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herausgegeben von Bernhard Zimmermann,
in Zusammenarbeit mit Karlheinz Stierle
und Bernd Seidensticker

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Martin Korenjak / Irina Tautschnig (Hrsg.)

Die antike Literatur und die Wissenschaftliche Revolution

Die von Gessner in seinem Brief an Fuchs zum Ausdruck gebrachte Auffassung, dass die Erschließung der Pflanzenwelt ein Gemeinschaftswerk sein müsse, prägt auch seine Werke über Tiere und »Fossilien«. Vom ersten Band der *Historia animalium* bis zu dem in seinem Todesjahr gedruckten Fossilienbuch spielen Beiträge von Zeitgenossen in Form von Beschreibungen, Zeichnungen oder Objekten eine entscheidende Rolle. Die Werke erfüllen dabei eine Doppelfunktion: Einerseits machen sie die Beiträger als Mitglieder von Gessners Netzwerk sichtbar und andererseits kommunizieren sie die Bitte um weitere Zusendungen. Wie das 1556 publizierte Werk *De piscibus et aquatilibus omnibus libelli III* den vierten, den Wasserlebewesen gewidmeten Band der *Historia animalium* vorbereitet, so stellt das Fossilienbuch Gessner zufolge eine unter Zeitdruck angefertigte und letztlich unvollendete Vorstudie für ein zweites, umfassenderes Werk dar. Die Funktion des Fossilienbuchs besteht unter anderem darin, die Leserschaft über bereits vorhandene »Fossilien« zu informieren und zu ergänzenden Beiträgen aufzurufen. Über 30 Zeitgenossen werden im Fossilienbuch im Zusammenhang mit dem jeweils übermittelten Beitrag genannt und treten daher prominent in Erscheinung. Die im Vergleich zur *Historia animalium* große Sichtbarkeit der Korrespondenten und ihrer Beiträge ist aber auch dadurch zu erklären, dass die Passagen mit den von Gessner angeführten Zitaten aus gedruckten Werken im Fossilienbuch mit seinem vergleichsweise geringen Umfang überschaubar bleiben. Der Autor Gessner fungiert partiell als Herausgeber von Beobachtungen von Zeitgenossen in Form von Text- und Bildmaterial. Die Einbeziehung der Beiträge anderer schmälert die Leistung des Autors jedoch keineswegs, sondern hebt hervor, was Gessner selbst auszeichnet. Er steht im Zentrum eines Netzwerks von Personen, die ihm Material zusenden, weil er über Erfahrung in der Zusammenarbeit mit Holzschnitzern und Druckern verfügt und darüber hinaus über philologische Kompetenz und umfassende Kenntnisse der Literatur und der durch sie vermittelten Natur, die ihn zu Stellungnahmen zu einzelnen Beiträgen und zur Verknüpfung mit dem Bekannten befähigen. Durch die Sichtbarkeit der Beiträge anderer und insbesondere durch Zitate aus Briefen inszeniert sich Gessner in seinem Fossilienbuch als Knotenpunkt, bei dem Informationen zusammenfließen und über sein Werk, das eine Momentaufnahme des aktuellen Wissensstandes darstellt, die gelehrte Öffentlichkeit erreichen.⁶⁷

67 Für Rückmeldungen zum Manuskript danke ich Dr. Urs B. Leu, Dr. Veronika Lukas und den Herausgebern.

The Use of Greek in Selected Writings of Kepler (*Astronomia nova*, *Epitome astronomiae Copernicanae* and *Harmonice mundi*)

In classical Latin, the mere insertion of Greek terms (as opposed to code switching with Latin as the matrix language and Greek as the embedded language), while frowned upon by Roman authors (and politicians) when used in official contexts and most literary genres, occurs quite often in highly technical texts. In informal dialogue and in letters, particularly letters to close friends and family members, we also find clear cases of code switching. As I have shown in previous publications, there is an implicit grammar when Latin is the matrix language and Greek the embedded or inserted language, and some of those rules still (or again) apply in Neo-Latin texts. In the early modern age, many intellectuals want to write like ancient Romans, if not necessarily like Roman politicians. However, old habits, including resuscitated ones, die hard: while there is no Greek in the framing narrative of Kepler's *Somnium sive Astronomia lunaris*, not because the narrator does not know Greek (he does) but because it is a narrative, there are some Greek technical terms in the report allegedly translated from Icelandic and attributed to a helpful demon who knows how to get to the moon and back and how Earth would look to inhabitants of the moon. The core of this report, and the best part of the book, started out as an astronomical thought experiment by Kepler, which explains the Greek technical terms. Those terms all constitute clear cases, not of code switching, but of what Carol Pfaff calls "borrowing"; whether Greek or Latin characters are used is of little or no importance.¹

First, some remarks on how the implicit grammar of code switching and other ways of inserting Greek words, phrases or quotations² into texts with Latin as the matrix language has changed in the course of the centuries. Copernicus uses Greek sparingly, and all his techniques for inserting Greek are well attested in classical Latin authors. On the whole, Kepler follows the same general rules but seems more adventurous,

1 C. Pfaff, Constraints on Language Mixing: Intrasentential Code Switching and Borrowing in Spanish/English, *Language* 55 (1979), 291–318; O. Wenskus, Triggering und Einschaltung griechischer Formen in lateinischer Prosa, *IF* 100 (1995), 172–192.

2 I am using the term "insert" for want of a better one; see below for the problems.

although this impression may be misleading because his corpus is so much bigger.³ There is a particularly interesting case in the prologue of HM 3, p. 3 (94 C.),⁴ where Kepler uses the Aristotelian terms τὸ ὄτι⁵ and τὸ δι' ὅτι in a *constructio ad sensum*, as if they were plural forms: *Proportionibus certis repertis, ut τῷ ὄτι, supererat, ut etiam causae, seu τὸ δι' ὄτι, indagarentur*.⁶ Trede translates (p. 15): “Nachdem nun die genauen Verhältnisse gefunden waren, d.h. τῷ ὄτι (das Was), da blieb noch übrig, auch noch die Gründe oder τὸ δι' ὄτι (das Warum) zu erforschen”; Caspar leaves out the Greek. Note, too, that the second of the two Aristotelian terms seems technically superfluous because synonymous with *causae*; at first sight at least, but Kepler obviously thought that you cannot use the one without the other. Why? Because Aristotle says that we have to start with the facts and then work out the cause or causes, and in that order, the one being incomplete without the other. In an. post. 2.11.94a20–21, he seems to say that we feel more confident we know the facts when we also know their causes. That is how empirical research works. In other words: the use of the Greek terms helps Kepler to point out just how methodical and empirical the study of harmonics is, not working from preconceived ideas or mystical insights, but from facts.

Kepler sometimes uses the dative of the Greek article giving a verb the value of a noun, e.g. in AN 4.45, p. 217 (290 C.): τῷ προσθαφαιρεῖν *per*

3 Sometimes there are dozens of pages without any Greek characters at all, particularly in highly technical contexts. The more formulae and diagrams there are, the less Greek will we find, at least as a rule.

4 All three works of my corpus were first printed in Linz by Johann Planck: *Astronomia nova* (AN) in 1609, *Harmonice mundi* (HM) in 1619, *Epitome astronomiae Copernicanae* (*Epitome*) 1–3 in 1618, 4 in 1620 and 5–7 in 1621. The unbracketed numbers refer to those editions, the bracketed ones to that by M. Caspar: Johannes Kepler, *Gesammelte Werke* III, Munich 1937 (AN), VI, 1940 (HM) and VII, 1953 (*Epitome*). The title *Epitome* is rather misleading applied to a work far longer than the whole corpus of Copernicus.

5 Meaning, of course, a fact or facts, but also something more: the *conditio sine qua non* of any kind of empirical research. W. Kullmann, *Wissenschaft und Methode. Interpretationen zur aristotelischen Theorie der Naturwissenschaften*, Berlin/New York 1974, 204–254, translates “Erkenntnisgrund”, and the other term “Realgrund”. For Kepler’s use of Aristotle’s theory of causation, cf. HM 3.3, p. 31 (123 C.), particularly *non est finis οὐ ἐνεκα*, translated “Es ist nicht der innere Endzweck (finis), das οὐ ἐνεκα” by H. Trede (ed./transl./comm.), Johannes Kepler, *Harmonice Mundi*, III, Buch, ed. posthumously (and not always faithfully) by H. Jahn, Dortmund 2011. See also M. Caspar (trans./comm.), Johannes Kepler, *Weltharmonik*, Munich 1939.

