Searching for poetry treasure hidden in Latin prose: On the automatic detection of hexameters in Latin prose
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Searching for poetry treasure hidden in Latin prose

On the automatic detection of hexameters in Latin prose

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Contents

Introduction

Roman prose authors show a great fondness for Roman and Greek poetry, which they reference throughout their texts. Cicero and Seneca for example include 327 and 156 references to poetry in their respective corpora, ranging from the texts of Aeschylus and Accius to Euripides and Ennius, from Homer and Hesiod to Pacuvius and Plautus, and from Solon and Sophocles to Valgius and Vergil[1]. In addition to the philosophers Cicero and Seneca, historians, biographers and grammarians like Ammianus Marcellinus, Suetonius and Varro also include numerous citations and paraphrases from poetry[2]. The special relationship between prose and poetry is furthermore evident by the way these great many references are used in the text. We often see quite affectionate introductions, such as *ut ait Vergilius noster* and *id autem postea ne nostrum quidem Ennium fugit*. The poetic citation that follows then frequently takes on the role of a wise person, an authority that conveys wisdom worth remembering or discussing. Additionally, the poetry can be used to decorate the prose. Here, it can break the monotony by allowing a metrical pattern for a comic relief, providing a sense of community to the audience by the shared recognition of poetry.

Regarding the status quaestionis, many studies have been conducted towards the many forms the relationship between prose and poetry can take on within the Greek and Roman corpora. A.C. Dionisotti[3] explored the ways fragments can be constructed from retrieving poetry quotations from prose. H. North[4] and S. Perlman[5] investigated the use of poetry in oratory, and M. Fusillo[6] and P. Robiano[7] its use in the Greek novel. More specifically, C. Collard[8] and E.L. Bowie[9] studied how Athenaeus employed early Greek poetry, with L. Van der Stockt[10] and the same Bowie[11] focusing on Plutarch and his use of literary sources. Regarding Plato and Strabo, their citation habits were investigated

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[1] D. Dueck. "Poetic Citations in Latin Prose Works of Philosophy". In: *Hermes* 137 (2009), pp. 314–334, p. 315.

[2] D. Dueck. "Poetic Citations in Latin Prose Works of Historiography and Biography". In: *Hermes* 137 (2009), pp. 170–189, p. 172.

[3] A.C. Dionisotti. "On Fragments in Classical Scholarship". In: *Collecting Fragments – Fragmente sammeln*. Ed. by G.W. Most. 1997, pp. 1–33, *passim*.

[4] H. North. "The use of poetry in the training of the ancient orator". In: *Traditio* 8 (1952), pp. 1–33, *passim*.

[5] S. Perlman. "Quotations from poetry in Attic orators of the fourth century BC". in: *A/P* 85 (1964), pp. 155–172, *passim*.

[6] M. Fusillo. "II testo nel testo: la citazione nel romanzo Greco". In: *MD* 25 (1990), pp. 27–48, *passim*.

[7] P. Robiano. "La citation poétique dans le roman érotique grec". In: *REA* 102 (2000), pp. 509–529, *passim*.

[8] C. Collard. "Athenaeus, the epitome, Eustathius and quotations from tragedy". In: *RFIC* 97 (1969), pp. 157–179, *passim*.

[9] E.L. Bowie. "Athenaeus' knowledge of early Greek elegiac and iambic Poetry". In: *Athenaeus and his world. Reading Greek culture in the Roman empire*. Ed. by D. Braund and J. Wilkins. 2000, pp. 124–135, *passim*.

[10] L. Van der Stockt. "Plutarch's use of literature: sources and citations in the Quaestiones Romanae". In: *AncSoc* 18 (1987), pp. 281–292, *passim*.

[11] E.L. Bowie. "Plutarch's citations of early elegiac and iambic poetry". In: *Plutarco y la Historia. Adas del V simposio Espanol sobre Plutarco*. Ed. by C. Schrader, V. Ramon, and J. Vela. 1997, pp. 99–108, *passim*.

by M. Demos[12] and S. Halliwell[13] for the former and D. Dueck[14] for the latter. Dueck additionally analysed the habits of Greek historians[15], Roman historians, biographers and grammarians[16], and Roman philosophers[17].

Additional studies to specific authors are those by S.N.D. Sister Charles[18] and the letters of St. Ambrose, D.R.S Bailey[19] and Cicero, A. Van den Hoek[20] and Clement of Alexandria, S. Monda[21] and Macrobius' use of Vergil, R. Coleman[22] and Seneca's citation in his epistles, J.T. Welsh[23] on verse quotations by Festus, and U. Tischer[24] on the rhetorical strategy of misquotations in Aulus Gellius. On a more abstract level, Tischer[25] also investigated the use of quotations in Roman prose as an intermedial phenomena, showing how features of oral communication shape the way quotations are presented. Last but not least, C. Trinacty[26] investigated the inter- and intratext relations between prose and poetry within Seneca's corpus.

From the multitude of mentioned studies, it may be clear that a great interest exists for quotations of poetry. However, all studies process known quotations, marked by poet and/or text. Therefore, to aid these studies further, this thesis will show the creation of a tool to automatically find poetic citations hidden in prose. A prose author did not always mention the poet they referenced, often because this was deemed unnecessary: the audience would know the source, as poetry was popular[27]. We know of this popularity as many plays are handed down to us in the form of fragments, stitched together by quotations of later authors. However, for a contemporary reader, any unattributed quotation is hidden in plain sight, the only clue being their metrical form, which is hard to detect within a piece of prose.

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[12]M. Demos. *Lyric quotation in Plato.* Lanham, MD, 1999, *passim.*

[13]S. Halliwell. "The subjection of mythos to logos: Plato's citations of the Poets". In: *CQ* 50.1 (2000), pp. 94–112, *passim.*

[14]D. Dueck. "Strabo's use of poetry." In: *Strabo's Cultural Geography: The Making of a Kolossourgia.* Ed. by D. Dueck, H. Lindsay, and S. Pothecary. 2005, pp. 125–149, *passim.*

[15]D. Dueck. "When the Muses meet: poetic quotations in Greek Historiography". In: *Greeks between East and West.* Ed. by G. Herman and I. Shatzman. 2007, pp. 93–114, *passim.*

[16]Dueck, "Poetic Citations in Latin Prose Works of Historiography and Biography", *passim.*

[17]Dueck, "Poetic Citations in Latin Prose Works of Philosophy", *passim.*

[18]S.N.D. Sister Charles. "The Classical Latin Quotations in the Letters of St. Ambrose". In: *Greece and Rome* 15.2 (1968), pp. 186–197, *passim.*

[19]D.R.S. Bailey. "Cicero and Early Latin Poetry". In: *Illinois Classical Studies* 8.2 (1983), pp. 239–249, *passim.*

[20]A. Van den Hoek. "Techniques of quotation in Clement of Alexandria: A view of ancient literary working methods". In: *Vigiliae Christianae* 50 (1996), pp. 223–243, *passim.*

[21]S. Monda. "Macrobius, 'Saturnalia' 5.11.1—3 and a Virgilian Reading". In: *The Classical Quarterly* 63.1 (2013), pp. 445–447, *passim.*

[22]R. Coleman. "The Artful Moralist: A Study of Seneca's Epistolary Style". In: *The Classical Quarterly* 24.2 (1974), pp. 276–289, *passim.*

[23]J.T. Welsh. "Verse Quotations From Festus". In: *Harvard Studies in Classical Philology* 108 (2015), pp. 403–465.

[24]U. Tischer. "manifestus error? Falsches Zitieren und literarische Kommunikation". In: *Mnemosyne* 66 (2013), pp. 411–432, *passim.*

[25]U. Tischer. "Quotations in Roman Prose as Intermedial Phenomena". In: *Trends in Classics* 11 (2019), pp. 34–50, *passim.*

[26]C. Trinacty. "Nulla res est quae non eius quo nascitur notas reddat (Nat. 3.21.2): Intertext to Intratext in Senecan Prose and Poetry". In: *Intratextuality and Latin Literature.* Ed. by S. Harrison, S. Frangoulidis, and T.D. Papanghelis. 2018, pp. 309–324, *passim.*

[27]G. Manuwald. "Editing Roman (Republican) Tragedy: Challenges and Possible Solutions". In: *Brill's Companion to Roman Tragedy.* Ed. by G.W.M. Harrison. Leiden, 2015, pp. 3–23, *passim.*

In this thesis, we therefore create a computer program that is able to find poetry within prose texts. This is extremely relevant for two reasons. Firstly, we might find an unknown quotation which could possibly extend one of the fragmentary plays we have today. The program can simply scan the prose texts which scholars believe may embed verse lines and flag any candidate citation, which then only need checking by a scholar to see if it could be a quotation or fragment. Secondly, the amount of metrical patterns, their locations within the text and their exact context would help our understanding of poetic citations and rhythms in prose, the intended purpose of the authors and the effects on audiences. Think for example about the first few words of Livy's *Ab Urbe Condita*, which form half a hexameter. It will be fascinating to see whether other prose texts show signs of metrical patterns and in which ways these are employed by the author.

