to decide whether an inference is valid, we do not need any (non-linguistic) empirical knowledge—all that is needed is semantic knowledge sufficient for understanding what the sentences making up the inference signify and the logical capacity to reason about possible combinations of truth-values of these sentences.

When an inference is employed in an attempt to convince one's discussion partner about the truth of a conclusion, it does not suffice that the inference be valid—even if its validity is a *necessary* condition, provided that the discussion partner is rational. For, he or she must have reasons to *believe that the premises of the inference are true*. A *successful argument* is a *valid* inference with *credible* premises. An inference with false premises can be valid. So can an inference whose premises are true, while the discussion partner has no reason to believe this. That is, an inference can be valid without being successful. Therefore, an important part of presenting an argument is to justify its premises. There are, thus, two entirely separate tasks when formulating a successful argument: checking that the inference is valid (a formal task) and presenting serious reasons for believing that the premises are true (substantive task). Ideally, the premises of a successful argument both *are* true and are *believed to be true* by the discussion partner. On the one hand, as said, the mere external fact that the premises are true does not contribute to making progress in a discussion, if the discussion partner does not recognize their truth. On the other hand, if some of the premises are false but the discussion partner nevertheless takes all of them to be true, the discussion proceeds for wrong reasons. Both aspects of the notion *successful argument* will be taken into account when analyzing Rudbeckius's arguments below.

2.3. Dependence of the arguments on the notion of infinity

Out of Rudbeckius's eight proposed philosophical proofs to the effect that the world is not eternal, I will concentrate on five arguments, which all in one way or another turn on the notion of infinity. In some cases (Arguments 1 and 2 below), Rudbeckius refers to the alleged impossibility of *actually infinite totalities*. In other cases his inference depends on assumptions about *cardinality comparisons* between two infinite totalities (Arguments 3 and 5). In certain cases Rudbeckius reflects on hypotheses about *infinite temporal distances* (Arguments 3 and 4). While he presents the arguments as inferences with explicitly given premises and an explicitly formulated conclusion, in each

case there are further assumptions that he uses but does not mention. I identify such hidden assumptions and indicate how he utilizes them.

In what follows, I take up one argument per section. Each section begins by the statement of an argument, whereafter I proceed to discuss its structure and to evaluate its successfulness.

3. The number of souls

Argument 1. If the world was eternal, the number of souls already in existence would be infinite. But no number can be actually infinite. Therefore: the world is not eternal.[12]

Aquinas mentions this argument both in *De aeternitate mundi* and in *Summa contra gentiles*; it is likewise taken up by Zanchius and Meisner.[13] Now, Rudbeckius wishes to show that the hypothesis according to which the world is eternal is incompatible with commonly accepted assumptions.[14] Let us use the following abbreviations: A = the world is eternal, B = the number of souls that already exist is actually infinite. Premise 1 of the inference is a conditional: 'if A, then B'. Premise 2 is negative: no number is actually infinite. The inference is valid. It follows from premise 2 that in particular *the number of souls that already exist* is not actually infinite ('not-B'). And if the sentences 'if A, then B' and 'not-B' are true, we can indeed infer that 'not-A' is true, as well.

Is the argument successful? The answer depends on the credibility of the premises. In any event, premise 2 can be called into question. Conceptually, "actual infinity" poses no insurmountable problem, although in Rudbeckius's Aristotelian framework it was, to be sure, taken for granted that actually infinite cardinalities are impossible—as Rudbeckius himself expressly says when providing justification for premises of Argument 2 discussed below. That said, the mathematical foundation for infinite cardinal numbers was only laid by Georg Cantor (1845–1918) toward the end of 19th century; understandably

[12] *Si mundus esset aeternus, tunc numerus animarum iam esset actu infinitus. At numerus ut numerus non potest esse actu infinitus. Ergo mundus non est aeternus.* (Rudbeckius, *De mundo* 1621, ch. 2, Arg. 1; cf. Rudbeckius, *De mundo* 1611, thesis 2, Arg. 1.)

[13] Thomas Aquinas, *De aeternitate mundi*, in *Editio Leonina, vol. 43*, (Rome, 1976), p. 89; Thomas Aquinas, *Summa contra gentiles, lib. I–II*, in *Editio Leonina, vol. 13* (Rome, 1918), bk. II, ch. 38, pp. 355–6; Zanchius, *De operibus Dei*, p. 21; Meisner, *Philosophia sobria*, p. 763.

[14] He views indirect proofs as *deductiones ad inconveniens*, meant to establish the incompatibility of a hypothesis with assumptions taken for granted—the hypothesis need not by itself be logically impossible. See Johannes Rudbeckius / Isacus Joannis; Israel Andreae; & Andreas Petri, *Propositiones de animae humanae immortalitate* (Västerås, 1626), ch. 4; Johannes Rudbeckius / Olaus Matthiae Hedemorensis, *Disputatio ordinaria theologica VIII. de animae immortalitate* (Stockholm, 1611), thesis 5. Henceforth, I refer to these two dissertations as "Rudbeckius, *De animae immortalitate* 1626" and "Rudbeckius, *De animae immortalitate* 1611", respectively.

enough, Rudbeckius did not successfully operate with them.[15] And even if the idea of an actually infinite number of created entities equipped with a soul could be accepted as meaningful, neither do present-day physical theories assume that the nature comprises an actual infinity of constituents of some sort. Thus, if premise 2 and notably its consequence 'not-B' are interpreted as empirical claims, they are in fact reasonable.