6 I do not know of any exact parallel in classical Latin, but for even more peculiar constructions see Wenskus, *Triggering* (see note 1), 188. In those cases, too, Aristotelian phrases are involved.

minima.⁷ See also below on HM 4.7, p. 163. This is perfectly in keeping with the unwritten grammar of code switching and similar phenomena observed by classical Latin authors, but very occasionally Kepler does things which seem to be unparalleled in classical Latin texts. The use of Greek participle phrases is not a feature of technical Latin; in classical Latin it is confined to letters and similar texts and rare even there.⁸ Cicero uses the Greek absolute genitive three times, but not only is the whole genitive construction in Greek but also some of the context. Contrast Kepler: In *Epitome* 1, p. 4 (25 C.) he uses what starts out as a Latin absolute ablative but then he inserts, after the Latin participle, its Greek equivalent in the genitive: *hoc vel illo posito vel supposito* (ὕποθεθέντος).⁹

This must count as a borderline case of code switching and is the only case of its kind I have found in Caspar’s vols. III, VI and VII. Less striking and far more common is Kepler’s practice of using a Latin term preceded or followed by the corresponding Greek term, sometimes, but not always, accompanied by *Graeci* or *graece*; see below on HM 3.4, p. 32. That this type of simple juxtaposition was considered correct in technical contexts is shown by the fact that it is employed by Fronto, one of the strictest guardians of the Latin language, in the opening sentence of a letter to Marcus Aurelius, *Ad Marcum Caesarem et invicem* 3.14: *Quod poetis concessum est ὀνοματοποιεῖν, verba nova fingere, quo facilius quod sentiunt expriment*.¹⁰ In Kepler we sometimes find the Greek term after the Latin equivalent, as in *Epitome* 3, p. 278 (179 C.), but also the reverse order. Note that the Latin expression is much longer but still not entirely satisfactory in *Epitome* 1, p. 16 (31 C.), announcing the topic of Earth’s axial rotation: *quinta de διήσει, turbinatione seu convolutione Globi telluris, aequabili circa axem immobilem*. After all, one cannot say that Earth’s axis is totally *immobilis* unless one adheres to a geocentric model. HM 3.4, p. 32 (124 C.) combines two types: *scilicet Intervalla, Graece διαστήματα*. *Nam*

7 Translated “through some slight adjustment” by W. Donahue (transl.), Johannes Kepler, *New Astronomy*, Cambridge 1992.

8 O. Wenskus, *Emblematischer Codewechsel und Verwandtes in der lateinischen Prosa. Zwischen Nähesprache und Distanzsprache*, Innsbruck 1998, 34 and notes.

9 Caspar (see note 4), wanting to correct the *vox nihili* ὕποθεθέντος of the original, chose the present active participle ὑποτιθέντος, which makes no sense in this context. The correct (if extremely rare) form is ὑποτεθέντος, which may have been what Kepler wrote.

10 M. van den Hout (ed.), M. Cornelius Fronto, *Epistulae*, Leipzig 1988, 45. Kepler could not know this text which was only rediscovered in the 19th century.

loca δίσταται, *distare dicuntur*. A special case is *Epitome* 1, p. 14 (30 C.): *motum quotidianum Graece* νοχθήμερον, as the Greek term (one of the few also used in the *Somnium*) does not in fact translate the Latin one, though there is a strong causal connection.

As in classical Latin, finite Greek verbs are rare in Kepler's Latin prose. I have not found any in Copernicus, apart from the quotation on the title page of *De revolutionibus* discussed below. When Kepler uses them, he, like the classical Latin authors studied by me tend to do, opts for composite verbs, preferably of types not admitted by classical Latin grammar.¹¹ He uses three of those after the title page of AN in his "answer" to Pierre de la Ramée (Petrus Ramus, 1515–1572, who had attacked Copernicus in his *Scholarum Mathematicarum libri*, 2, p. 50): *non igitur* μυθολογεῖ Copernicus, *sed serie* παραδοξολογεῖ, *hoc est*, φιλοσοφεῖ: *quod tu in Astronomia desiderabas*.¹² We find another compound in AN 1.5, p. 21 (82 C.): *quod nihil nos impediēt, qui hic tantum* προσημαζόμεθα,¹³ and another still in HM 4.5, *axioma* 2, p. 135 (242 C.): *Deinde Tetragonus etiam sibi ipsi ἀντιπέπονθε*.¹⁴ But this pales in comparison with the *epiphonema* of HM 5.9, p. 243 (362 C.): *Hactenus igitur de Dei Creatoris opere nobis ἐπιπεφωνήσθω*. For once, Caspar (see note 5) does not quite get the point. He translates *epiphonema* as "Schluss-satz" and the sentence as "Das ist es also, was ich über das Werk des göttlichen Schöpfers vorbringen wollte." Now, it is true that ἐπιφώνημα has many different meanings, but Kepler is probably following Ciceronian usage here; see Att. 1.19.3: *quid enim ego aliorum in me ἐπιφωνήματα exspectem cum haec domi nascantur*, where it obviously means "recognition" or "praise". Unlike Cicero, who is praising himself, if in a slightly roundabout manner, Kepler wants to praise God: this is the aim of his work, particularly of the fifth book of HM, as he makes clear many

11 There are exceptions, as in the paragraph on star phases in *Epitome* 6, pp. 834–835 (476 C.), where we find a cluster of Greek technical terms, two of them verbs: *emergunt*, ἐπιτέλλουσι, *ex Solis radiis*, and *conduntur*, κρύπτονται, *sub Solis radios*. For the use of composite Greek verbs in classical Latin, see O. Wenskus, *Zitatzwang als Motiv für Codewechsel in der lateinischen Prosa*, *Glotta* 71 (1993), 205–216, here 216. However, I hereby take back what I wrote then about Kepler, see below. I also feel I must point out that I did not mean to say that all quotations in a foreign language constitute cases of code switching.

12 Donahue (see note 7): "Thus Copernicus does not mythologize, but seriously presents paradoxes, that is, he philosophises. Which is what you wish of the astronomer."

13 Donahue (see note 7): "This should prove no impediment to us, since we are only performing a preliminary exercise here."

14 Caspar (see note 5): "Weiterhin ist das Viereck zu sich selbst reziprok."

times, starting with the quotation from Galen on the title page of said book, see below. But why use this form of the verb – a third person imperative, and in the perfect tense to boot? At first I thought he was just ending with a flourish, even showing off a bit, but there is more to it than that. This kind of form, while rare in most Greek texts, is quite common in mathematical texts from Euclid onwards, γεγράφω and πεποιείσθω being particularly well attested. In other words, Kepler uses a type of insertion which is not a feature of technical *Latin*, but the ending of the inserted verb is typical of technical *Greek*, and a noun derived from the same verb is attested in one of Cicero's letters.¹⁵ Kepler uses a form dear to geometers because according to him God himself is continually practicing geometry: an idea Kepler expresses again and again, and particularly in HM 5.3, p. 187 (299 C.), where he translates the famous dictum ascribed to Plato¹⁶ by Plut. symp. 8.2, 718b–c: *ut Plato scripsit, aeternam exercens geometriam*. Note that all the manuscripts of the *Quaestiones conviviales* "omit" the αἰεὶ which is presupposed by Kepler's *aeternam* and indeed attested in the chapter heading but not in the main text, into which it has been imported by a conjecture of Bachet de Méziriac, who obviously, being brilliant at mathematics and enjoying it tremendously,¹⁷ thought that God, too, must never want to stop indulging in this practice, which is not only challenging and useful, but also recreational. It is worth bearing in mind that Plutarch and his three interlocutors propose four different interpretations of this dictum, of which the third is at odds with Méziriac's conjecture, and that their discussion takes six pages in the Loeb edition.