We will limit ourselves in this thesis to finding hexameters in prose. The first reason for this is that it is one of the most popular meters and therefore a prime candidate for quotations by later authors. The second reason is computational, in that the current state-of-the-art automated scansion tools perform best on the hexameter, as it is one of the simpler meters without too many exceptions to rules.

Two questions will therefore be answered: first, *to what extent can we analyse prose texts for hexameters?* Second, if hexameters are found, *what are the possible reasons and functions for hexameters to appear in a prose text?*

Regarding the structure of this thesis, chapter 1 will first take a look at the different ways poetry could be included in prose, followed by the possible ways of attributing the citation. Next, it will take a at look how the reader or listener can detect and pinpoint the quotations. Continuing, the way authors would obtain citations is related, after which various uses of quotation are looked at. Using this information, chapter 2 will explain the steps taken to create a program to scan prose texts for hexameters, using Seneca's *Epistula* 88:14-17 as an example text. With the effectiveness of the program demonstrated on the Senecan passage, chapter 3 will relate the program's results on Macrobius' *Saturnalia*, Aulus Gellius' *Noctes Atticae* and Seneca's *De Clementia* and *Epistula* 84 and 85, analysing the candidate hexameters and attempting to find relevant quotations.

1 On quoting poetry in Latin prose

This chapter will take a look at the appearance of poetry in prose, which was often in the form of a prose author quoting poetry. We will first take a look at the various ways of quoting poetry, followed by methods of attribution of said quotations. Next, this chapter will show how quotations were marked and how they could be recognised by a reader, with subsequently an explanation on how such poetry quotations could be obtained. To conclude, an overview will be given of the many functions quotations had in prose texts.

1.1 On the possible types of quoting

There are multiple ways for a prose author to weave poetry into a text. A. van den Hoek distinguishes three ways of introducing a citation based on the degree of affinity between a quotation and its original text[28]:

- Quotation, having (almost) verbatim degree of literality.

- Paraphrase, having only a few words of the original source present.

- Reminiscence, having no literal correspondence, but using theme or thought.

To illustrate the three categories, the following passage from Seneca's letters contains a verbatim quotation preserving meter and wording[29], where the author, using Vergil's *Georgics*, expresses the notion that it is pointless to predict events which cannot be avoided:

> *Scias ista, nescias: fient.*
> *Si vero solem ad rapidum stellasque sequentes*
> *ordine respicies, numquam te crastina fallet*
> *hora, nec insidiis noctis capiere serenae*[30]

> Whether you know these things, or do not know: they will take place.
> If you will truly behold the fleeting sun and the stars,
> following in its track, never will tomorrow's hour cause you to fall,
> nor will you be seized in an ambush of a clear night[31]

An example of paraphrasing can be found in Ammianus Marcellinus' *Res Gestae*, where he decorates his text with Vergil (referred to as the *poeta praeclarus*) as follows:

> *(...), erat secundi loci post Antoninum, ut ait poeta praeclarus, "longo proximus intervallo".*[32]

> He [Craugasius of Nisibis] was in second place after Antoninus, as the eminent poet says, "*close* by a long interval".

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[28] Van den Hoek, "Techniques of quotation in Clement of Alexandria", pp. 227–229.
[29] Dueck, "Poetic Citations in Latin Prose Works of Historiography and Biography", p. 171.
[30] Sen. *Ep.* 88.15–16, referencing Verg. *G.* 1.424–426.
[31] All translations in this paper are mine.
[32] Amm. 19.9.7, referencing Verg. *A.* 5.320.

In this case we do not see a verbatim quotation, as the original line from Vergil reads: *proximus huic, longo sed proximus intervallo*[33]. Although all words used by Ammianus Marcellinus can be found in the *Aeneid*, the hexameter and its metrical features as a whole are lost due to this paraphrasing[34].

Lastly, the idea of reminiscence can be found in Tacitus, in the passage where he discusses the ethnic origin of the Jews:

> *sunt qui tradant Assyrios convenas, (...). clara alii Iudaeorum initia: Solymos, carminibus Homeri celebratam gentem, conditae urbi Hierosolyma nomen e suo fecisse.*[35]

> There are those that would describe them as Assyrian hordes, (...). Others (describe) the origins of the Jews as illustrious, that they were the Solymi, a people celebrated in the poems of Homer, and that they gave the name Hierosolyma to the city they founded, after their own name.

In this passage, Tacitus alludes to Homer's *Iliad* or *Odyssee* by mentioning the Solymi. No Greek is quoted, nor translated to Latin: Tacitus simply mentions the thought that the Solymi people are already mentioned by Homer[36].

1.2   On the attribution of quotations

The previous section demonstrated how authors might interweave poetry in various contexts via verbatim quotations or more indirectly via paraphrasing or a reminiscence. The poetry is often accompanied by an attribution to the original author and/or the original text, like Tacitus mentioning Homer and Ammianus referring to Vergil with the words *poeta praeclarus*. If no mention of any author is made, attribution might still be easy, as in the case of verbatim quotations. Here the quote might simply be found in the extant corpus, like Seneca's unattributed citation of the *Georgics* seen in the previous section. Attribution becomes more difficult if the quotation is from a lost work or in the form of a paraphrase or reminiscence. In these latter cases, the only clue for a poetic citation would be the author's specific announcement[37].

Summarising, one can attribute quotations in prose by mentioning one or more of the three components of poet, poem and/or context[38]. In the majority of cases, if source indications are given, they include only the author's name. To illustrate these possible announcements, let us first take a look at a passage by Aulus Gellius, which shows that Roman authors were able to precisely refer to certain passages in a way that resembles our current (text-oriented) quotation practices[39].

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[33]Verg. *A.* 5.320.

[34]It was also possible to paraphrase Greek poetry by providing a Latin translation. For example, Cicero provides a translation of 31 lines of the *Iliad* (2.299–330) in *De Divinatione* (2.63–64), and of a verse from Euripides' *Andromeda* in *De Finibus* 2.105. See Dueck, "Poetic Citations in Latin Prose Works of Philosophy", pp. 318, 323.

[35]Tac. *Hist.* 5.2, referencing Hom. *Il.* 6.184 (δεύτερον αὖ Σολύμοισι μαχέσσατο κυδαλίμοισι) or *Od.* 5.283 (τὸν δ᾽ ἐξ Αἰθιόπων ἀνιὼν κρείων ἐνοσίχθων τηλόθεν ἐκ Σολύμων ὀρέων ἴδεν).

[36]Similar are allusions and intertextuality, like Seneca reworking Ovid *Met.* 1.144–150 in *Thy.* 40–46. See Trinacty, "Intertext to Intratext in Senecan Prose and Poetry", p. 310.

[37]Dueck, "Poetic Citations in Latin Prose Works of Historiography and Biography", p. 171.

[38]Ibid., p. 175.

[39]Tischer, "Quotations in Roman Prose as Intermedial Phenomena", p. 48.

> *'Sinni' inquit 'Capitonis, doctissimi ueri, epistulae sunt uno in libro multae positae, opinor, in templo Pacis. Prima epistula scripta est ad Pacuuium Labeonem, cui titulus praescriptus est Pluria, non plura dici debere. (...)'*[40]

> He said: 'Of Sinnius Capito, a very learned man, there are many letters in a single book, (which are) deposited, I think, in the Temple of Peace. The first letter is addressed to Pacuvius Labeo, which is prefixed by the title *Pluria, not plura, should be said*. (...)'

However, so much information does not help the natural flow of the written prose. Most attributions are therefore much shorter. For example, when Suetonius describes the funeral of Julius Caesar, he writes:

> *inter ludos cantata sunt quaedam ad miserationem et inuidiam caedis eius accommodata ex Pacuui Armorum iudicio:*
> *men seruasse ut essent qui me perderent?*[41]

> At the (funeral) games, these words from Pacuvius' *Award of Arms* were sung, appropriate for the pity and indignation towards his death:
> That I have saved (them), just so that they would become
> those who would murder me?