In order to justify premise 1, Rudbeckius utilizes two implicit assumptions:

- additional premise (+): *souls are immortal*
- additional premise (++): *at every time point at least one soul comes into existence*.[16]

Let us suppose that the world is eternal (in either of the senses 1 or 2). Consequently, there are infinitely many time points preceding the present at which the world has existed. By (++), each of these time points gives rise to at least one soul. According to (+), all these souls are immortal, so that once they have begun to exist, they continue to exist at every later time point. If the additional premises are accepted, it follows that the number of souls in existence at present is infinite. Premise 1 can indeed be justified by such reasoning.

The additional premise (+) is taken for granted in theological settings—or separately justified.[17] By contrast, it is less clear why we should accept (++). This is why premise 1 is problematic: the question of the eternity of the world is conceptually independent of the existence of souls. In particular, the question of the frequency of the emergence of human souls over time is hardly possible to decide with reference to reason alone.[18] Therefore, Argument 1 can be considered weak, even though it is valid. In particular, premise 1 is not sufficiently transparent.

[15] Georg Cantor, *Grundlagen einer allgemeinen Mannigfaltigkeitslehre. Ein mathematisch-philosophischer Versuch in der Lehre des Unendlichen* (Leipzig, 1883).

[16] Actually, it would suffice that there be an infinite set of past time points each of which gives rise to at least one soul, even if not *all* time points in the past had this property.

[17] In his dissertations, Rudbeckius offers twelve philosophical arguments to this effect (Rudbeckius, *De animae immortalitate* 1626, ch. 4; Rudbeckius, *De animae immortalitate* 1611, thesis 5).

[18] Aquinas indeed rejects the argument for this reason (*De aeternitate mundi*, p. 89).

4. The number of days already traversed

Argument 2. If the world was eternal, infinitely many days would already have been traversed. But nothing that is infinite can be traversed. Therefore: the world is not eternal.[19]

Both Aquinas and Bonaventure mention this argument.[20] It is essentially an improved version of Argument 1 discussed above—it avoids needless premises and is directly based on the assumed infinity of past time points. We employ the following abbreviations: A = the world is eternal, B = infinitely many days have already been traversed. The inference has two premises. Premise 1 is: 'if A, then B'. According to premise 2, nothing that is infinite can be traversed—which entails in particular that *an infinite number of days* cannot be traversed ('not-B'). Thus, we can infer 'not-A'. The inference is valid.[21]

Premise 1 is reasonable. If by "eternity of the world" we mean that the world has not begun to exist at a certain time point (as we do, according to sense 1 of this phrase), then there are infinitely many days—or in any event, infinitely many time points—that precede the present and at which the world has existed. From this it follows that the number of days traversed thus far is infinite.

In order to justify premise 2, Rudbeckius begins by referring to Aristotle, who in his *Physics* denies that there could exist something *actually infinite* and accepts only the idea of *potential infinity*.[22] From Aristotle's perspective, we could only speak of actual infinity if there were certain stepwise processes of division or addition that could be completed by effecting infinitely many steps—and he excludes the possibility of such completed processes. By contrast, potentially infinite processes of division or addition can involve arbitrarily many steps, as long as the number of steps is finite. While mathematically we can, as remarked above, make perfect sense of actually infinite sets (Cantor), premise 2 is warranted in Rudbeckius's Aristotelian

[19] *Si mundus esset aeternus, tunc infiniti dies iam essent transacti. At infinitum transigi non potest. […] Ergo mundus non est aeternus.* (Rudbeckius, *De mundo* 1621, ch. 2, Arg. 2; cf. Rudbeckius, *De mundo* 1611, thesis 2, Arg. 2.)

[20] Aquinas, *Summa contra gentiles*, bk. II, ch. 38, p. 355: "[I]nfinita non est transire. Si autem mundus semper fuisset, essent iam infinita pertransita"; Bonaventure, *Commentaria in secundum librum sententiarum magistri Petri Lombardi*, in *S. Bonaventurae opera omnia*, vol. II, ed. Collegium S. Bonaventura (Florence, 1885), 1.1.1.2. (p. 21): "« Impossibile est infinita pertransire »; sed si mundus non coepit, infinitae revolutiones fuerunt. […] [E]rgo impossibile fuit devenire usque ad hanc."

[21] One of Hutter's (theological) arguments against the eternity of the world bears some resemblance to this argument. He claims that if time had no beginning (so that the past would consist of an actual infinity of moments), no chronology would be possible, while God himself *certas annorum epochas definivit.* (Hutter, *Loci*, p. 199.)

[22] Aristotle, *Physica* III, 4–8.

framework. That is, if a set of units—for example, days—is assumed to have been generated by repeated additions, and the number of such additions can only be finite, the set itself cannot possibly be infinite. For the same reason the sentence 'not-B' in Argument 1 of Section 3 was warranted.

In order to justify the specific sentence 'not-B' in Argument 2 (entailed by premise 2), Rudbeckius does not content himself with referring to Aristotle on a general level. He sketches the following direct argument meant to refute the statement that infinitely many days have already been traversed. Methodologically this could be useful: even if one did not accept a general claim (premise 2), one could nevertheless accept one of its consequences ('not-B'), provided that a separate justification could be given to this more specific claim.