As for Greek terms not explicitly flagged as Greek and used in ways well attested in technical Latin, our authors use them in the original or in a la-

15 For this procedure of using even non-technical Greek words because they have been used by earlier Latin authors see P. Cugusi, *Evoluzione e forme dell' epistolografia latina nella tarda repubblica e nei primi due secoli dell' Impero*, Rome 1983, 90; Wenskus, *Zitatzwang* (see note 11), 214.

16 Not attested in Plato's writings, as Kepler seems to assume and as Plutarch (both as the author and as the *dramatis persona*) emphatically states is not the case. See also H.-D. Saffrey, *Ἀγεωμέτρητος μηδεὶς εἰσὶτω*. Une inscription légendaire, *REG* 81 (1986), 67–87, here 69.

17 He was one of the pioneers of recreational mathematics; the title of one of his most famous works begins with the words "Problèmes plaisants et délectables qui se font par les nombres" (1612). I am far from sure that his conjecture is justified; it calls for angle brackets at least.

tinized form interchangeably, the way we do,¹⁸ and there are Greek terms for which they seem to prefer Greek letters. As for Kepler, whatever course he chooses to adopt, he usually seems to do so because for him it was the easiest way to write. This is no wild guess but supported by Kepler's preliminary notes to AN,¹⁹ which were never meant to be published and in which the Greek terms are either shorter or less convoluted than the Latin equivalents (which may yet have to be invented), cf. the case of *Epitome*, p. 16 quoted above. I suppose that Copernicus used Greek insertions in a similarly unselfconscious way, which raises the question whether we are dealing with code switching or even conscious insertion of Greek terms or not, as most Greek terms seem to be part of the code "Neo-Latin technical language" or, in some cases, of a particularly elaborate version of this already elaborate code. But how about neologisms? Those should certainly count as borrowings, but things get tricky when it comes to finite verbs and neologisms coined by the author himself.

And we should not be looking at Greek terms only: Copernicus and Kepler are also familiar with other languages, such as German and Italian, and, in Kepler's case, some Hebrew. They can ask friends when they want to discuss Arabic terms. While the authors of medical Latin texts had, by the year 1500, already eliminated most of Arabic medical terminology, western astronomers never eliminated the Arabic technical terms regarding the horizontal system of coordinates, still in use today, albeit in a garbled form, like "zenith", "nadir", "azimut" and "almukantarāt". Other terms, like the "Arabic" names of most of the fixed stars,²⁰ are avoided by Copernicus, Tycho Brahe and Kepler, who use either the classical Latin or latinized names when available, or Latin translations of the somewhat cumbersome descriptions given in Ptolemy's *Catalogue*, or equally compli-

18 The terms for the musical intervals are sometimes translated, sometimes transcribed and sometimes untranscribed Greek. A peculiar case is HM 3.5, p. 42 (136 C.), where the first term is transcribed and the second is not: *Quinta supra octavam, aut Octava supra quintam, Diapasonepidiapente, vel* Διὰ πέντε ἐπὶ διὰ πρῶτων. Trede's translation (see note 5) does not reproduce this; for both intervals he gives the untranscribed form first, then the transcribed one, but he brackets only the second of the transcribed terms. I do not know who is responsible for leaving out four letters in the first transcribed form; the corresponding untranscribed one is perfectly correct. Caspar's translation (see note 5) reproduces Kepler's usage.

19 Published by Caspar (see note 4) in an appendix to his vol. III.

20 Those are usually not original Arabic names but derived from the descriptions of their position given in Ptolemy; see P. Kunitzsch, *Arabische Sternnamen in Europa*, Wiesbaden 1959, passim.

cated descriptions which sound as if they are translated from Ptolemy but are not, for the simple reason that Brahe in particular described more stars than Ptolemy did.²¹ Kepler never seems to have used the system invented by Johannes Bayer and popularized in his *Uranometria*.

As for mathematics, thanks to Euclid and his commentators Greek is the language of geometry, but for a long time algebra was known to German speakers from Adam Ries(e) onward as "die Coss", and this (including the German article) is also the term preferred by Kepler's collaborator Jost Bürgi. Unlike Bürgi, Kepler felt uncomfortable with algebra, but he does use this term: AN 2.16, p. 93 (153 C.): *Solutio non est Geometrica, siquidem Algebra Geometrica non est: sed fit per duplicem falsam positionem. Nam et Algebra hic nos deserit.*²² In *propositio* 45 of HM 1, p. 34 (50 C.) he repeats an erroneous etymology which, according to Caspar's commentary, was quite common in his time: *Objiciat hic mihi aliquis doctrinam analyticam, ab Arabe Gebri denominatam Algebra, Italico nomine Cossam.* Why "Coss" and "Cossa"? Because "cosa" was the charmingly vague Italian technical term for "variable" in the mathematical sense. The "thingy", if you will. One of the points I am trying to make here is that early modern authors of Latin technical texts were often spoiled for choice when it came to technical terms. They could use existing Latin words, but also newly coined Latin words, Greek words with or without phrases of the *ut dicunt Graeci* type, phrases which started out in classical Latin as apologies for not sticking to Latin but were retained as part of the technical style by authors who no longer saw any reason to apologize. As for Greek words, authors of Neo-Latin technical prose could use the original Greek words in Greek letters, Greek words transliterated but retaining Greek case endings, or in a latinized form with Latin endings. But, particularly when Greek failed them, they could also use Arabic, Hebrew, Italian, or German in moderation, even if Latin equivalents existed. But only in the case of German can we spot an occasional bona fide code switch because it involves triggering, i.e. the author uses the embedded language not only for the terms he needs but also for words in the immediate vicinity.²³ I have found only one case in my corpus, but then Kepler uses German more sparingly than Greek: *Epitome* 3.1, p. 138 (206 C.): *Germanicae*

21 See Kunitzsch (see note 20), 17 n. 1.

22 Donahue (see note 7) translates: "The solution is not geometrical, at least if algebra is not geometrical, but proceeds by a double iteration. For algebra, too, forsakes us here."

23 Wenskus, *Triggering* (see note 1).

praepositiones “Auff und nidergang” *manifestae sunt*, instead of “Auffgang *et* nidergang”, or even just “auff *et* nider” (the German is set in gothic type).

Like Neo-Latin technical writers in general, Kepler saw no reason not to coin new Latin terms or to propose different Latin translations for Greek technical terms. In his definition 15 of HM 1, p. 10 (23 C.) he strongly objects to the term *irrationalis* in the mathematical sense corresponding (more or less) to Euclid’s use of ἄλογος in the geometrical sense (*Nos sepe liamur hunc vocis usum*) and used *ineffabilis* instead. He does not say why, but I think there are two reasons. One concerns linguistic symmetry: *ineffabilis* is the contrary of *effabilis*, which in its turn is the calque of Euclid’s ῥητός in the geometrical sense.²⁴ But there is a more important reason. Kepler, being both a deeply religious person and endorsing the topos of God as geometer, could not support the idea that somebody might attribute to God the creation of something unreasonable (see below on AN 4). Ineffable, yes, unreasonable, no. Of course “unreasonable” is not the meaning of “irrational” in the mathematical sense. In the mathematical sense a number is irrational if it cannot be expressed as a ratio of two integers. I am cutting corners here because Euclid only talks about geometry, not arithmetics, and his commentator Proclus, an author Kepler quotes quite extensively, still seems to assume that there are no irrational numbers, which is why he considers arithmetic to be superior to geometry (see his commentary on Eucl. elem. 1, prologue 1).²⁵ In fact, Kepler, although aware of the existence of irrational numbers even if he refuses to call them irrational, still follows Proclus’ use of the Aristotelian expression δυνάμει in the sense of “potentially”. Square roots of integers are quite often irrational, but you only have to square them, and they become perfectly rational. It is almost as if our authors said that those numbers can be rational if they only make an effort. Unlike Kepler, I am not going to bury the mathematical term “irrational”, as there seems to be no viable alternative. The situation is different in the case of ἀντιπεπονθότα: I do not know why, but mathematicians do not

24 Kepler, therefore, does not follow Euclid who used ἄρητος and ἄλογος for two different orders of irrationals in elem. 10, definitions 3 and 4, the first term denoting a line incommensurable in length with a given rational line, the second a line which is commensurable neither in length nor in square with the given line.