The mentioning of both the author Pacuvius and his tragedy called *Armorum iudicium* fits nicely in the prose text, providing the reader with some background information regarding the quotation[42]. Continuing, it is also possible to mention only the poet, like Cicero does in *De Natura Deorum*:

> *Quod ni ita esset, qui potuisset adsensu omnium dicere Ennius: 'Aspice hoc sublime candens, quem invocant omnes Iovem' (...)*[43]

> Were it then not so, how could it have been possible that Ennius speaks to the approval of everyone 'look upon this, shining so sublimely, who all men call Jupiter'

In addition to mentioning only poet, one can also mention only the work from which the quotation came, like the grammarian Varro does in the following passage, citing the *Andromacha* from Ennius:

> *templum tribus modis dicitur: ab natura, ab auspicando, a similitudine; (...)*
> *Sub terra, ut in Andromacha: 'Acherusia templa alta Orci salvete infera.'*[44]

> *Templum* is used in three different ways: regarding nature, regarding the taking of auspices, regarding similarity; (...) beneath the earth, like in *Andromacha*: 'Be greeted deep Acherusian, underworld temples of Orcus'

It should be noted that this is only possible if the title is unique to a specific author, like only Ennius having written a play called *Andromacha*.

Last but not least, it is also possible to leave out any attribution, like this example from Seneca's *De Clementia*:

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[40]Gel. 5.21.9–10.

[41]Suet. *Jul.* 84.2, referencing F45 W.

[42]Technically, a quotation is quoted, as Suetonius quotes Caesar quoting Pacuvius.

[43]Cic. *Nat. D.* 2.4, referencing Enn. *Thyestes*, 134 *TrRF*. See also https://oscc.lucdh.nl/.

[44]Var. *L.* 7.6, referencing Enn. *Trag.* 70–72 R^3; 107–110 Va.^{2}; 113–116 W.; 98 Joc.; 24 *TrRF*.

> *Ille est enim uinculum, per quod res publica cohaeret (…).*
>   *Rege incolumi mens omnibus una;*
>   *amisso rupere fidem.*
> *Hic casus Romanae pacis exitium erit,*[45]

> Indeed, he is the link by which the state is united (...).
>   While their king is safe, (they have) one mind for all,
>   (but) when he has gone, they lose all hope.
> Such misfortune will be the ruin of the Roman peace,

The only way to attribute this quotation is by the context, searching for the words in the extant corpus. Luckily, Seneca quoted Vergil verbatim, making the search rather easy.

1.3   Marking quotations

As shown in the previous section, the attribution of a quotation can be done via a combination of mentioning author, text or context. But after this attribution, where does the quotation start and end? The precise marking of a quotation is different to the search for visible quotation marks we are used to today, as written Latin texts did not provide these[46]. Instead, several approaches to mark a quotation exist within the running text. Firstly, there are the *inquit formulae*[47], marking that someone said something, followed by the quotation. Examples of this are the mentioned passages by Suetonius providing the marker *cantata sunt* (page 7) and from Ammianus Marcellinus writing *ait* (page 5).

Secondly, a quotation can be deictic, indicated by demonstrative pronouns like *illud* and *haec*. To illustrate, Nepos indicates the paraphrasing of Homer in his bibliography of Dion with the words *haec sententia*.

> *non tulit hoc animo aequo Dion, et versum illum Homeri rettulit ex secunda rhapsodia, in quo haec sententia est: non posse bene geri rem publicam multorum imperiis.*[48]

> Dion could not bear this with quiet spirit and recalled that verse of Homer from his second book, in which this maxim appears: that a state cannot be governed well with too many in command.

Thirdly, quotations can be spotted by conjunctions as *ut* and *sicut*, like in this quotation of Vergil by Seneca:

> *Te quoque proteget illa quae "tarda venit seris factura nepotibus umbram," ut ait Vergilius noster, qui non quid verissime sed quid decentissime diceretur aspexit, nec agricolas docere voluit sed legentes delectare.*[49]

> It shall protect you too, [the tree] which "grows slowly, the bringer of shadow for later grandchildren," as our Vergil said, who considered not what was most true, but what would be most appropriate to say, and did not want to teach farmers but to delight the readers.

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[45]Sen. *Cl.* 1.4.1–2, referencing Verg. *G.* 4.212–213.

[46]Tischer, "Quotations in Roman Prose as Intermedial Phenomena", p. 42: a small arrow was sometimes put in the margins of ancient papyrus books, used to indicate the occurrence of quotations.

[47]Ibid., p. 48.

[48]Nep. *Di.* 6.4, referencing Hom. *Il.* 2.204–205.

[49]Sen. *Ep.* 86.15, referencing Verg. *G.* 2.58.

This quote also demonstrates that the markers can be used in combination with each other, as well as combined with references to the poet (and possibly text): *ut ait Vergilius noster*. Other examples of this are Seneca's *Homericum illum exclamans versum*[50] in *De Ira* and *ut ait ille tragicus*[51] in his 49th letter.

The fourth and last way to mark a quotation is using its metrical rhythm, as the poetic quotation, if quoted verbatim, is written in verse and is therefore recognisable by its metrical features. In the case of anonymous quotations, the metrical pattern is the only way the quotation can be recognised as such. To illustrate, Cicero quotes an anonymous verse[52] while demonstrating how simple things can be described in superfluously elaborated ways:

> *mea causa me mones quod non intellegam? quid me igitur mones? ut si quis medicus aegroto imperet ut sumat*
> > *'terrigenam, herbigradam, domiportam, sanguine cassam'*
> *potius quam hominum more cocleam diceret.*[53]

> You give me advice for my own good in a way I cannot understand? Why then do you advise me? That is like if some doctor would order a patient to take
> > an earth-born, grass-crawling, house-bearing, bloodless thing
> rather than that he would say in a normal way *snail*.

Without the metrical information, we would not have known that Cicero referenced poetic lines in this passage.

1.4   On the obtaining of quotations

Many poetic quotations, such as Cicero's anonymous snail quotation from the previous section, are without any form of attribution. An important question to ask is why these quotations are left anonymous. The answer to this question also sheds light on how authors obtained quotations.

Regarding the anonymity, one explanation could be that the author deemed that the quotation should be known and that his readers could therefore easily attribute the verse[54]. Another explanation could be that the attribution details were simply not necessary for its use in the new prose context and were therefore neglected[55]. This agrees with the very essence of a poetic citation, which is to detach the original verse from the context of the poem and to insert it into a new and usually different context[56].

A last explanation could be that certain verses had become proverbial: short maxims completely detached from their original context, to be used freely in suitable new contexts[57]. In this case, the authors themselves might not have known the origin of the quotation. To illustrate, Ammianus Marcellinus says that the prerequisite for happiness is to live in a glorious fatherland, attributing this idea to the poet Simonides:

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[50]Sen. *Dial. De Ira*, 1.20.8–9.
[51]Sen. *Ep.* 49.12.
[52]Dueck, "Poetic Citations in Latin Prose Works of Philosophy", p. 326.
[53]Cic. *Div.* 2.133.
[54]Dueck, "Poetic Citations in Latin Prose Works of Philosophy", p. 319.
[55]Ibid., p. 317.
[56]Ibid., p. 331.
[57]Ibid., p. 319.

ut enim Simonides lyricus docet, beate perfecta ratione uicturo, ante alia patriam esse conuenit gloriosam.[58]

As indeed the lyric poet Simonides teaches, for him who shall live happily with the perfect reason, it is, above all else, convenient to have a glorious fatherland.

Plutarch attributes the same idea to Euripides, who might have mentioned the idea according to the prevailing report. However, Plutarch does not rule out the attribution to someone else:

Ὁ μὲν γράψας τὸ ἐπὶ τῇ νίκῃ τῆς Ὀλυμπίασιν ἱπποδρομίας εἰς Ἀλκιβιάδην ἐγκώμιον, εἴτ᾽ Εὐριπίδης, ὡς ὁ πολὺς κρατεῖ λόγος, εἴθ᾽ ἕτερός τις ἦν, Σόσσιε, φησὶ χρῆναι τῷ εὐδαίμονι πρῶτον ὑπάρξαι "τὰν πόλιν εὐδόκιμον." (...)[59]

The author of the encomium upon Alcibiades for his victory in the chariot-race of Olympia, whether he was Euripides, as the prevailing report has it, or whether it was someone else, my dear Sosius, says that, for prosperity, it is first necessary to be born "in a glorious city:" (...)