Rudbeckius wishes, then, to explicate why consequent B of premise 1 is false. He says that the infinite number of future days that remain to be traversed is not smaller than would be the supposedly infinite number of past days already traversed [*infiniti dies qui restant, non sunt pauciores praeteritis*]. He further says that the set of future days cannot be completed [*dies qui restant transiti non possunt*] and infers from this that neither could the supposedly infinite set of past days be completed [*ergo nec praeteriti*]. Rudbeckius appears to reason as follows. First, he takes as a premise that after each future day that gets traversed there will be a day that gets traversed only later: we cannot attain a point in time at which all days that now lie in the future will have been traversed. That is, the set of future days is potentially infinite. Second, he wishes to derive a contradiction from the assumption that the set of past days already traversed has the same size as the set of future days yet to be traversed—i.e., that there are infinitely many past days (which as such would have been traversed already). Rudbeckius's reasoning appears to be based on a hidden premise:

- additional premise (×): *if the number of past time points is infinite, then in particular there are infinitely many time points between a certain past time point and the present*.

He seems to take it for granted—erroneously—that the only reason why the number of past days could be infinite is that there is an infinite succession of past days *after* a certain past time *t**. In that case, infinitely many of those days that from the perspective of *t** are future would have been actualized by now, contrary to Rudbeckius's conviction that an infinite number of future days cannot be completed. In this way, Rudbeckius believes to be able to show that the potential infinity of the future excludes infinity of the past: if a temporal

succession beginning at the present can never become completed, then it cannot happen that a structurally similar succession beginning in the past is completed in the present. It is correct that there cannot be an infinite number of past days all of which have by now been actualized as a result of a stepwise potentially infinite process that has begun in the past. However, Rudbeckius ignores the possibility described in Example 1—there could be an infinite number of past days each at a finite distance from the present. The question is whether we can today find ourselves in a situation in which infinitely many days have already got actualized *without* this being the result of a stepwise potentially infinite process that has begun in the past—and Rudbeckius's reasoning excludes this possibility without further discussion. His Aristotelian framework certainly justifies this, but then he could just as well have proceeded directly from premise 2, instead of attempting to find an additional justification for the more specific sentence 'not-B'.

Summing up, it can be said that Argument 2 is stronger than Argument 1; its premises are better justified within the Aristotelian framework, which itself can of course be called into question.

5. The coming into existence of celestial bodies

Argument 3. If the sun or another celestial body was created in eternity, it would have been created in the east or in the south or in some other place. Let us suppose it was created in the east. Let us further suppose that according to our calculations it has moved from the east to the west in 12 hours. Given that the celestial body in question was created in eternity, this is, however, impossible. Therefore: no celestial body has been created in eternity.[23]

Bonaventure employs this argument, which is likewise taken up by Aquinas.[24] We use the following abbreviations: A = a celestial body was

[23] *Si sol vel aliqua pars caeli facta esset ab aeterno, tunc aut facta esset in oriente, aut meridie, vel alibi. Ponatur factam esse in oriente, tunc supputo ab occidente in orientem, et invenio motam esse 12. horis. At hoc non potest esse. Siquidem in aeterno a quocunq[ue] instanti oportet esse distantiam infinitam usq[ue] ad aeternum. Tum si dixeris infinitum tempus effluxisse postquam illud instans fuit, quo pars illa ponebatur fuisse in occidente, ad nos. Sequitur infinito posse aliquid addi, videlicet 12. horas, versus partem qua est infinitum. Et quia ab eo tempore, quo paulo ante fuit in oriente, maius tempus effluxit, dabitur infinito aliquid maius.* (Rudbeckius, *De mundo* 1621, ch. 2, Arg. 5; cf. Rudbeckius, *De mundo* 1611, thesis 2, Arg. 5.) For the phrase "pars qua est infinitum", cf. footnote 36.

[24] Bonaventure, II *Sent.*, 1.1.1.2 (pp. 20–1): "Impossibile est infinito addi […] quia omne illud quod recipit additionem, fit maius, « infinito autem nihil maius » — sed si mundus est sine principio, duravit in infinitum: ergo durationi eius non potest addi. Sed constat, hoc esse falsum, quia revolutio additur revolutioni omni die." Aquinas rejects the argument, claiming that indeed we can effect an addition to the infinite "on that side of it which is finite" (*Summa contra gentiles*, bk. II, ch. 38, p. 355).

created in eternity; B = the celestial body was created in the east; C = 12 hours after the celestial body was created, it was in the west. The argument can be analyzed as follows. There are three premises. Premise 1 (A) is taken to mean that an *infinitely long time* has passed since the celestial body was created. Here the following implicit assumption is employed:

- additional premise (‡): *if something is created in eternity, then there are past time points at an infinite distance from the present.*

Premises 2 (B) and 3 (C) express certain assumptions regarding the celestial body mentioned in premise A, based on the fact that the body continues to exist over a certain period of time. The idea is to show that the premises are mutually contradictory. If that is the case, and premises 2 and 3 are retained as assumptions, then 'not-A' can be deduced: the celestial body was not created in eternity—the distance between the present and the moment at which the celestial body began to exist is finite.

Here the inference is more complicated than in Arguments 1 and 2, because the mere *form* of the premises does not allow us to deduce the desired conclusion. Their semantic content must be analyzed in order to explicate their alleged incoherence.