25 G. Friedlein (ed.), Procli diadochi in primum Euclidis elementorum librum commentarii, Leipzig 1873 (repr. Hildesheim 1967), 6.

seem to be able to agree on a German or English translation. We can choose between at least four rivalling translations in German and five in English.²⁶ Perhaps we would have done better if we had just stuck to the Greek term, like Kepler in HM 5, p. 377 (667 C.). To return to Kepler’s refusal to use *irrationalis* in the mathematical sense, note that he says *hunc vocis usum*, not *huius vocis usum*! In *Epitome* 1, p. 5 (25 C.), he even uses ἄλογος in the sense “without words” when talking of God as the author of the book of Nature, in which *Deus conditor suam essentiam, suamque voluntatem erga hominem ex parte, ἀλόγω quodam scriptiois genere propalavit atque depinxit*.

Perhaps the most striking, and certainly the most obvious, case of calculated use of Greek concerns the use of Greek quotations on title pages. Owen Gingerich claims, discussing the title page of the original edition of Copernicus’ *De revolutionibus*: “Quietly sleeping on the title page of *De revolutionibus* is a Greek epigram reading *Ageometretos medeis eisito*.” Not entirely true. Copernicus misquotes the legendary inscription on the entrance to Plato’s Academy, printing the ungrammatical οὐδεὶς instead of μηδεὶς in which he is followed by Johannes Bayer.²⁷ Copernicus’ title page is to his book what the door is to an institution of learning not open to the general public, but I hasten to say that Copernicus’ title page is unadorned (as are those of my Keplerian corpus) and Bayer’s, while showing lots of architecture, does not depict a door.

While Copernicus appeals to the tradition of mathematical studies, Kepler breaks with this very tradition in an essential point and therefore does something totally different on the title page of the first of his major astronomical works, the AN, and justifiably so because he no longer considers astronomy to be an almost purely mathematical science. Plato

26 For the record: “reziprok proportional”, “indirekt proportional”, “umgekehrt proportional” and “antiproportional” mean exactly the same thing or, to be more cautious, as becomes a non-mathematician: they are coextensive, as are “inversely proportional”, “varying inversely”, “in inverse variation”, “in inverse proportion” and “in reciprocal proportion.”

27 Owen Gingerich, *The Book Nobody Read*, London 2004, 46. For the history of this quotation in antiquity, see Saffrey, *Inscription* (see note 16), for its use by Copernicus and Johannes Bayer, see V. Remmert, *Widmung, Welterklärung und Wissenschaftslegitimierung. Titelbilder und ihre Funktion in der Wissenschaftlichen Revolution*, Wiesbaden 2005, 126, who, unlike Gingerich, gives the correct reading but does not mention that the grammar is neither correct nor Platonic, not even in a broader sense, which suggests that Bayer is following Copernicus. Why Bayer inverts the word order, however, is anybody’s guess.

(allegedly) stressed the importance of “saving the phenomena”, i.e. of making sure the mathematical models fitted the observable facts,²⁸ and so did Christopher Clavius shortly before his death, according to Kepler’s introduction/dedication of the *Epitome* to Emperor Matthew and the dignitaries of Austria above the Enns, fol. 4^v (9 C.). Plato is not explicitly mentioned in this Latin quotation, but Galileo is: any model of the universe will have to account for the newly discovered moons of Jupiter and the phases of Venus. In fact, Kepler’s break with the Platonic tradition as understood by most of his, Kepler’s, contemporaries is mirrored by his use of a Greek term he may have invented himself (I have not found it in LSJ) in the full form of the title: *Astronomia nova αιτιολογητος seu Physica coelestis, tradita commentariis de Motibus stellae Martis*.²⁹ The Greek term is meant to stress the fact that Kepler has done what Aristotle wanted: to find the facts first and then figure out the reason,³⁰ something which nobody had done before Kepler as far as the motions of the heavenly bodies are concerned, including Copernicus. See also the table of contents of AN regarding 3.32 on fol. 2^v (43 C.): *Arrigite aures Physici. Hic enim deliberatio suscipitur de impressione in vestram provinciam facienda*. Which is not to say Kepler disregarded Plato and his love of mathematics. On the contrary: Kepler has also followed the spirit of Plato’s alleged dictum. To make this very point he quotes a paragraph of Proclus’ commentary on Eucl. elem. 1 on the title page of the first book of HM – a quotation of six lines beginning with the words Πρὸς δὲ τὴν φυσικὴν θεωρίαν (ἡ μαθηματικὴ) τὰ μέγιστα συμβάλλεται. Note Kepler’s (correct) bracketed expansion; but in order to realize that Kepler skipped about four lines (in his translation, Caspar inserts three dots to show something is missing) we have to look up the original quotation (from the long first part of the prologue, pp. 22–23 Friedlein, see note 25). The part Kepler considers his readers can do without concerns a rather vague reference to Plato’s *Timaeus*.

28 In this case, the apparent motions of the heavenly bodies, particularly the planets. See J. Mittelstraß, *Die Rettung der Phänomene*, Berlin 1963; for AN, see 208–221. Before Kepler astronomy was a physical science only insofar as it assumed that the motions of the heavenly bodies were circular and regular.

29 Donahue (see note 7), 1–2 doubts that this title is actually the one chosen by Kepler, but would an editor have made up a Greek word to use as an important part of the title? For the formation, cf. the term ἀπολόγητος used by Kepler in a marginal note on AN 4, p. 269 (348 C.).

30 See above after note 6.

That Kepler did not consider (titles and) title pages to be merely ornamental (besides, of course, serving a bibliographical function) is shown by the use he makes of a long quotation³¹ of about 13 lines from Galen’s *De usu partium* 3, p. 174 Helmreich (3.236–238 Kühn) on the title page of HM 5, introduced by *Galenus de usu partium Libro III* and followed by a Latin translation introduced by *id est*. Kepler later refers his readers to this text in the course of this very book; see below. Why Galen, and why *De usu partium* 3? Because Galen takes teleology to its extremes, and nowhere more so than in *De usu partium*, which he calls a prose hymn to nature at the very end of his work, 17.3, p. 451 Helmreich (4.365–367 Kühn).³² Galen uses φύσις, δημιουργός and, as in the paragraph quoted by Kepler, δημιουργήσας, interchangeably, which Kepler feels justified to translate as *Deus conditor*. He leaves out the beginning of Galen’s sentence and modifies the rest by leaving out the relative pronoun from Galen’s ἱερὸν λόγον, ὃν ἐγὼ τοῦ δημιουργήσαντος ἡμᾶς ὕμνον ἀληθινὸν συντίθημι, and then goes on to translate *Sacrum sermonem, hymnum Deo Conditori verissimum ordior*. In fact, there is nothing in the whole quotation which does not admit a Christian interpretation, while the differences play no role here: Galen’s demiurge is not omnipotent (he cannot, as Galen has explained at the beginning of this book, create viable centaurs) and has to work with preexisting matter, which is why Galen uses the expression τὸν ἐνδεχόμενον κόσμον (“as beautifully as possible”). And this is where Kepler cheats a bit in ch. 9, p. 240 (359 C.), attributing to Galen an expression he (Galen) did not use in the paragraph quoted by Kepler: *quia hic κόσμος γεωμητρικὸς inscriptionis perfectae, non erat amplius juxta illum alterum κόσμον ἀρμονικὸν ἐνδεχόμενον*,³³ *ut Galeni verbis utar, ex hujus libri V, frontispicio desumptis*. The quotation is not quite exact and, more importantly, Galen is not talking about the universe, but the human body.

31 ἱερὸν λόγον, ὃν ἐγὼ [...] δυνάμειος ἀηττήτου. Kepler only transforms the relative clause at the beginning of the text he quotes into a main clause; the rest seems to correspond to the edition he must have used, i.e. either the Aldina (1525) or the Basileensis (1538). As far as *De usu partium* is concerned, the text of the latter does not differ much from the former. The text of G. Helmreich (ed.), *Galenus De usu partium corporis humani I*, Leipzig 1907, is vastly superior, but the differences need not concern us here. I wonder, though, why Kepler uses the superlative *verissimum*.