The saying must therefore have been known independently of the original poem, making the identity of the original author doubtful, ambiguous or even irrelevant[60].

A verse of poetry being a well known maxim would allow the author to quote it without any trouble. One of the most employed techniques to use a piece of poetry was therefore simply from memory. This is illustrated beautifully by Seneca, who has trouble remembering the exact author to attribute the word *unicum* to.

quem quare dixerit Messala unicum, sive Valgius – apud utrumque enim legi – non reperio,[61]

Why Messala has called it "unique", or was it Valgius – for I have read both – I cannot make out,

More striking even is Seneca misquoting a verse from the *Aeneid*, in which he writes (the still metrically fitting) *corpore* instead of the correct *pectore*. This indicates that ancient authors were able to quote other authors by heart[62].

cuicumque autem deest aliquid ad bonum, malus est. Sed
  si cui virtus animusque in corpore praesens,
hic deos aequat,[63]

However, whoever is lacking anything (that makes) for goodness, is bad. But
  if virtue and spirit dwells in his body,
he is equal to the gods,

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[58]Amm. 14.6.7.

[59]Plut. *Dem*, 1.1.

[60]Dueck, "Poetic Citations in Latin Prose Works of Historiography and Biography", p. 176.

[61]Sen. *Ep.* 51.1.

[62]Dueck, "Poetic Citations in Latin Prose Works of Philosophy", p. 332.

[63]Sen. *Ep.* 92.29–30, referencing Verg. *A.* 5.363–364.

Remembering a quote was of course not the only source for a quotation. T.J. Cornell[64] notices that around 25% of Ennian fragments derive from the first book of the *Annals*, which, in his opinion, indicate that authors deliberately searched for quotations, naturally starting at the beginning of the poem[65]. Furthermore, quotations could derive from collections of sententiae. One example is the list of sententiae from Publilius Syrus, consisting of seven hundred moral maxims in iambic and trochaic verse, sorted in alphabetical order, but without any attribution[66]. Along the same line, anthologies, epitomes and handbooks could have been sources for quotations[67]. Lastly, authors could have saved quotations in their notebooks for later use. For example, Pliny the Younger relates about the notes and excerpts his uncle made from the books he had read that day[68], and Plutarch talks about his private notebooks in *De Tranquillitate Animi*:

> ἀνελεξάμην περὶ εὐθυμίας ἐκ τῶν ὑπομνημάτων ὧν ἐμαυτῷ πεποιημένος ἐτύγχανον· ἡγούμενος[69]

> I gathered observations on the tranquillity of mind from my notes, which I happened to have made for myself

Interestingly, an author could also quote himself, like Cicero humoristically does in his fictional dialogue *De Divinatione*. In this case, the source of the quotation is Cicero's own corpus, which is related about by the interlocutor:

> *Sed quo potius utar aut auctore aut teste quam te, cuius edidici etiam versus et lubenter quidem, quos in secundo ⟨de⟩ consulatu Urania Musa pronuntiat: (...)*[70]

> But of what authority or witness can I better make use than of yourself, from whom I have even learned by heart (many) verses with great pleasure indeed, which the muse Urania utters in the second (book) of *On Consulship*: (...)

1.5   On the usages of quotations

The previous section related about ways authors could obtain quotations to use in their prose. The last question remaining is to what purpose ancient authors used the obtained poetry in their prose. To answer this question, we should return to Cicero's self-quoting in the previous section. Especially interesting about this passage is the mentioning of authority. The interlocutor uses the words of Cicero because they bear a certain power. One of the use cases for a quotation was therefore its ability to provide authority and to legitimise claims or information presented in the text. The provision of this authority is furthermore two-fold. First, it grants the one who quotes a certain prestige, showing that they are familiar with poetry, which was considered a desirable property in good Roman society[71]. To illustrate, Seneca relates of the rich Calvisius Sabinus who wished to appear learned:

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[64]T.J. Cornell. "The Annals of Quintus Ennius". In: *JRS* 76 (1986), pp. 244–250, p. 246.

[65]These results could be skewed however by the idea that one remembers the first book best.

[66]O. Ribbeck. *Scaenicae Romanorum poesis fragmenta*. Vol. 2. Leipzig, 1871, 303 ff.

[67]Van den Hoek, "Techniques of quotation in Clement of Alexandria", p. 224.

[68]Plin. *Ep.* 3.5.7 ff.

[69]Plut. *De Tranq.* 464f.

[70]Cic. *Div.* 1.17.

[71]Dueck, "Poetic Citations in Latin Prose Works of Philosophy", p. 333.

> *Hanc itaque compendiariam excogitavit: magna summa emit servos, unum qui Homerum teneret, alterum qui Hesiodum; novem praeterea lyricis singulos adsignavit. (…). Habebat ad pedes hos, a quibus subinde cum peteret versus quos referret, (…). Ille tamen in ea opinione erat ut putaret se scire quod quisquam in domo sua sciret.*[72]

> In this way has he contrived this short cut: he bought slaves with great sums of money, one who knew Homer, another who knew Hesiod; furthermore, he appointed individual slaves for the nine lyric poets. (...). He held them by his feet, and would often ask from them verses which he might repeat, (...). He was in that opinion, that he thought that he himself knew what anyone in his house knew.

Apparently, being able to cite poetry on the right occasions was considered a mark of social status, and, in the case of Sabinus, worth a fortune. The other side of the mentioned authority derives from the status of the cited poet. According to Dueck, Greek and Roman intellectuals argued about the social and literary role of poets and poems, concluding that poets are to be considered somewhere between teachers and entertainers[73]. If we do view a poet as a teacher, a quotation can be compared to what we would call a footnote. In a footnote, we rely on others we do not personally know for legitimacy, asserting that the referred person is worth listening to. In other words, a footnote, and therefore a quotation when used in this context, confers authority to the writer[74] and is an excellent way to present scientific information. And because Romans did not have footnotes like we do, this information was included in the running text.

To illustrate, a quotation can be used in a historic sense, either as a primary source or as a secondary source preserving primary information[75]. Livy, while discussing the actions of Fabius Maximus during the second Punic war, cites Ennius as a primary source when stating:

> *Cautior tamen quam promptior hic habitus; et sicut dubites utrum ingenio cunctator fuerit an quia ita bello proprie quod tum gerebatur aptum erat, sic nihil certius est quam unum hominem nobis cunctando rem restituisse, sicut Ennius ait.*[76]

> It was his character to be more cautious than eager; and though you may question whether he was a dawdler by his nature, or because it was especially apt for the war which was in progress then, still, nothing is more certain than that one man, by his slowness, has restored our state, as Ennius says.

Cicero quotes the same illustrious poet as a secondary source for the solar eclipse during the Peloponnesian war. Although Ennius did not witness the eclipse first hand, Cicero uses the quotation and the authority of Ennius to legitimise his narrative on the eclipse:

> *id autem postea ne nostrum quidem Ennium fugit; qui ut scribit, anno trecentesimo quinquagesimo fere post Romam conditam*
> *Nonis Iunis soli luna obstitit et nox.*[77]

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[72]Sen. *Ep.* 27.6–7.

[73]Dueck, "Poetic Citations in Latin Prose Works of Historiography and Biography", p. 170.

[74]A. Grafton. *The Footnote: A Curious History.* Cambridge, MA., 1999, pp. 7–8.

[75]Dueck, "Poetic Citations in Latin Prose Works of Historiography and Biography", p. 177.

[76]Liv. 30.26.9, referencing Enn. *Ann.* (Vahlen[3] v.370; Warmington, *Remains of Old Latin I.* p.132.)

[77]Cic. *Rep.* 1.25.

> This also did not escape our own Ennius; who writes that, close to the three hundred and fiftieth year after Rome was founded,
>> On the fifth of June, the moon and night have obscured the sun.

In addition to history, it is also possible to refer to poetry for geography. For instance, Ammianus Marcellinus calls upon Homer for his description of Thrace. What is especially interesting about this reference is Ammianus' doubt about the factuality of Homer. He thus refers to Homer for his authority, immediately continuing to question the very things Homer mentions about Thrace, calling it either a fable or wondering whether Homer's definition of Thrace was different. In other words, conducting a scientific discussion:

> *has terras inmensa quondam camporum placiditate aggerumque altitudine fuisse porrectas Homeri perennis auctoritas docet aquilonem et zephyrum uentos exinde flare fingentis, quod aut fabulosum est aut tractus antehac diffusi latissime (...) cuncti Thraciarum uocabulo censebantur.*[78]

> that these lands once consisted of an immensity of pleasant plains and large stretches of lofty hills, the immortal authority of Homer teaches, who imagines that the northern and western winds blow from there, which is either a fable, or else in the past the widely extended tracts (...) were all counted within the name of Thrace.