5.1. Creation of celestial bodies and the question of infinite durations in the past

It is important to observe that Rudbeckius is not here primarily interested in the question of the eternity of the world, but in the question of whether an infinite amount of time has lapsed since celestial bodies began to exist. At the end of the present section, I will comment on how this reasoning, if successful, could be utilized for responding to the main question about the eternity of the world. Now, why does Rudbeckius claim that the premises are mutually contradictory? He says that in eternity the distance of every time point to the eternity is necessarily infinite, by which he presumably means (given how he continues to reason) that between us and any two events that by hypothesis would occur in eternity there would be equally many time points, namely infinitely many. The temporal distance of the present from both of these events would be the same infinitely long distance. Rudbeckius continues his reasoning: if we now focus on the time point at which the celestial body was in the west soon after it had been created, and if it is said than an infinitely long time has passed after that moment, then it follows that it is possible to add something to the infinite, namely 12 hours, so that the result remains the infinite. For, after the slightly earlier time point at which the body had been

created and was in the east (t_1), a certain amount of time has lapsed before it came to be in the west (t_2), whence *more* than an infinitely long of time has passed after the first-mentioned time point. There would, thus, be a time *longer* than an infinitely long time—a temporal distance greater than an infinite distance—which is something that Rudbeckius deems impossible, because he adheres to the principle *infinitum infinito non est maius*:

- additional premise (‡‡): *nothing infinite can be greater than anything else infinite—i.e., there can be no size differences among infinite quantities.*

Rudbeckius's strategy for deriving a contradiction depends on the idea that arithmetic operations can be applied to infinite numbers. He reasons as follows: On the one hand, if the infinite distance between the present and t_2 is $\boldsymbol{\kappa}$ hours, then the distance between the present and t_1 will be $\boldsymbol{\kappa} + 12$ hours. On the other hand, he takes it for granted that $\boldsymbol{\kappa} + 12 > \boldsymbol{\kappa}$. According to Rudbeckius, this means that there would be something (namely the quantity $\boldsymbol{\kappa} + 12$) that is greater than the infinite (viz. the quantity $\boldsymbol{\kappa}$)—which is impossible by (‡‡). Such reasoning is problematic, since Rudbeckius does not have at his disposal a sufficiently precise mathematical background theory. He attempts to apply reasoning we are used to employ in connection with finite numbers to cases involving infinite quantities. However, concepts such as *distance*, *number*, and *addition* cannot be unproblematically transferred to contexts having to do with infinity. Only with Cantor's theory of transfinite numbers a mathematical framework was formulated in which it is meaningful to ask whether for example the equality $\boldsymbol{\kappa} + n = \boldsymbol{\kappa}$ holds or not.

We *can* give a precise meaning to Rudbeckius's words—something Rudbeckius himself could not do. In relation to a time point we can, on the one hand, speak of its *relative position* in the temporal order (considering which time points *succeed* it in the order and which *precede* it). On the other hand, we can speak of the *distance* of the time point from a given other time point. If the temporal order happens to be such that between any two time points there are only finitely many further points, then these two notions—distance and relative position—are interrelated in a simple way. If t_1 is followed by t_2 in the temporal order ($t_1 < t_2$), the *distance* between t_1 and t_2 can be determined on the basis of the *number* of time points between t_1 och t_2.[25] If, furthermore, t_2 is followed by t_3 (so that $t_1 < t_2 < t_3$), the distance between t_1 and t_3 is automatically

[25] We can stipulate that the distance equals the number of time points x that fulfill the condition $t_1 \leq x < t_2$.

greater than the distance between t_1 and t_2. This is because the number of time points between t_1 and t_3 consists of the number of time points between t_1 and t_2 *plus* the number of time points between t_2 and t_3, a (finite) sum that is greater that the mere number of time points between t_1 and t_2. Thus: *the further away in the order* a time point is from a given time point *t*, the *greater* is its *distance* from *t*.

The fact that the concepts *distance* and *relative position* are tied together in this way in finite contexts does not guarantee that they are in the same way tied together even in *infinite* contexts. First, the notion of *number* (or *cardinality*) must be defined in such a way that at least it becomes applicable to infinite sets.[26] If the temporal order is "discrete", we can define the distance between t_1 and t_2 as the number of points between them—even if there were infinitely many such points.[27] Thereby the distance will always be a cardinal number, but this cardinal number may be infinite. Now, if t_1, t_2, and t_3 are three time points such that $t_1 < t_2 < t_3$, we *cannot* automatically infer that the distance of t_3 from t_1 is greater than the distance of t_2 from t_1. Namely, it can happen that both distances are *infinite* and that in particular in both cases the distance equals the same infinite cardinal number—despite the fact that insofar as *positions* are concerned, in temporal order t_3 is indeed further away from t_1 than t_2. The example Rudbeckius discusses is precisely of this type. The moment at which the celestial body was created in the east (t_1) is followed by the 12 hours later moment (t_2) at which the body was in the west. Both moments are followed by the present (t_3), whose distance from t_2 equals a certain infinite cardinal number ($\boldsymbol{\kappa}$ hours). The distance between t_1 and t_2 is 12 hours. What can be said of the distance between t_1 and t_3? The distance equals $\boldsymbol{\kappa} + 12$ hours, and according to the arithmetic of infinite cardinal numbers we have $\boldsymbol{\kappa} + 12 = \boldsymbol{\kappa}$. When we add a finite cardinal number to an infinite cardinal number, the result is that same infinite cardinal number. The number of time points between t_1 and t_3 is the same infinite number as the number of time points between t_1 and t_2—even though the position of t_1 in the temporal order

[26] This is done in such a way that "sets S_1 and S_2 have the same number of elements (the same cardinality)" comes to mean: "the elements of the set S_1 can be put in one–one correspondence with the elements of the set S_2".