32 On teleology in *De usu partium* 3 in particular, see O. Wenskus, *Wenn wir alle Kentauren wären. Wissenschaftliches Denken und Vorformen der Science Fiction bei Galen, De usu partium 3,1*, *WJA* 39 (2015), 69–91.

33 Caspar’s edition (see note 4) has ἐνδεχόμενος, which makes no sense, but Caspar (see note 5) translates the text as if he, too, read the accusative case.

Not only that, in the sentence following the text quoted by Kepler Galen explicitly begs us to consider, for the time being, not the sun, the moon and the other heavenly bodies, but our own anatomy. Not that Galen was not interested in astronomy or geometry; in fact, he was and would probably have agreed with Kepler, but this is not what he is writing about in *De usu partium*. Between the table of contents for HM 5 and ch. 1, pp. 179–180 (291 C.), Kepler quotes another pagan Greek text, this time one which speaks of gods and goddesses and therefore does not admit a Christian reading, of about seven lines (in the Oxford edition) from Pl. Tim. 27c, a text Kepler introduces at some length as something all Christians should admire and take to heart: *De his acturo mihi lubet Lectoribus inculcare Timaei, Gentilis philosophi, de iisdem exordientis, adhortationem sanctissimam, à Christianis hominibus summâ cum admiratione et pudore, nisi imitemur, cognoscendam*. The quotation is followed by a faithful translation, and then Kepler goes on to talk about Plato's five regular solids, i.e. one of the subjects of the *Timaeus*, but not about their connection to the elements but rather on how they can be inscribed in a sphere. There is a reason for all this Greek in the paratexts of HM 5: 5.3 contains the most important contribution Kepler makes in HM: his third law, albeit not yet in its modern form, is the climax of his prose hymn to God, as *De usu partium* is Galen's prose hymn to nature.

Quotations in the Greek original are rare in the main text. There are some clusters, particularly in HM 5.10, pp. 244–248 (363–368 C.), but this is not just any chapter, bearing the title *Epilogus de Sole, conjecturalis*. For reasons of space and because this epilogue is not typical of Kepler's style, I have decided to put off discussing this text for the time being. Suffice it to say that in the epilogue and in the bulk of Kepler's three major astronomical works, quotations longer than two or three words are usually from poetic texts, which is quite normal.³⁴ Interestingly, Kepler quotes and praises Hes. erg. 564–567 without noticing an astronomical crux of this text (probably a polar error, i.e. an error which is not only easy to make but also easy to overlook).³⁵ Prose quotations in the main text are very rare; one exception is AN 5.70, pp. 336–337 (422–424 C.) where Kepler painstakingly discusses the exact meaning of one of the

terms used by Ptolemy plus a problem concerning the identification of the star Ptolemy means at the beginning of *Almagest* 10.9, ἔφος ὁ τοῦ Ἀρέως ἐδόκει προστεθεικέναι τῷ βορείῳ μετώπῳ τοῦ σκορπίου. Kepler's discussion is far too long to be quoted in full; so I will just point out a) that Kepler also quotes from Gerard of Cremona's Latin translation of the *Almagest*, without giving Gerard's name and just calling him "Arabs",³⁶ b) that he suggests a German translation for the problematic verb (*usus sum voce superpositum, Germani proprie* "drangesetzt"; the German word is in gothic type), c) that he ends his discussion with the resigned words *Frustrataque in voce προστεθεικέναι fui argutus*,³⁷ and d) that this is a case of a quotation given in the original because the exact wording is discussed,³⁸ as in Kepler's discussion of Aristot. cael. 2.12, 292a14–b25 in the prologue of *Epitome* 4, p. 427 (254 C.) where another factor is at play: this is a quotation (from Aristotle) within a quotation, from a letter to James I: *Itaque Lunae πράξεις (planè hac voce etiam utitur)*. In one case at least I am not sure whether Kepler is quoting or just making up some Greek: AN 2.16, p. 92 (152 C.), where Kepler is discussing something he had written in his *Mysterium Cosmographicum*, ch. 22, p. 79, where he had accused Ptolemy of blind guesswork (*caeca conjectura*), wrongly, as he now realizes: *Cum itaque tunc quidem existimarem, hoc μέγα λίαν αἴτημα esse*.³⁹ Kepler uses the Latin form of the copula, not the Greek one, following the usage of classical Latin.⁴⁰ This is, of course, almost unavoidable when converting direct speech into indirect, since the copula does not belong to the part quoted verbatim, as in AN 2.17, p. 108 (171 C.), where Kepler is quoting Ptolemy, *Almagest* 10.9, p. 352 Heiberg: *Et quia Ptolemaeus lib. XIII cap. I limitem Boreum Martis ait esse περί τὰ τελευταῖα τοῦ Καρκίνου, καὶ σχεδὸν περί τὸ ἀπογηότατον*.⁴¹ Kepler is not quoting the original Greek for *limitem Boreum Martis* because this would have meant some switching to and fro,

34 Wenskus, Zitatzwang (see note 11), 210–211.

35 O. Wenskus, Time in Greek Epic, in: Ch. Reitz/S. Finkmann (eds.), Structures of Epic Poetry II 2, Berlin/Boston 2019, 183–214, here 197. One reason Kepler overlooked this crux is that the dating by stellar phases had become obsolete.

36 When quoting those who translated from the Arabic, Kepler habitually refers to them as *Arabs* or *Arabicus*.

37 Donahue (see note 7) translates: "Therefore my clever interpretation of the word προστεθεικέναι was in vain."

38 Wenskus, Zitatzwang (see note 11), passim.

39 I suppose that Kepler uses αἴτημα in the Euclidean sense of "postulate", but Donahue (see note 7) translates: "And so, since I thought then that this was altogether too much to assume."

40 O. Wenskus, Markieren der Basissprache in lateinischen Texten mit griechischen Einschaltungen und Entlehnungen, IF 101 (1996), 233–257, here 252–254.

41 Donahue (see note 7): "And because Ptolemy says in book 13 ch. 1 that Mars's northern limit is 'near the end of Cancer and almost at its apogee'."

something classical authors seem to enjoy doing but not Kepler.⁴² In HM 4.1, pp. 113–114 (217 C.), he seems to quote a line of Aristot. metaph. 13.7, 1082b3, λόγον πλασματώδη, πρὸς τὴν ὑπόθεσιν βεβιασμένον, but a) this is not what Aristotle wrote, but made up from Aristotelian material,⁴³ and b) it is not an attack on Plato's theory of ideas.⁴⁴

I have only found one instance in my corpus where Kepler tries his hand at textual criticism, but while his text makes perfect sense it is far less satisfying than the original. In HM 4.1, p. 115 (219 C.), he translates a line from Proclus' commentary on Euclid (prologue 1, p. 13 Friedlein), who (Proclus) is quoting Plat. Tht. 151e: Theaitetus has just proffered a hypothesis, and Socrates urges him to put it to the test and see whether γόνιμον ἢ ἀνεμιαῖον τυγχάνει ὄν, i.e.: “whether it is fertile or a wind egg” (my translation). Kepler obviously did not realize that ἀνεμιαῖον means the same thing as ὑπνήμιον, the term used by Aristotle in the sense of “unfertilized egg” (not in the sense of an egg lacking a shell). This is a wonderful metaphor because, unlike shell-less eggs, unfertilized eggs look fine and, unless inspected with a strong lamp, exactly like fertilized ones, but no chicken will ever hatch from them. Kepler, not familiar with this meaning of ἀνεμιαῖον, translates: *sintne subsistentia et constantia* (μόνιμα *non γόνιμα lego*), *an in ventos evanida, et spectra potius quam vera?* Not bad, in fact, *μόνιμος* is attested at the top of the same page of Proclus' text (in Friedlein's edition), but Plato's (and Proclus') text of the phrase we just analyzed is so much better than Kepler's, especially if we take into account that while we, uncomfortable with the idea of eating embryos, will only eat unfertilized eggs (if at all), Aristotle claims their taste is inferior (hist. an. 6.2, 559b24–25).⁴⁵

In his *Letters*, Cicero sometimes modifies a Homeric quotation.⁴⁶ Kepler does this at least once, in his *Apology* to Robert Fludd, p. 15 (vol. VI, p.