The same author also relies on the same poet for his discussion of the effects of plagues. Here the authority of poetry seems a better fit to describe these medical circumstances than a book on medicine:

> *affirmant etiam aliqui, terrarum halitu densiore crassatum aera emittendis corporis spiraminibus resistentem, necare nonnullos, qua causa animalia praeter homines cetera iugiter prona Homero auctore et experimentis deinceps multis, cum talis incesserit labes, ante nouimus interire.*[79]

> Some also assert that when the air is made denser by the breath from murkier grounds, obstructing the air holes of the body used for emitting, it kills some, and because of this the other animals next to the men, looking constantly downward, as we know on the authority of Homer, and on many later experiences, when such a misfortune has started, perish first.

Of course, it is also possible to cite poetry for more philosophical applications. Authors like Cicero and Seneca fondly detached verses from their original context to use them in a new context suiting their philosophical aims[80]. For example, in Seneca's quotation of Vergil's *Georgics* as seen on page 8, we see the philosopher taking a verse about the behaviour of bees and applying it to the behaviour of humans. The reason for this is to convey his ideas about the importance of a ruler in a state in a clear and colourful way for his audience:

> *Ille est enim uinculum, per quod res publica cohaeret (...),*
>> *Rege incolumi mens omnibus una;*
>> *amisso rupere fidem.*
> *Hic casus Romanae pacis exitium erit,*[81]

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[78] Amm. 27.4.3, referencing Hom. *Il.* 9.5–6.
[79] Amm. 19.4.6, referencing Hom. *Il.* 1.50.
[80] Dueck, "Poetic Citations in Latin Prose Works of Philosophy", p. 320.
[81] See page 8 for the translation and source.

This quote deviates from using poetry as purely authoritative to a more illustrative use case. To further this point, Seneca also quotes Lucretius when speaking of fear. Here, Lucretius' poetry is included because of its aptness within Seneca's argumentation and used to demonstrate an opinion of Seneca in an argumentative manner:

> *Tanti putemus oculos intendere: iam apparebit quam brevia, quam incerta, quam tuta timeantur. Talis est animorum nostrorum confusio qualis Lucretio visa est:*
> > *nam veluti pueri trepidant atque omnia caecis*
> > *in tenebris metuunt, ita nos in luce timemus*
> *(...) Sed falsum est, Lucreti, non timemus in luce: omnia nobis fecimus tenebras.*[82]

> Let us consider to focus our eyes on the matter; it will then be clear how brief, how uncertain and how harmless the things are which we fear. Such is the disturbance of our spirits, precisely which is evident to Lucretius:
> > for just like boys tremble and fear in the dark shadows,
> > So we (also) feel fear in the light.
> (...) But you are wrong, Lucretius, we do not feel fear in the daylight: we have turned everything into darkness for ourselves.

Therefore, if no authority or legitimacy was needed in a piece of prose, authors could still cite poetry. In this case, it would serve the purpose of decoration, either for the adornment of the author's narrative style or for breaking the monotony of the prose[83]. Poetry would give pleasure to the audience[84], providing relief from the austerity of forensic speech.

To illustrate this, we can return to the quotation by Ammianus Marcellinus seen on page 5, where he decorates his description of Craugasius being second place after Antoninus with the neatly fitting words by Vergil:

> *(...), erat secundi loci post Antoninum, ut ait poeta praeclarus, "longo proximus intervallo".*[85]

The same type of prose decoration can be seen in Cicero, when he weaves a Pacuvian quotation into his own narrative[86]:

> *Nunc autem, si quis illo Pacuviano 'invehens alitum anguium curru' multas et varias gentis et urbes despicere et oculis conlustrare possit, videat primum in illa incorrupta maxime gente Aegyptiorum (...), bovem quendam putari deum, (...)*[87]

> Now, if one, travelling in Pacuvius' 'chariot of winged snakes' could look upon many and diverse countries and cities and examine them with their own eyes, he could see first of all that by these people of Egypt, ever unchanging, (...), a bull is deemed a god, (...)

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[82]Sen. *Ep.* 110.6–7, referencing Lucr. 2.55.

[83]Dueck, "Poetic Citations in Latin Prose Works of Historiography and Biography", p. 184.

[84]North, "The use of poetry in the training of the ancient orator", pp. 8, 22–23.

[85]See page 5 for the translation and source.

[86]The quotation has not been attributed to any play, though it could be from *Medus*. TRF³ states that *invehens alitum anguium* is the Pacuvian fragment, leaving *curru* out. See K. Büchner. *De Re Publica: Kommentar.* Heidelberg, 1984.

[87]Cic. *Rep.* 3.14.

The seamlessness of Cicero's use of the content of Pacuvius' play can even be surpassed by using a longer quotation that suits the grammatical formation too. For example, in *Epistula* 18, Seneca addresses his friend Lucilius in the imperative form. At the same time, he decorates his prose with a Vergilian verse which is also in the imperative:

> *incipe cum paupertate habere commercium;*
>> *aude, hospes, contemnere opes et te quoque dignum*
>> *finge deo.*
> *Nemo alius est deo dignus quam qui opes contempsit;*[88]

> Establish a communication with poverty;
>> dare, my friend, to scorn wealth,
>> and in addition form yourself to be worthy for god.
> Noone else is worthy for god than he who has scorned wealth;

Lastly, a poetic quotation could simply be added because the verse expresses the idea an author tries to convey better or more stylishly[89], as Cicero states in *De Finibus*:

> *Quem quidem locum cum multa venustate et omni sale idem Lucilius, (...):*[90]

> The same Lucilius relates the anecdote with much beauty and wit, (...):

To briefly summarise this chapter, the addition of poetry to prose could be in the form of verbatim quotations, paraphrasing or reminiscence. These forms were often accompanied by an attribution in the form of author, text or context and marked by *inquit formulae*, deictic pronouns and/or a metrical pattern. Authors could have gotten these lines from, amongst others, maxims or sententiae, from memory, bookrolls and personal notebooks. Lastly, they were used to give certain passages of prose authority and legitimacy, or to decorate the text.

As shown by the examples above, adding poetry to prose was popular. Additionally, as prose and oratory were often enjoyed together in groups by listening to someone reading it out loud, recognising a quotation as a group would give a sense of togetherness. If we therefore regard the quotation of poetry as a kind of inside joke, we can imagine that the quotation did not need any explanation or marking, as that would ruin the fun of including the quotation: a joke that needs explaining is no longer a joke. It is therefore possible that many quotations of poetry go unnoticed, as they are only marked by metrical features. The next chapter will now focus on finding these unmarked poetry quotations, which could give us insight on how authors weaved hidden poetry in their texts and what the effects could be on the audience. Additionally, it could even provide new fragments from lost plays.

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[88]Sen. *Ep.* 18.12–13, referencing Verg. *A.* 8.364–365.
[89]Dueck, "Poetic Citations in Latin Prose Works of Philosophy", p. 329.
[90]Cic. *Fin.* 1.9.

2 Automatically finding quotations

The previous chapter mentioned how not all quotations are accompanied by an attribution. If there are also no visible markers (see section 1.3), the only possible way to detect citations is by their metrical features. However, for a modern reader, these are hard to find in a large body of prose text. One would have to start the Heraculean task of manually scanning every piece of text that could hide one of the many possible meters. While reading out loud, one needs to try to fit different combinations of long and short syllables to try and make the given prose fit a metric pattern. Within the first few lines of this arduous task, one would not see the wood for the trees. Even without counting half-lines, one paragraph of prose can hide hundreds of possible metrical verses. But possibly finding poetic citations is extremely relevant for our understanding of lost plays and the way authors and audience interacted with each other.

It is therefore worthwhile to pursue this challenge. Although the sheer number of possible metrical patterns in the vast seas of prose might be dazzling for a human, a computer is an expert when it comes to continuously searching for patterns within large corpora of texts. For this thesis, we have thus created a program to automatically find hexameters in prose. The reason for the hexameter is because multiple scansion programs exist that can accurately and automatically scan hexameter, giving us a good chance to find quotations. Furthermore, the hexameter was extremely popular and, as seen in the previous chapter, one of the most used in quotations.