[27] Here, we say that a temporal order $<$ is "discrete" if every moment t (except the eventual last moment) has an "immediate successor": whenever there is s such that $t < s$, there is t' such that $t < t' \leq s$ and there is no x such that $t < x < t'$. Here, t' is "the immediate successor" of t. In this paper, we may limit attention to such discrete orders, and Rudbeckius seems not to have reflected on more general cases. Generally, however, the notion of *distance* between two points cannot be defined in terms of the *number of points* between them. For example, there are infinitely many fractions between the rational numbers 0 and 1; yet, the distance between 0 and 1 is not infinite, but equals 1.

indeed precedes the position of t_2. The premises are *not* mutually contradictory. Rudbeckius's inference is *not* valid.

Rudbeckius's argument is not rendered uninteresting by the fact that he applied certain mathematical concepts in a fallacious way—it took almost 250 years after his death before a sufficiently sophisticated mathematical theory was developed that could lay down what it means to employ such mathematical concepts in relation to infinite sets. What is of interest here is that he proposed to his students in Uppsala, and to priests of his Diocese in Västerås, to reflect on how to refute the statement that the world is eternal by means of a reasoning that proceeds from hypotheses regarding infinite distances between time points and that employs mathematical inferences.

5.2. Implications to the question of the eternity of the world

Let us indeed ask what Rudbeckius's reasoning *would have shown* about the eternity of the world in the counterfactual case that he had succeeded in showing that no celestial body—or any other physical object with a nonzero duration for that matter—can have begun to exist for an infinite amount of time ago.[28] That is, let us ask what he himself could have thought to have established by Argument 3 regarding the issue of the eternity of the world. Disambiguating this question, consider first the sense 2 of eternity.

Can it happen that there are past time points infinitely far away from the present even if the distance of the time of creation of each physical object from the present is finite? It is normally assumed in theological contexts like the one in which Rudbeckius is operating that the world consists of the earth and the heaven and all that they contain.[29] This seems to exclude the possibility of "empty time"—i.e., the hypothesis that the world could have existed in time without the simultaneous presence of any physical object. If indeed [a] every past time point is accompanied by at least one physical object existing at that time point, and [b] the distance of the creation of every physical object from the present is finite, then the hypothesis of a past moment infinitely far away from the present at which the world already existed would be refuted. (By [a], a physical object would have existed at such a moment, and by [b] the moment would, after all, be only at a finite distance from the present.) The world would *not* be eternal in sense 2. Further, if [c] the number of physical objects having

[28] The generalization pertaining to arbitrary temporally extended physical bodies is possible because nothing particular was assumed of the hypothetical celestial body except that it has a nonzero duration and that the distance between its time of creation and the present is infinite.

[29] Rudbeckius states that according to the primary sense of the word, "mundus" ("the world") denotes *totum hoc universum, videl[icet] caelum et terram cum omnib[us] quae his continentur* (*De mundo* 1621, ch. 1; cf. *De mundo* 1611, thesis 1).

existed in the past is not actually infinite (an assumption Rudbeckius would have taken for granted), the world would *not* be eternal in sense 1, either. Namely, by assumptions [b] and [c], some past physical objects have been created earlier than any others, the distance between their time of creation t^* and the present being however finite. Given assumption [a], it follows that the world itself has begun to exist at t^*.

Without assumption [c], it would *not* be possible to infer that the world has a beginning. Namely, assumptions [a] and [b] are compatible, say, with there being infinitely many past moments t_1, t_2, t_3,… and infinitely many physical objects O_1, O_2, O_3,… such that

$$\ldots < t_3 < t_2 < t_1 < \text{the present},$$

where t_n is the moment at which O_n comes into existence (for all $n > 0$). In this scenario, each object O_n is created at a finite distance from the present (this distance being, in fact, equal to n units), but for every finite distance there is a longer distance (in fact, infinitely many longer distances) at which an object is created, as well. Consequently, for every time point at which the world exists, there is an earlier time point at which the world already existed, and the world *would* be eternal in sense 1.

6. The continued existence of humanity

Argument 4. If the world was eternal, the human race would already have become extinct. This is not the case. Therefore: the world is not eternal.[30]

Rudbeckius appears to attribute the argument to Lucretius; he refers to a passage in *De rerum natura* (5.324–327) in which Lucretius implies that should the world not have had a beginning, we would have reason to wonder why history as we know it merely dates back to Theban and Trojan wars. Elsewhere Lucretius says we must confess that things with a mortal body have a beginning in time and could never have survived from infinite past until the present (5.376–379).[31]

[30] *Si mundus esset aeternus, iam consummatum fuisset genus humanum. Siquidem homines semper decrescunt, et vitae longitudine et statura, ut apparet ex Virg. 12. Aeneid. et lib. 1. Georg. itemq[ue] Juvenal. Sat. 15. ubi sic ait: « [Nam genus hoc vivo iam decrescebat Homero.] Terra malos homines nunc educat atq[ue] pusillos ». […] « Praeterea si nulla fuit genitalis origo / Terrarum et caeli, semperq[ue] aeterna fuere, / Cur supra bellum Thebanum et funera Troiae, / non alias alii quoq[ue] res cecinere poëtae? » ut canit Lucretius.* (Rudbeckius, *De mundo* 1621, ch. 2, Arg. 8; cf. Rudbeckius, *De mundo* 1611, thesis 2, Arg. 8.)