401 C.), and quite skillfully, transforming Il. 18.392 to ἤφαιστε πρόμολ' ὄδε· κεπλήρος σεῖο χατίζει. But why he would then ascribe the original to Plato is anybody's guess. I wonder what Fludd made of this – did he feel Schadenfreude? However, anybody can mix up Hesiod and Homer when quoting from memory, and in fact Kepler does precisely that in *Epitome* 1, pp. 8–9 (27 C.): εὐρύστερνος γαῖα is an inverted quotation from Hes. theog. 117, γαῖ' εὐρύστερνος. Unlike Cicero, however, Kepler never uses abridged quotations which would have to be supplemented from the reader's memory. Kepler only trusts his readers' Greek so far and does not want to alienate any of them.⁴⁷

Like many classical authors, Kepler sometimes makes etymological remarks, whether he transcribes the Greek or not, as in HM 3.9, p. 53 (148 C.) when discussing the terms for the different strings (of a stringed instrument): *Ergo (a digito indice sic dicta) est c.*⁴⁸ Like Plin. epist. 2.14.5 and others, he sometimes uses ἀπὸ + the genitive case of the article to introduce an etymology,⁴⁹ but neither in AN nor HM, only in *Epitome*, e.g. 3.1, p. 206 (138 C.): discussing the verb *oriri*, he states *ut non abs ratione credas, vocem ἀπὸ τοῦ ὄρους, quod montem significat et ab ὀρούειν surgere derivari* (note that he uses both the Greek and the Latin construction in the same sentence). These words are indeed connected; in fact, the connection between *oriri* and ὀρούειν has never been doubted,⁵⁰ though the one is not derived from the other. Some cases are obvious, as *Epitome* 3.3, p. 276 (178 C.): *Graeci τροπικὸν ἀπὸ τῶν τροπῶν*. We find, not an etymology but the result of a mistaken etymological speculation, in HM 4.7, p. 163 (271 C.): *et imaginis igitur divinae essentia ἐν τῷ ἐνεργεῖν consistit, ut flammae ἐν τῷ ῥύειν*. What is wrong? While the noun ῥύσις Kepler had used earlier in this paragraph does exist, the verb *ῥύειν does not. It may have, and in this case it would have been the zero grade form of ῥεῖν, but

42 Wenskus, Markieren (see note 40); O. Wenskus, Codewechsel bei Mark Aurel, in: L. Zybatoŵ (ed.), Europa der Sprachen: Sprachkompetenz – Mehrsprachigkeit – Translation, Frankfurt 2003, 305–315.

43 Aristotle wrote ἀποπὸν καὶ πλασματώδες (λέγω δὲ πλασματώδες τὸ πρὸς ὑπόθεσιν βεβιασμένον).

44 See Caspar's (note 4) commentary.

45 How could he have known? K. Epstein, Wie weit reicht die Empirie des Aristoteles?, in: J. Althoff/S. Föllinger/G. Wöhrle (eds.), Antike Naturwissenschaften und ihre Rezeption 27, Trier 2017, 35–56, here 37, is almost certainly right: Aristotle is prejudiced because he thought unfertilized eggs, lacking male seed, would be less “cooked”.

46 A. Behrendt, Mit Zitaten kommunizieren. Untersuchungen zur Zitierweise in der Korrespondenz des Marcus Tullius Cicero, Rahden 2013, 84–97.

47 On incomplete quotations and Cicero's fondness of this technique, see also R. B. Steele, The Greek in Cicero's Epistles, *AJPh* 21 (1900), 387–410, here 394–397.

48 For once Trede's translation (see note 5) is not satisfactory, through no fault of his: “Mithin ist der Lichanos (nach dem betr. Finger so genannt) c”; instead of “nach dem Zeigefinger so genannt”. The problem is that the Greek term is derived, not from a word meaning “to show”, but “to lick”.

49 Wenskus, Triggering (see note 1), 189.

50 For someone who lived long before the theory of a common ancestor of Latin and Greek was voiced, Kepler is doing remarkably well here. He seems to think, as did many ancient grammarians, that Latin is derived from Greek, but he also seems to suggest that Greek is derived from Hebrew; see *Epitome* 2.4, pp. 315–316 (199 C.), and he correctly states *ibid.* that *Autumnus Hetruscum terminationem habet*.

it is not attested in any of the texts known to our dictionaries, at least not in the present tense. But it is certainly an easy mistake to make.

However, the question is: are those cases of triggering? I think they are because Kepler has to activate his knowledge of the Greek case system, but they are borderline cases, unlike plays on words which have nothing to do with triggering but do show Kepler's linguistic competence, as in the dedication, to James I, of HM, fol. 3^r (p. 10 C.): *Harmostae tam laudabili, meas aliquando Mundanas Harmonias accinere tanto firmiter mihi proponebam*.⁵¹ True, this is not impressive taken out of context, but it is actually part of a complicated yet coherent system of allusions, both to James' musical culture and to his being king of Scotland (as James VI) even before being crowned king of England as well. When Kepler speaks of James' *harpe Davidica*, he means, not only David, king of Israel, who enchanted the problematic king Saul with his music, but also James as an ardent player of the clarsach, the Scottish version of the Celtic harp, and I wonder whether he was also aware of the fact that David was the name borne by two kings of Scotland. I also think that Kepler was convinced that someone as thoroughly versed in music as James would also restore harmony in his realms: fol. 3^r (p. 10 C.): *Cur autem a tuâ potissimum Harpe Davidica, Rex Inclyte, principium aliquod expectare consonantiae restaurandae, desideria me iuberent*. That Kepler is alluding to religious strife is evident from the first draft of this dedication, published by Caspar, pp. 517–519. He is hoping that James will turn out to be just as tolerant regarding the different western Christian churches as he was himself. And while the thoughts expressed by Kepler may seem somewhat far-fetched to us, they would not have seemed so to his contemporaries. This is the positive counterpart of Shakespeare's much quoted dictum (*The Merchant of Venice* 5.1.79–81) that "The man that hath no music in himself / nor is not moved with concord of sweet sounds, / is fit for treasons, stratagems and spoils".

Sometimes Kepler gives a new meaning to an existing Greek term. The most obvious case is his response to François Viète (Franciscus Vieta) in AN. Viète had attacked Ptolemy and Copernicus for having failed to work according to the methods of classical geometry, which admits ruler and compass constructions only. Kepler quite rightly replies that yes, those were cases of ἀτεχνία, but that he challenges Viète or anybody else to

do better because the problem in question is insoluble with the set of methods admitted by Viète: a) the methods of classical geometry and b) algebra, a branch of mathematics Viète had revolutionised, not that this would have endeared him to Kepler. In fact, Kepler's equation (which follows from his first two laws and which he presents in AN 4.60, if only for the planet Mars, see below) is a transcendental one and can only be solved by iteration, not algebraically, let alone by ruler and compass. So, Kepler takes a term which traditionally meant "lack of method" and gives it the meaning "using a stopgap procedure in a case where traditional procedures fail". Or, in more simple terms: Viète says "Ptolemy and Copernicus do not use the tools of the trade", and Kepler replies: "They probably tried using those tools, and so would I, but said tools just do not work in those cases, and I defy you or anybody else to show me how they possibly could." This is also what Kepler does with the terms ἀγεωμέτρητος and ἀγεωμετρησία.

Let us take a closer look at this polemic, because Kepler's use of Greek terms in this context is an interesting variation of the catchword technique. Using Greek catchwords against an opponent's text is well attested in classical Latin texts⁵² and still more striking in Neo-Latin texts because the Greek is more visible in printed texts because of its entirely different ductus. Viète was a brilliant mathematician and wanted this fact to be as widely known as possible, which is understandable up to a point but also leaves the author wide open to heavily ironic retaliation, particularly in the case of the title of one of his major works: *Apollonius Gallus seu Exsusitata Apollonii Pergaei περὶ Ἐπαφῶν Geometria* (Paris 1600). To give Viète credit, he did reconstruct a lost argument of Apollonius of Perge, and neither Ptolemy nor Copernicus managed to solve the problem posed by the apparent motions of the planets, and (to my mathematically untutored mind) Viète's accusations (fol. 11^r) of ἀτεχνία and ἀγεωμετρησία do not seem to be totally unfounded. Or, rather, Ptolemy's and Copernicus' geometry is good per se, at least I suppose it is, but it does not quite match the observable facts. The phenomena, in other words, have not been saved by either of them. But Apollonius could not have saved them either; the models known to him according to Ptolemy, *Almagest* 12.1, while superior to Eudoxus' theory of homocentric spheres, do not yield entirely satisfactory results. I am not sure whether Viète was aware of

51 Trede (see note 5), 11 translates: "einem so löblichen und harmonischer Regierung kundigen Herrscher dermaleinst meinen Sang von der Harmonie des Alls zu weihen."