The first order of business for our program is to find all possible hexameters within the text given the basic constraints of that meter. This is described in section 2.1. We will call every combination of words that fits the given constraints a candidate. Next, we need to scan the candidates, labeling their syllables as *long*, *short* or *elision*. This is however a more difficult task for a computer because of the many rules and exceptions a meter can have. We therefore employ three different tried-and-tested methods to scan the candidates. In section 2.2.1 we employ machine-learning to scan the candidates, followed by a constrained-based approach in section 2.2.2 and concluded by a rule-based approach in section 2.2.3. When all three methods agree on the feasibility of a candidate being a hexameter we will add the line to a final computer-generated list. With current tools, this is as far as a computer program can bring us. These remaining candidates need then to be analysed in a qualitative way, as false positive candidates might have slipped through the program's filtering process. This is discussed in section 2.3. As we will see in chapter 3, this process is manageable for a human, having to analyse only 372 candidate verses from Macrobius' first book of the *Saturnalia*, instead of carefully reading its 25,000 words and manually searching for hexametric patterns.

To demonstrate the effectiveness of the program, we have selected paragraphs 14–17 from Seneca's *Epistle* 88, which contains the quotation of Vergil's *Georgics* as seen on page 5, surrounded by two bodies of prose. The program should do two things. First, it needs to find the three hexameter lines. This would show that our program can indeed detect known hexameters. Second, it should present other possibly interesting candidates for us to investigate further. The used text is as follows[91]:

Hoc scire quid proderit? ut sollicitus sim cum Saturnus et Mars ex contrario stabunt aut cum Mercurius vespertinum faciet occasum vidente Saturno, potius quam hoc discam, ubicumque sunt ista, propitia esse nec posse mutari? [15] Agit illa continuus ordo fatorum et inevitabilis cursus; per statas vices remeant et effectus rerum omnium aut movent aut notant. Sed sive quidquid evenit faciunt, quid inmutabilis rei notitia proficiet? sive significant, quid refert providere quod effugere non possis? Scias ista, nescias: fient.

> *[16] Si vero solem ad rapidum stellasque sequentes*
> *ordine respicies, numquam te crastina fallet*
> *hora, nec insidiis noctis capiere serenae.*

Satis abundeque provisum est ut ab insidiis tutus essem. [17] 'Numquid me crastina non fallit hora? fallit enim quod nescienti evenit.' Ego quid futurum sit nescio: quid fieri possit scio. Ex hoc nihil deprecabor, totum expecto: si quid remittitur, boni consulo. Fallit me hora si parcit, sed ne sic quidem fallit. Nam quemadmodum scio omnia accidere posse, sic scio et non utique casura; itaque secunda expecto, malis paratus sum.

The next sections will describe the process of finding hexameters in this passage.

2.1 Creating candidate hexameters

In order to find candidate hexameters we need to walk through the text and create a list of candidates according to the most basic constraints of the hexameter. In other words, a candidate is a sequence of syllables that could in theory be a hexameter[92]. In this regard, it is important to note that a hexameter has at least twelve syllables if it is completely spondaic, and seventeen if it is completely dactylic[93]. Furthermore, hexameter verses tend to have a maximum of three elisions per verse. For example, Vergil's *Aeneid* has no verse with more than three elisions, resulting in a maximum length of twenty syllables per hexameter. In addition, hexameters always start and end at a word boundary, never in the middle of a word. Using these constraints, we can start looking for candidate hexameters in the text.

As we need to count the number of syllables to find candidates, the next step is to syllabify the entire prose text. To illustrate, the first sentence of paragraph fifteen would look as follows:

```
a git - il la - con ti nu us - or do - fa to rum - et
- in e vi ta bi lis - cur sus
```

Here, all words are split in their respective syllables. Whitespaces between words are denoted with a dash: (-). This is necessary to serve as a distinction between the whitespace that now signifies the separation between syllables[94]. If we would not do this, there would be no possible way to distinguish between word and syllable separation, which is important as the next paragraph will illustrate. Lastly, all punctuation has been removed and all words have been lowercased to allow for the smooth operation of the program.

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[92]As far as the computer is concerned, a syllable is what we read, not necessarily what we hear. We will therefore still call an elided syllable a syllable in the rest of this thesis.

[93]Five dactylic feet followed by a trochaic foot.

[94]We could also have used the dash to denote syllable separation and the whitespace to denote word separation: this is a matter of implementation and preference.

Our approach to gather all candidate hexameters with a length between twelve and twenty syllables is simple but effective. Starting at the beginning of the text, we create a list of the nine possible hexameters, having a length from twelve to twenty syllables. Concretely, the first candidate hexameter consists of the first twelve syllables of the prose text, the second of the first thirteen, the third of the first fourteen and so forth, until we have a candidate of twenty syllables. To illustrate, the first three candidates and their lengths are shown below:

- (12) agit illa continuus ordo fato

- (13) agit illa continuus ordo fatorum

- (14) agit illa continuus ordo fatorum et

For all nine candidates, we now check whether they begin and end with a word boundary. If not, we remove them from our list of candidates. For example, the candidate *agit illa continuus ordo fato* has to be removed, as we do not want a split within *fatorum*. A line with an incomplete word is extremely unlikely to be a quotation or hexameter. This results in the following three remaining candidates from the first nine possibilities:

- (13) agit illa continuus ordo fatorum

- (14) agit illa continuus ordo fatorum et

- (20) agit illa continuus ordo fatorum et inevitabilis

We now have all hexameter candidates starting from the first word in the prose text. To process the entire passage by Seneca, we keep deleting the first word from the prose while repeating the finding of candidates in the next twelve to twenty syllables at every step. To illustrate, let us imagine that the first search for candidates was within the following piece of text:

Agit illa continuus ordo fatorum et inevitabilis cursus;

We then delete the first word and start looking again:

illa continuus ordo fatorum et inevitabilis cursus;

We stop the process of deleting the first word if the remaining text has less than twelve syllables remaining, since there are no more hexameters to be had. Using this process and paragraph fifteen as an example, we find seven candidates in total:

- agit illa continuus ordo fatorum

- agit illa continuus ordo fatorum et

- agit illa continuus ordo fatorum et inevitabilis

- illa continuus ordo fatorum et

- illa continuus ordo fatorum et inevitabilis

- continuus ordo fatorum et inevitabilis

- ordo fatorum et inevitabilis

These seven strings have the absolute minimum requirements to be technically a hexameter: twelve to twenty syllables that start and end at a word boundary. However, a better look at the third candidate shows how rudimentary our approach of finding candidates is. Although a hexameter verse can in theory contain twenty syllables, it does mean that three elisions need to occur. Regrettably, there is maybe one possibility for an elision in this verse, between *fatorum* and *et*. This means that the verse cannot be scanned as a hexameter, as there is simply no possibility to fit two additional elisions in the line. We therefore need now to focus on scanning the candidates and rejecting those which cannot be scanned.

2.2 Scanning candidate hexameters

The four paragraphs by Seneca contain 633 valid candidate hexameters. However, not every sequence of twelve to twenty syllables as found by our program is a hexameter. The length of its syllables should fit the spondaic or dactylic building blocks that create the metrical pattern of the meter. Since 633 candidates for such a small passage is too much for a human to process, especially once we add more prose, we need to automate the process further. As briefly mentioned at the beginning of this chapter, the task of scanning a line of poetry with a computer is difficult. We will therefore be using three well-performing programs, called the LSTM model, Anceps and Pedecerto. All three are however created to scan poetry and are not designed for or tested on pieces of prose. The next sections will therefore show how we tackle any upcoming problems, why it is so important to use these three methods and why we should only accept hexameter candidates all three agree on.

2.2.1 Scanning with an LSTM

For the first validation step, we created a machine learning model using a Long short-term memory (LSTM) model[95], which is a type of neural network that is able to learn which parts of a context are important for the long and the short term. In practical terms and as far as the model is concerned, this means that syllables can influence each other, having an impact on each other's long, short or elision labels. Because an LSTM does not allow the input of character strings, we will employ a model where all syllables are one-hot encoded. In such a model, every unique syllable is represented by a unique integer. To illustrate, the first three words of Vergil's *Aeneid* could look as follows to the model:

ar - ma - space - vi - rum - que - space - ca - no

10 - 12 - 3 - 26 - 18 - 19 - 3 - 11 - 15

Furthermore, as the LSTM requires all input to be of the same length, which verse clearly is not, post padding was used to make all lines of an even size[96].