[31] Cyril Bailey (ed.), *Titi Lucreti Cari De rerum natura libri sex, vol. 3* (Oxford, 1947). As a matter of fact such remarks hardly constitute an argument—at best they suggest one.

We will use the following abbreviations: A = the world is eternal, B = the human race has become extinct, C = not-B. Given how Rudbeckius proceeds to reason, it turns out that here he resorts to sense 2 of "eternity of the world" and takes sentence A to mean that there are past time points whose distance from the present is infinite. Premise 1 is a conditional: 'if A, then B'. Premise 2 equals C—i.e., 'not-B'. Sentence 'not-A' can be deduced. Thus, Rudbeckius's inference is valid.

Premise 2 is empirically true. In order to justify premise 1, Rudbeckius actually employs the following tripartite assumption:

- additional premise (#): (i) the human lifespan tends to become shorter and the stature smaller generation by generation; (ii) the rate by which the values of these quantities diminish from one generation to the next is roughly constant; (iii) certain values of these quantities render the emergence of further generations impossible.

It is an empirical fact that (#.iii) holds. Rudbeckius formulates assumption (#.i) expressly, and attributes it to Vergilius (*Aeneis* and *Georgicon*) and Juvenal, with reference to the latter's *Saturae* (XV, 69–70):[32] "For even in Homer's day the race of man was on the wane; earth now produces none but weak and wicked men." As further sources for the view he mentions Pliny the Elder's *Naturalis historia* and Augustine's *De civitate Dei*.[33]

Rudbeckius does not articulate assumption (#.ii), but he needs it in his reasoning. For, (#.i) and (#.iii) are compatible with the existence of strictly decreasing infinite sequences of lifespans and statures (corresponding to an infinite sequence of generations capable of reproduction) such that these sequences approach asymptotically certain values without ever attaining them (say, the lifespan 15 years and the stature 150 cm). Given the conclusion Rudbeckius wishes to attain, it is evident that he means to exclude such scenarios: the quantities must diminish quickly enough to allow attaining in finitely many generations any values that in principle are attainable.

Finally, Rudbeckius makes even the following supplementary assumption:

[32] G. G. Ramsay, *Juvenal and Persius: With an English Translation* (London, 1918).

[33] Pliny says (VII, 16.73): "[I]t is almost a matter of observation that with the entire human race the stature on the whole is becoming smaller daily" (Harris Rackham, *Pliny – Natural History: With an English Translation*, vol. 2); Augustine suggests that people who lived before the Flood had, compared to us, a considerably longer life and greater stature—and refers to Pliny as maintaining that the older the world becomes, the smaller will the bodies of men be; Augustine, *De civitate Dei*, in *Patrologiae cursus completus*, vol. 41, ed. J.-P. Migne (Paris, 1845), bk. XV, ch. 9 (pp. 447–8).

- additional premise (##): *if the world is eternal in sense 2, then there existed human beings already for an infinitely long time ago*.

We may now reconstruct the reasoning by which Rudbeckius means to justify the conditional premise 1 (i.e., the sentence 'if A, then B'). Let us suppose that the world is eternal in sense 2 (i.e., that the antecedent A of the conditional holds). Hence, by assumption (##), there existed human beings already for an infinitely long time ago (generation g_0 existing at time t_0). The people who lived then had a certain average finite lifespan (say l_0 years) and a certain average finite stature. We may focus attention on lifespans, since the average stature of a generation is presumably dependent on its average lifespan. By assumptions (#.i) and (#.ii), the transition from one generation to another systematically leads to a shortened lifespan, and there is a positive rational number Δ such that the diminishing rate of lifespan equals Δ years per generation. Now, by assumption (#.iii), generations with a certain average lifespan (say 10 years) cannot yield further generations. Thus, a possibly large but finite number of generations is needed to attain a generation g^* whose lifespan no longer enables the emergence of further generations. Let t^* be the time at which the last human being of generation g^* dies. The temporal distance between t_0 and t^* is finite. Since t_0 is, by hypothesis, at an infinite distance from the present, the same holds for t^*, and *a fortiori* the moment t^* is earlier than the present. Therefore, the human race has indeed become extinct (for an infinitely long time ago, actually). Thus, the consequent B of premise 1 holds. Since B has been derived from hypothesis A, premise 1 has been justified.

While Rudbeckius's argument is valid, it is not successful, since notably the additional premises (#.i) and (#.ii) are utterly unfounded empirically.

As an aside, the following remark regarding assumption (#.i) can be made. Today's reader might be tempted to think that Rudbeckius took up Argument 4 merely for the sake of exercise, especially as he employs texts written by ancient Roman poets to justify (#.i). However, presumably he seriously believed that (#.i) and indeed (#.ii) are true—on biblical grounds. In his funeral sermon for the queen dowager Catharina Stenbock (1622), he argues for the conclusion that the extinction of the human race is not very remote. By reference to the Bible, he states that Adam lived to be 930 years, Noah's father Lamech 777 years, Noah's son Shem 600 years, Abraham 175 years, Isaac 180 years, Jacob 145 years, the latter's son Joseph 110 years, and David 80 years. He adds that in his own time the average life expectancy is 60 to 70 years. He estimates that the first man lived for approximately 5600 years ago, and observes that in this time our life expectancy has dropped by 860 years. He

calculates the consequent diminishing rate of an average lifespan (a generation 100 years later than an earlier one has roughly 15 years shorter life expectancy) and concludes that should the world still continue to exist for 400 years, the human life expectancy would be around 10 years and further generations would therefore no longer be possible.[34]