52 Wenskus, Zitatzwang (see note 11), 208.

this; the argument reconstructed by him is a purely mathematical one and has nothing to do with astronomy. When reading the AN, it is easy to lose sight of the fact that Viète cannot possibly be attacking what Kepler would eventually publish nine years later, about six years after Viète's death. Kepler introduces the term ἀτεχνία in his table of contents of AN, regarding 4.43, on fol. 3^v (p. 47 C.): *huic rei necessaria est mensuratio spacii inter duas Conchoides capituli XL, quae cum habeat nonnullam ἀτεχνίαν, Geometrae provocantur*. Unlike Donahue,⁵³ I would translate “expedient”, possibly “stopgap expedient”, or “stopgap procedure”, not “contrivance”. Donahue's translation of this word in a marginal note to AN 2.15, p. 87 (147 C.), “approximation”, is somewhat too free, and I would certainly also use the transcribed Greek term in brackets in every case, and make sure to explain that it was originally meant as an insult and now denotes Kepler's solution to what he calls, already in the table of contents, regarding AN 4.46, fol. 3^v (p. 47 C.), ἀμηχανία, and what modern astronomers call Kepler's problem.

Kepler also uses forms of ἀτεχνία three times, still in the table of contents, AN 4.48, fol. 3^v (47 C.). But for 4.60 (the chapter in which Kepler presents first his second law and then his famous equation), Kepler uses *methodus ἄτεχνος*, translated by Donahue as “clumsy method”, while I would prefer “stopgap method”, as the method is anything but clumsy and I am sure Kepler does not want to imply it is. In the main text of AN, Kepler first attacks Viète and all those who will be sure to follow Viète's example in 2.16, p. 95 (156 C.): *Existent acuti Geometrae VIETAE similes, qui magnum aliquid esse putabunt hujus methodi ἀτεχνίαν. Id enim et PTOLEMAEO et COPERNICO et REGIOMONTANO objectum in hoc negocio a VIETA. Eant igitur et schema Geometrice ipsi solvant, et erunt mihi magni Apollines*.⁵⁴ Apollos, not Apolloniuses! Only a god, and a god

53 Donahue (see note 7): “For solving this problem, it is necessary to have a measure of the area between the two conchoids of ch. 40, to the solution of which geometers' attention is drawn, as it involves many contrivances.” In view of what Kepler actually writes in AN 4.43, p. 212 (284 C.), viz. *Videat Geometra aliquis, an thema sit demonstrabilis* (translated by Donahue as “Some geometer should see whether this be demonstrable”), I think *provocantur* should be understood as meaning “are challenged”, or something on those lines.

54 Donahue (see note 7), translating *existent* as a present tense “There exist subtle geometers such as Vieta who will think it something great to show the contrived nature of this method. Let them therefore go forth themselves and solve the figure geometrically, and they will be to me great Apollos.” As M. Korenjak pointed out to me, this is not only a pun but also an allusion to Verg. ecl. 3.104–105. I wonder whether Kepler is

allegedly interested in geometry, could find a solution using only a ruler and compass – provided such a solution exists, which does not seem to be the case. Kepler, on the other hand, is content with the thread of Ariadne (a mere mortal in classical mythology, whatever her status may have been in Minoan times), which is ἄτεχνον but will lead us out of the labyrinth: *Mihi sufficit ad quatuor vel quinque conclusiones ex uno argumento (in quo quatuor observationes et duas hypotheses insunt) extruendas, id est, ad viam e labyrintho remeandam, pro lumine Geometrico filum ἀτεχνον (quo tamen ad exitum dirigaris) ostendisse*.⁵⁵ In 3.46, p. 218 (292 C.), Kepler points out that *multiplex hic occurrit ἀμηχανία*,⁵⁶ which must be solved by the corresponding ἀτεχνία: p. 220 (294 C.): *age, subsidium ab ἀτεχνία petamus*.⁵⁷ And only a God could properly square an oval, unless perhaps the geometers can help: 4.47, p. 223 (296–297 C.): *Hic igitur accersendus nobis e Tragoedia θεὸς, immo vero λόγος τις, ἀπὸ μηχανῆς, qui nos doceat machinari quadraturam ooidis*,⁵⁸ elegantly varying the ἀμηχανία motif twice. In 4.47, p. 226 (299–300 C.) he again implores the geometricians to help him, and since no such help will be forthcoming, he declares *quia nobis per Geometriam non patet liber exitus, paciscemur cum ἀτεχνία*.⁵⁹ Not that Kepler likes this: 4.48,

not making another point: no solution is given for the riddle posed by Damoetas, and philologists do not seem to agree on one.

55 Donahue (see note 7): “For me it is enough to draw four or five conclusions from a single argument (which includes four observations and two hypotheses); that is, in getting from the labyrinth back to the highway, to show, instead of a geometrical light, a contrived thread, which nonetheless will lead you to the exit.” I think the translation “contrived” rather misleading. There is nothing contrived about Ariadne's method, which, by the way, is still used by cave divers and firemen, among others.

56 Donahue (see note 7): “A multiple obstacle to calculation”. In a footnote, he just adds Ἀμηχανία (sic).

57 Donahue (see note 7): “let us go seek the assistance of a contrivance”, with the added footnote Ἀτεχνία.

58 Donahue (see note 7), for once, gets and seizes the opportunity to substitute one switch for the other: “Here we will have to summon up from tragedy a *deus*, or rather a sort of *ratio*, *ex machina*, which will show us how to manufacture a quadrature of the ovoid.” Why square an oval? Because, when writing this chapter, Kepler still assumed that Mars' orbit was an oval; the true solution only occurred to him (or so he says) when writing ch. 58: *o me ridiculum!*

59 Donahue (see note 7): “since there is no way out through geometry, we shall be content with a contrivance.” Again, Kepler likens his problem to a labyrinth, and it is certainly true that, for getting out of a labyrinth of the multicursal type, geometry is useless (and for getting out of unicursal ones, unnecessary).

p. 235 (310 C.): *Contra cum pigeret ἀτεχνίας multiplicis*.⁶⁰ See also 4.49, p. 235 (310 C.).

God, of course, cannot be supposed to make geometrical mistakes: 4.49, p. 235 (310 C.): *qualem ἀγεωμέτρητον anticipationem in caeteris ejus operibus hactenus non invenimus*.⁶¹ But humans must not be bothered by some slight lack of geometry: 4.49, p. 238 (314 C.): *certumque est, quae illic ut ἀγεωμέτρητα suspecta habuimus, nihil nobis sensibile incommodasse*.⁶² Kepler goes on to use forms of ἀγεωμέτητος several times in ch. 4.57: on p. 274 (354 C.), on p. 282 (362 C.), and on p. 283 (364 C.). It is important to keep in mind that he himself (or perhaps his persona) has not yet hit upon the right solution, i.e. that the orbit of Mars is elliptical, which he only does in the following chapter. And in the chapter after that, as we are approaching the famous ch. 60, the polemic against Viète a.k.a. Apollonius returns with a vengeance: 4.59, p. 293 (374 C.), at the end of § 14: *Demonstratio ut certissima, ita ἀτεχνος est et ἀγεωμέτητος, quantum quidem attinet hanc partem, de progressu intermediorum augmentorum. Cuperem, ut caetera, sic hanc quoque particulam, geometrica et ἐντέχνως expediri; sic ut etiam Apolloniis satisfiat*.⁶³ And ch. 60 (and indeed book four) ends at p. 300 (381 C.) with a final jab at Viète but also with the explanation why Kepler's problem cannot be solved with ruler and compass: because the arc and the sine are incommensurable. Strangely enough Kepler uses, instead of a more technical term denoting incommensurability, a Greek but vague term: *Mihi sufficit credere, solvi a priori non posse propter arcus et sinus ἑτερογένειαν. Erranti mihi, quicumque viam monstraverit, is erit mihi magnus Apollonius*.⁶⁴ Perhaps

60 Donahue (see note 7): "since I disliked the many contrivances."

61 Donahue (see note 7): "We have hitherto found no anticipation of such lack of geometry in the rest of his works."

62 Donahue (see note 7): "It is certain that wherever we entertained suspicions on the grounds of a lack of geometry, we were not inconvenienced in any perceptible way."