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[95]More information about this project can be found on `https://github.com/Ycreak/Latin_scansion_with_neural_networks`.

[96]Regarding the structure of the one-hot LSTM, an embedding layer with fifty output dimensions was used, followed by a dropout of 0.1 to prevent overfitting. Subsequently a bidirectional LSTM was used

Having trained the model on 56,500 lines of dactylic meter[97], we reach an average f1-score of 99% on our test sets[98]. This means that one in every one hundred syllables is scanned incorrectly. The next step is to let the model scan all 633 candidates and check whether the resulting scansion could be a hexameter. To cope with the possible mislabeling of the model, the hexameter is allowed to contain one mistake. For instance, if the first foot is scanned as *long short long*, but the rest of the line contains valid feet, we allow the candidate to persist[99].

From the given 633 candidates, the LSTM deems it possible to scan 42 as a hexameter. Although this is a much smaller number, a qualitative investigation into the 42 results shows an overzealous model. Take a look at the following candidates:

sīm cūm sātūrnūs ēt mārs ēx cōntrărĭō stābunt

dīscam⏝ŭbĭcūmquē sūnt īstā prōpītĭă⏝ēsse

In the first example, the LSTM tries to argue that the verse begins with four spondees, followed by a dactyl and three additional syllables. This would make the line an incomplete heptameter. Although it is dactylic, we would preferably exclude any such candidate, since we are looking for hexameters. In the second example, the model tries to force a hexameter by scanning *-que* as long. However, this syllable should always be read as short, unless it is followed by a consonant which makes *-que* long by position. As this is not possible when followed by *sunt*, the candidate should be rejected.

To solve these problems, we would need to know whether syllables like *-que* can be long or should be short. Furthermore, we need to make sure that the candidate is a hexameter without any additional stray syllables. As this is outside the scope of the LSTM, we will employ the helpful Anceps program in the following section.

2.2.2 Scanning with Anceps

Anceps is a computer-assisted tool by S. Fedchin[100] for the scansion of Latin poetry. It scans Latin by using meter as a constraint. First, it loads dictionaries[101] that list all theoretically possible ways a word can be macronised[102]. Next, it considers all the possible

[97] with a recurrent dropout of 0.1. Via a softmax activation and the *rmsprop* optimiser, the model was fitted using a batch size of 32 for 25 epochs. An extension with word embeddings was also investigated, but showed lesser results on hexameters. Additionally, Conditional Random Fields returned f1-scores of 0.9 and are therefore left aside in favour of the one-hot LSTM. For more information on what does and does not work regarding machine learning and Latin scansion, see `https://github.com/Ycreak/Latin_scansion_with_neural_networks`.

[97] The following authors were used to train the model: Ivv., Lucr., Ov. *Met.*, Pers., Verg. *A.*, Prop. and Ov. *Elegiae*.

[98] The following authors were used to test the model: Boe. *Cons.*, Catul, Enn. *Ann.*, Hor. *Ars.*, Luc., Stat. *Theb.* and Tib. The model was also tested on the training texts using cross validation, returning similar f1-scores.

[99] The labeling *long short long* could of course show signs of another metrical structure. In future research that could include different meters, such a scansion could be very valuable and should not be automatically scrutinised.

[100] A. Fedchin et al. "Senecan Trimeter and Humanist Tragedy". In: *American Journal of Philology* Forthcoming (2020).

[101] The dictionaries are made available by the MusisQue DeoQue project and the Morpheus project (see bibliography).

[102] We can specify a minimum frequency of occurrences. For example, we can only allow a scansion if it happens more than three times in the entire known corpus. We use three occurrences for author count and five for scansion count.

ways the syllables in a verse might be labeled in order to be consistent with the meter and the possible scansions from the dictionaries. The result is a macronised line that fits the constraints of the meter. To illustrate, we return to the LSTM approved line *discam ubicumque sunt ista propitia esse*. Anceps then considers every possible combination of spondees, dactyls and elisions. One of the scansion possibilities is the one the LSTM came up with:

$$d\bar{\imath}scam\smile \breve{u}b\breve{\imath}c\bar{u}mqu\bar{e}\ s\bar{u}nt\ \bar{\imath}st\bar{a}\ pr\bar{o}p\bar{\imath}t\breve{\imath}\breve{a}\smile\bar{e}sse$$

Anceps then takes a look into its dictionaries and sees that the *-que* in *ubicumque* cannot be long. Based on this, it rejects this scansion possibility. Additionally, Anceps cannot come up with any other scansions given the constraints, therefore rejecting the candidate completely. The other LSTM candidate mentioned in the previous section,

$$s\bar{\imath}m\ c\bar{u}m\ s\bar{a}t\bar{u}rn\bar{u}s\ \bar{e}t\ m\bar{a}rs\ \bar{e}x\ c\bar{o}ntr\breve{a}r\breve{\imath}\bar{o}\ st\bar{a}bunt$$

will also be rejected by Anceps, as we asked this program to not allow incomplete heptameters.

The importance of using Anceps after the LSTM lies in its ability to check dictionaries to know whether specific scansions of words are possible. After running Anceps, thirteen candidates remain: the next chapter will show why further investigation using Pedecerto is important and desirable.

2.2.3   Scanning with Pedecerto

Pedecerto is a rule-based Python program for automatic scansion of Latin hexameter and pentameter verses developed by the Università di Udine[103]. It is part of the MusisQue DeoQue digital archive[104], which contains Latin poetry texts from the archaic period to the 7th century CE. From this archive, it has already successfully scanned 247k of the 263k dactylic verses available as of the time of this writing. Although the program only works on dactylic meter, it is a bit more sophisticated than Anceps, as it has some qualitative investigative abilities, like providing comments and reasoning if a scansion is considered odd. To illustrate, Pedecerto issues warnings for the scansions of the following three candidates:

$$r\bar{e}sp\breve{\imath}c\breve{\imath}\bar{e}s\ n\bar{u}mqu\bar{a}m\ t\bar{e}\ cr\bar{a}st\breve{\imath}n\breve{a}\ f\bar{a}ll\bar{e}t\ h\bar{o}ra$$

$$\bar{e}st\ \breve{u}t\ \breve{a}b\ \bar{\imath}ns\breve{\imath}d\breve{\imath}\breve{\imath}s\ t\bar{u}t\bar{u}s\ \bar{e}ss\bar{e}m\ n\bar{u}mqu\bar{\imath}d\ me$$

$$r\bar{e}sp\breve{\imath}c\breve{\imath}\bar{e}s\ n\bar{u}mqu\bar{a}m\ t\bar{e}\ cr\bar{a}st\breve{\imath}n\breve{a}\ f\bar{a}ll\breve{e}t\ h\breve{o}r\bar{a}\ nec$$

The program argues that the first two lines need to be scanned as spondaic, which means that the fifth foot is a spondee[105]. Although this is not impossible, such a scansion is uncommon[106]. It is only rarely used to convey heavy emotions or to illustrate a certain slowness. For example, in Ovid's *Metamorphoses* 1.732, Io, having been transformed into a cow by Jupiter and being held prisoner by the many-eyed Argus, is tormented by an enraged Juno and moos sadly for help:

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[103]Pedecerto. *Automatic analysis of Latin verses.* `http://www.pedecerto.eu/public/`. Online; accessed 2022-05-22.

[104]Musisque Deoque. *A digital archive of Latin poetry.* `https://mizar.unive.it/mqdq/public/`. Online; accessed 2022-05-22.

[105]H. Drexler. *Einführung in die römische Metrik.* Darmstadt, 1967, pp. 85–86.

[106]For example, Lucretius only has thirty-two spondaic lines in the 7415 lines of *De Rerum Natura*, less than half a percent.

> *ēt gĕmĭtu⌣ēt lăcrĭmīs ēt lūctĭsŏnō mūgītu*

> and with a sigh and tears and with dolefully mooing

Similarly, in Vergil's *Aeneid* 2.68, the Greek deserter Sinon looks around slowly at the hostile Trojans who surround him:

> *cōnstĭtĭt ātque⌣ŏcŭlīs Phrygĭa⌣āgmĭnă cīrcūmspēxit*

> he stood and looked at the Phrygian troops

Within the hexameter, this rarity was allowed if the fourth foot is a dactyl[107], as we see in both example lines above. As always, there are cases where this additional rule is broken[108], but these instances are even rarer: Vergil does it only twice in the *Aeneid* and once in his *Georgics*. If we take a look at *rēspĭcĭēs nūmquām tē crāstĭnă fāllēt hōra*, we notice how the fourth foot is a dactyl and the fifth a spondee, which would make this line the more likely spondaic candidate. Taking a look at the second candidate, *ēst ŭt ăb īnsĭdĭās tūtūs ēssēm nūmquĭd me*, we notice a spondee in the fourth and fifth feet, making it an extremely unlikely candidate.