7. The number of past time units

Argument 5. If the world was eternal, there would be in the past as many years as there are months, and as many months as there are days and hours. But a year contains several months, a month contains even a greater amount of days, and so on. Therefore: the world is not eternal.[35]

This is a variant of an argument that Bonaventure puts forward in his *Commentary on the Sentences*.[36] Let us employ the following abbreviations: A = the world is eternal; B = the number of past years equals the number of past months, which equals the number of past days and equals the number of past hours; C = there is more than one month in a year, more than one day in a month, and more than one hour in a day. Premise 1 is the conditional sentence 'if A, then B', while Rudbeckius takes premise 2 (i.e., C)—which he does not himself explicitly formulate—to entail that the consequent B of premise 1 is false, whereby the desired conclusion 'not-A' could be inferred. Rudbeckius does not clarify in detail why he fails to accept sentence B, but the reason is no doubt the everyday experience (valid in *finite* settings) according to which there are 12 times as many months as there are years, approximately 30 times as many days as there are months, and 24 times as many hours as there are days. For this argument, it is actually immaterial whether "eternity of the world" in sentence A is interpreted according to sense 1 or sense 2; all that

[34] *Tagh nu thessa 60. eller 70. år aff then första menniskios ålder, nemlighan aff 930 år, så befinner man at 860. år äro minskade aff menniskiones ålder uthi 5600. år widh pass. Fölier ther aff om werden skulle än stå til 400. år, tå skulle icke menniskiones ålder bliffva höghre än 10. eller 12. år, och tå woro hon intet dughligh til Echtenskapzståndet, och moste så thet menniskligha slächtet tagha en enda.* (Johannes Rudbeckius, *Een christeligh jordeferdz predikan, hållen…tå then höghborna fru och förstinna fru Catharina etc. Swerighes, Göthes och Wendes etc. drottning, enckia…fördes til sin lägherstadh uthi Upsala* (Västerås, 1622), p. C1v.)

[35] *Si mundus esset aeternus, sequeretur tot praeteriisse annos quot menses, et quot menses tot dies et horas. Siquidem infinitum infinito non est maius.* (Rudbeckius, *De mundo* 1621, ch. 2, Arg. 7; cf. Rudbeckius, *De mundo* 1611, thesis 2, Arg. 7.)

[36] Bonaventure, II Sent., 1.1.1.2 (p. 21): "[S]i mundus est aeternus, revolutiones solis in orbe suo sunt infinitae; rursus, pro una revolutione solis necesse est fuisse duodecim ipsius lunae: ergo plus revoluta est luna quam sol; et sol infinities: ergo infinitorum ex ea parte, qua infinita sunt, est reperire excessum. Hoc autem est impossibile." Here the phrase "pars infinitorum qua infinita sunt" refers to Aquinas's distinction finite/infinite side of an infinite duration (*pars qua finitum*/*infinitum est*); Aquinas, *Summa contra gentiles*, bk. II, ch. 38, p. 355; cf. footnotes 23 and 24.

matters is that the eternity of the world would entail that there are infinitely many time points before the present.

In order to justify premise 1, Rudbeckius employs—this time explicitly—the principle *infinitum infinito non est maius*—i.e., assumption (‡‡) mentioned in Section 5. If the world was eternal (in either of the two senses), there would exist an infinite succession of hours before the present,

$$\ldots < t_n < \ldots < t_2 < t_1 < \text{the present},$$

in such a way that the succession could be further divided in years, months, and days. And since the succession is infinite, the classification resulting from the divisions would involve infinitely many past years, infinitely many past months, infinitely many past days, and infinitely many past hours. The question is, then, what can be said of the number of these years *compared* with the number of the months, and so on. Is, for example, the set of all past days greater than the set of all past months? With the help of (‡‡), Rudbeckius deduces that all these sets have the same size; there are infinitely many past years and infinitely many past months, and so on. And if there cannot be differences in size among infinite sets, then these sets must have the same cardinality. Rudbeckius judges that this consequence is absurd—given that already one year contains as many as 12 months, etc.—and deduces the sentence 'not-A'.

To evaluate whether Rudbeckius's reasoning is valid, we must consider properties of infinite sets that Rudbeckius could not have been aware of. On the one hand, principle (‡‡) is false: an infinite set *can* have a greater cardinality than another infinite set (according to the precise mathematical definition of the concept *cardinality*).[37] On the other hand, in the specific scenario that Rudbeckius describes, the sets considered indeed *do* have the same cardinality. The infinite set of all past years has the same cardinality as the infinite set of all past months, and so on—precisely as Rudbeckius himself (on faulty grounds) says.[38] But this in no way contradicts, for example, the fact

[37] For example, the cardinality of the set of all real numbers is greater than the cardinality of the set of all positive integers. On the one hand, the former set includes the latter. On the other hand, it is a mathematical fact that the elements of these two sets cannot be put in one–one correspondence—as proven by Georg Cantor, "Über eine elementare Frage der Mannigfaltigskeitslehre", *Jahresbericht der Deutschen Mathematiker-Vereinigung*, vol. 1: 1890–91 (Berlin, 1892), pp. 75–8.