63 Donahue (see note 7): "Although the demonstration is most certain, it is likewise *gauche* and ungeometrical, at least in the part pertaining to the progress of the intermediate increases. As always, I would like to have this small part carried out geometrically and with *finesse*, so that even an Apollonius would be satisfied." The gallicisms seem rather out of place, if not as misleading as "geometrical faux pas" in Donahue's translation of 4.57, p. 274 (354 C.). A *faux pas* is a type of avoidable mistake, and that is certainly not what Kepler wants to say. – Note that in ch. 49 Kepler observes the unwritten rule that, when a Latin and a Greek adverb are used in conjunction, the Latin one comes first; see Wenskus, *Emblematischer Codewechsel* (see note 8), 10 n. 16.

64 Donahue (see note 7): "It is enough for me to believe that I could not solve this a priori, owing to the heterogeneity of the arc and the sine. Anyone who shows me my error and points the way will be for me the great Apollonius."

he flinched from using e.g. ἀσυμμετρία because it did not square with his view of God the Geometer. And now this particular polemic is finally over, we no longer find uses of ἀτεχνία in AN, just the neutral ἀμηχανία: 5.65, p. 312 (396 C.).

By the time Kepler wrote HM, he and his assistants have been able to ascertain that what Kepler had said about the orbit of Mars in AN also applies to the other planets, so a polemic against Viète had become superfluous. Kepler now uses ἀτεχνία in the traditional sense and when talking about unnamed others: 3.9, p. 54 (150 C.): *Nos vero spectamus hic non ἀτεχνίαν Empiricorum, sed Naturae ἀκρίβειαν*.⁶⁵

But even this type of ἀτεχνία is better than κενOTEχνία, a term (not found in LSJ) Kepler uses in a rather harsh attack on Peter Apian's *Astronomicum Caesareum* which consisted partly of complicated models, and by this I mean actual if two-dimensional models: AN 2.14, p. 82 (142 C.): *De Automatopeoerum vero κενOTEχνία quid dicemus?*⁶⁶

Now, for one of three instances (all from the *Epitome*, probably because it is the farthest ranging of Kepler's major works, in spite of its misleading title) where Kepler proposes new Greek terms coined by himself. They did not "take", however, the first group not by any fault of Kepler's⁶⁷ but because it turned out that there was no need for them. In classical Greek geography, every κλίμα is named after a town equidistant from two parallels, e.g. διὰ Μερόης.

But what about the southern hemisphere? What if there is no important town where we would need it for reasons of symmetry? Kepler suggests, *Epitome* 3.3, p. 313 (197 C.): *Australia denominari possent a Borealibus quorum sunt rationes oppositae, ut Ἀντι διὰ Μερόης*. But climate does not depend on latitude only, which is why "κλίμα" means something totally different in modern Greek, i.e. exactly what "Klima" means in German or

65 Trede (see note 5) translates: "Uns kommt es hier nicht auf das rohe Verfahren (ἀτεχνία) der Praktiker an, sondern auf die strenge Genauigkeit (ἀκρίβεια) der Natur."

66 Donahue (see note 7) translates: "But what are we to say of the empty artistry of those who made the devices?" and explains "A lavishly produced book consisting mainly of movable graduated paper wheels, like circular slide rules, by which one could predict planetary positions."

67 Unlike *Epitome* 3.4, p. 327 (205 C.), where he proposes a term which, while correct from a morphological point of view, is actually inferior to the term he wants to abolish. As for the term *dihelios* he proposes in *Epitome* 5.2, p. 681 (385 C.) for a particular, hitherto nameless form of the *diacentros*, I do not know whether it was ever adopted, even the term *diacentros* being out of fashion today (I had never heard of it before reading the *Epitome*).

“clima” in Italian etc., and only historians of science know what it used to mean in Ptolemy’s time.

Of course I would have liked to delve further into Kepler’s writings, particularly his letters, to see whether they contain cases of Kepler actually switching from Latin to Greek or vice versa in mid sentence. Our corpus, while not containing indubitable cases of code switching, does show our author’s mastery of both Greek and technical Latin, and it does contain instances of not only self-conscious but extremely creative insertion of Greek words, phrases and quotations: when Kepler is intending to say something revolutionary, he takes great pains to show his respect for the classical authorities, their attitudes towards the Divine, and their methods, but also his determination to replace their theories with better ones.

Die gefangene Nymphe. Naturerfahrung und wissenschaftlicher Fortschritt in Bernardo Zamagnas *Echo* (1764)

Im Zentrum meines Beitrags steht ein Text, der in der Forschung bislang noch wenig beachtet worden ist, der aber für die literarische Diskursivierung der »Scientific Revolution« einige Relevanz besitzen kann. Die *Echo* des Ragusiner Jesuiten Bernardus Zamagna (Bernard/Brno Zamanja/Džamanjić)¹ wurde 1764 erstmals in Rom gedruckt,² über die Jesuiten-Netzwerke verbreitet und neun Jahre später, von dem Philosophie-Professor und Jesuiten Jakob Zallinger mit einer Inhaltsangabe und einem erweiterten Anmerkungsapparat versehen, in Dillingen nochmals aufgelegt.³ Gegenstand des Gedichts, dessen Umfang mit zwei Büchern und 56 Druckseiten überschaubar bleibt,⁴ ist das akustische Phänomen des Widerhalls.⁵ Nach einer Definition des Themas klärt der Dichter im ersten Buch zunächst einige Grundlagen der Akustik, die für das Verständnis des Phänomens erforderlich sind. Im weiteren Verlauf bespricht er die physikalische Beschaffenheit von Dingen, die ein Echo produzieren können, sowie geometrische Voraussetzungen für die Echo-Entstehung, etwa den Einfallswinkel des Schalls und die maximale Distanz der Schallquelle zur Fläche, an der der Schall reflektiert wird. Das zweite Buch beschreibt die für die Produktion eines Echos ideale Form der Reflektionsfläche (konkav oder mit einem rechten Winkel), außerdem die meteorologischen Bedingungen für die Echo-Entstehung. Der zweite Teil des Buches beschäftigt

1 So lautet der Name in dem Eintrag in der Hrvatska enciklopedija: Zamanja, Bernard, Hrvatska enciklopedija, <http://www.enciklopedija.hr/Natuknica.aspx?ID=66791>, eingesehen am 4.12.2021. Im Folgenden wird die lateinisch-italienische und in der neulateinischen Forschung etablierte Namensform Zamagna verwendet.

2 *Bernardi Zamagnae e Societate Iesu Echo libri duo, selecta Graecorum carmina versa Latine a Raymundo Cunichio ex eadem Societate*, Rom 1764. Die Seitenzahlen und Angaben beziehen sich auf diese Ausgabe.

3 *Bernardi Zamagnae e Societate Iesu Echo libri duo, imprimi curavit ex Romana editione P. Jacob Zallinger e S.J.*, Dillingen 1773. Die Textgestalt weicht in einigen Punkten von dem Text der römischen Edition ab. Es fehlen zudem die Paratexte, v.a. die für das Verständnis des Gedichts m.E. nicht unwichtige *Elegia ad Raymundum Cunichium*.

4 Die Verszählung bei Zallinger ergibt für das erste Buch 684 Verse, für das zweite Buch 677 Verse.

5 Eine ausführliche Inhaltsübersicht bei Zallinger, *Echo* (wie Anm. 3), ohne Seitenzählung.