[38] It is, for example, possible to establish a one–one correspondence between infinitely many years (y_1, y_2, y_3,…) and the months these years contain. Let the first 12 years in the list (viz. y_1,…, y_{12}) correspond to the months in y_1 (so that y_1 corresponds to January of y_1, y_2 corresponds to February of y_1,…, and y_{12} corresponds to December of y_1). Let, then, years y_{13},…, y_{24} correspond in the

that 7 years involve more than 7 months. Properties that manifest themselves in finite settings cannot as such be transferred to infinite settings. Therefore Rudbeckius's reasoning does not suffice for detecting anything contradictory in the premises. His inference is *not* valid.

8. Conclusion

Summing up, the following observations can be made regarding the arguments discussed above. Mostly Rudbeckius employs sense 1 of the phrase "the world is eternal". The only case in which he is strictly obliged to switch to sense 2 is in connection with Argument 4, where the hypothesis of the eternity of the world requires that the temporal order be such that there is an infinite distance between the present and a given past time point. Argument 3 is not directly about the eternity of the world, but concerns in the first instance the question of whether temporally extended objects can have come into existence for an infinitely long time ago. The hypothesis that so is the case would entail that the world is eternal in sense 2.

It is evident that Rudbeckius did not properly recognize the difference between the two senses of "the world is eternal". He appears to have thought—erroneously—that if the worlds lacks a beginning, then there automatically are earlier time points at an infinite distance from the present. Indeed, Rudbeckius failed to distinguish between the following three possible features of a temporal order: the *absence of a beginning*, an *infinite length of the past*, and the existence of an *infinite distance between the present and some past moments*. In point of fact, the three features are mutually independent, with the exception that the third entails the second.[39]

After having presented the arguments against the "eternity of the world" that Rudbeckius takes to be based exclusively on reason, he sums up what he thinks he has achieved: "Thus, the world has not existed from eternity, but originates in time and has a certain beginning".[40] This shows that the sense of "eternity of the world" he primarily has in mind is sense 1.

We have seen that Arguments 1, 2, and 4 are valid, unlike Arguments 3 and 5. None of the arguments is entirely successful, since each employs certain

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same way the months in y_2; etc. If we continue to establish correspondences in this way *ad infinitum*, each year will correspond to exactly one month and each month to exactly one year.

[39] That the first fails to entail the second was established in footnote 9. Example 1 (in Sect. 2.1) shows that neither the first nor the second entails the third. And it follows from Example 2 (in Sect. 2.1) that the first is neither entailed by the second, nor entailed by the third.

[40] *Non itaq[ue] ab aeterno fuit mundus, sed in tempore coepit et certam originem habet* (Rudbeckius, *De mundo* 1621, end of ch. 2). In the private collegium dissertation, the conclusion is not theologically neutral: *Non itaq[ue] ab aeterno fuit mundus, sed a DEO factus est* (Rudbeckius, *De mundo* 1611, thesis 3).

assumptions that we have no sufficient reason to accept. (This said, presumably no philosopher has ever put forward an argument of any interest that would be universally judged successful.) In light of modern cosmology, Rudbeckius's conclusion is empirically true. And he combines the discussion regarding his desired conclusion with various other theoretically interesting questions, such as: the nature of infinity (actual vs. potential), the relationship between infinite quantities, the question of applying arithmetic operations to infinite quantities, the idea of infinite distances between time points, and the cumulative effect of properties transferred from one generation to the next. The arguments are therefore far from trivial or uninteresting.

The observations made in the present article illustrate how Rudbeckius understood the relationship between philosophy and theology. First, he opts to dedicate a considerable part of his discussion of *locus de creatione* to the question of the eternity of the world (instead of limiting attention to a theological discussion on the act of creation). Second, he explicitly promotes the idea that this question can be answered *both* by philosophical *and* theological arguments. Third, the arguments he uses for philosophical purposes are either taken from 13th century scholastic thinkers (Aquinas and Bonaventure) or inspired by Roman authors—although Rudbeckius does not spell out this dependence in the former case. Thus, the dissertations taken up provide, for their part, grounds for viewing Rudbeckius as a representative of Lutheran scholasticism. On the one hand, he shares with the medieval scholastics the conviction that reason and revelation are not mutually exclusive sources of knowledge: he takes it to be possible to establish certain propositions by reason *and alternatively* by reference to revelation. On the other hand, he is markedly influenced by humanists' interest for Classical literature. These two features were characteristic of the Lutheran variant of scholasticism.[41]

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[41] Regarding criteria for Lutheran scholasticism, see Ulrich G. Leinsle (Washington, DC, 2010), pp. 299–302; Erland Sellberg, *Kyrkan och den tidigmoderna staten* (Stockholm, 2010), pp. 71–83. For Rudbeckius as a representative of this variant of scholasticism, see, e.g., Erland Sellberg, "Logic and Controversial Theology in Seventeenth-Century Sweden", in *Hortus Troporum. A Festschrift in Honour of Professor Gunilla Iversen*, eds. Alexander Andrée & Erika Kihlman (Stockholm, 2008), pp. 305–8; Tero Tulenheimo, *Johannes Rudbeckius och logik: Gestaltning av en luthersk skolastik* (Skellefteå, 2024).

Rudbeckius's arguments against the eternity of the world taken up in the present paper are discussed in less detail in my book *Johannes Rudbeckius och logik: Gestaltning av en luthersk skolastik* (Artos, 2024), Sect. 4.1.

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