Therefore, because of the rarity and the additional pitfalls of word boundaries, we will reject all spondaic candidates in our analysis. Although we might miss some hexameters which could convincingly be spondaic, chapter 3 will show that prose texts of longer sizes will return numerous candidates. A harsher pre-selection is therefore necessary to allow a proper qualitative investigation in the remaining myriad of candidates.

Returning to the third candidate, *rēspĭcĭēs nūmquām tē crāstĭnă fāllĕt hŏrā nec*, Pedecerto issues a warning because of the unusual prosody for the word *hora*. A dictionary will indeed indicate that the first syllable should be scanned long. However, Pedecerto (and Anceps) allow unusual prosodies using the mentioned dictionaries. We will not reject these candidates outright, but we will make sure that the *uncommon* scansion would be appropriate within the context[109]. Lastly, we will not reject candidates ending with a monosyllable. Although this too is uncommon and undesired, it is not impossible[110]. Furthermore, and this is important, we could always remove one or multiple words from a candidate during the qualitative approach. This would leave us with a hexameter half-line, which could very well be a quotation, as these did not always have to be full lines.

In addition to the three verses with warnings, Pedecerto also rejects five verses outright. For example, the LSTM and Anceps argue that the following verse could be scanned with twelve spondees:

> *sīt nēscīō quīd fīĕrī pōssīt scīō*

However, this would never be picked up by a reader in a prose text, so rejection is an apt solution to these theoretical hexameter verses. Therefore, before any qualitative analysis, we would remain with six candidates that the LSTM, Anceps and Pedecerto think could be hexameters:

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[107]S. Winbolt. *Latin hexameter verse; an aid to composition.* London, 1903, pp. 128–130.

[108]Or nonexistent. Ennius for example did not observe this rule, writing nine spondaic lines with five having a spondee in the fourth foot. S. Winbolt. "Latin hexameter verse", p. 130.

[109]For example, Pedecerto issues a warning whenever *prŏfecto* is scanned, which is a valid scansion if the word is the participle form of *prŏfectus*, though less common than the adverb *profectō*.

[110]See A.B. Harkness. "The Final Monosyllable in Latin Prose and Poetry". In: *The American Journal of Philology* 31.2 (1910), pp. 154–174, *passim*.

<div style="text-align:center">

sīvē sīgnĭfĭcānt quīd rēfērt prōvĭdĕrē quod

sī vērō sōlem‿ād răpĭdūm stēllāsquĕ sĕquēntes

ōrdĭnĕ rēspĭcĭēs nūmquām tē crāstĭnă fāllet

rēspĭcĭēs nūmquām tē crāstĭnă fāllĕt hŏrā nec

hōră nĕc īnsĭdĭīs nōctīs căpĭĕrĕ sĕrēnae

fāllĭt ĕnīm quōd nĕscīēnti‿ēvēnĭt ĕgō quid

</div>

The importance of using Pedecerto as the last program to scan remaining candidates is two-fold. First, it allows the rejection of unlikely lines that were allowed without issue by the LSTM and Anceps, such as the mentioned spondaic lines. Note however that we cannot remove Anceps in favour of only Pedecerto, as the latter allows the mentioned line *dīscam‿ŭbĭcūmquē sūnt īstā prōpītĭă‿ēsse*, which is only rejected by the former. The second important reason to use Pedecerto last is that it issues useful warnings about hiatus and uncommon scansions, aiding the qualitative analysis described in the next section.

2.3   Qualitative analysis of remaining candidates

The previous sections demonstrated how we can process a prose text to find candidate hexameters. Leaving the computer-assisted tools behind, it is now time to start a qualitative research into the remaining lines, to see which candidates can be pruned further from our list.

First of all, we can ignore any known quotations of poetry from the list of candidates. As we are looking for hidden quotations, known hexameters do not need investigation. Furthermore, we reject hexameters that are found within known hexameters. For example, *rēspĭcĭēs nūmquām tē crāstĭnă fāllĕt hŏrā nec* is part of the second and third quoted line, which is of course hexametric, but has no chance of being a standalone quotation within this context[111].

Next, we will scrap any instances where the hypothetical hexameter stretches across two clauses, or where some key semantic or syntactic complement is missing, and enjambment is not possible. However, in these cases, we will still check whether a half-line is possible (beginning from a major caesura for example). It is then important that the half-line is not totally spondaic, as this would not to be picked up as part of a hexameter.

Regarding the Latin itself, we will prune hexameters that are syntactically incorrect. For example, if we refer back to the line *dīscam‿ŭbĭcūmquē sūnt īstā prōpītĭă‿ēsse*, the *-a* in *ista* had to be scanned long for the hexameter to work. However, *ista* goes with *propitia* and is therefore not an ablative: scanning it as long would thus be impossible from a syntactical standpoint.

Lastly, we will investigate whether a line would be considered proper poetry. A line theoretically working as a hexameter does not mean that it is a proper one. For instance, one would expect an elision between *propitia* and *esse* in the verse mentioned in the previous paragraph. Pedecerto however, in order to make the line work, adds a hiatus between the two words (shown by the ⌢). Although the resulting line might work in theory, in practise it would be a very disagreeable verse. Another such example would

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[111]It would be possible to remove these lines using the computer. Since these are easily spotted and removed by hand however, we keep this functionality on our wishlist.

be the mentioned line *ēst ŭt ăb īnsĭdĭĭs tūtūs ēssēm nūmquīd me* from section . Although already rejected for its spondaic nature, it would be unpronounceable. The hexameter does not really break any rules per se, but pronouncing the first words as *ēs tŭ tă bīnsĭdĭĭs* cannot be called proper poetry. Therefore, any such unpoetic practices will be looked at carefully in the analysis.

Using these constraints, we can take a look at the two remaining candidates:

sīvē sīgnĭfĭcānt, quīd rēfērt prōvĭdĕrē quod (effugere non possis?)

Or if they give indications, what good is there in foreseeing what (you cannot escape?)

fāllĭt ĕnīm quōd nĕscīēnti‿ēvēnĭt. ĕgō quid (…)

Whatever happens without my knowledge escapes me. But I for my part (...)

The first line starts out strong, almost sounding like a sententia. Sadly, it fizzles out because of the conjunction, which ruins the syntactical integrity of the hexameter. Additionally, ending with a monosyllable is less than ideal. Trying to save the verse by adding *effugere non possis* as a following half-line would also not work, as it would require *ēffŭgĕrē* in the case of a dactyl and *ēffūgērē* in the case of a spondee. Both are not possible for this infinitive, as the last two syllables should be short.

The second line is more interesting, starting very strong with a complete sententia. However, *ego quid* is also part of the hexameter, disallowing a clear cut between it and the sententia *fallit enim quod nescienti evenit*. Nevertheless, there is a certain flow in the sentence, with *ego quid* following directly upon *fallit enim quod nescienti evenit* while also providing a great contrast: *whatever happens without my knowledge escapes me, **but I for my part (…)***. Although in this form this candidate might not be a quotation, it could certainly be inspired by one.

3 Qualitative investigation

In this last chapter we will combine the knowledge about quotations from chapter 1 with the created computer program and qualitative analysis insights from chapter 2. To achieve this, we selected four prose texts: Aulus Gellius' *Noctes Atticae* 1, Macrobius' *Saturnalia* 1, and Seneca's *De Clementia* and *Epistula* 84 and 85[112]. All were selected because of their author's tendencies to quote other writers, which increases the possibility for hidden hexameters[113]. In other words, these texts are prime locations for finding hidden quotations of poetry, which, as mentioned in the previous chapters, could provide new fragments from lost plays or provide insight in the way hidden poetry quotations function in a text.

Listed below are all the word counts and the number of hexameter candidates of the four texts[114]. Here, a candidate is a piece of prose between twelve and twenty syllables on which the three scansion programs from the previous chapter agreed seeing a hexameter.

Author	Title	Word count	Candidates
Aulus Gellius	*Noctes Atticae*	9,238	252
Macrobius	*Saturnalia*	25,020	372
Seneca	*Clementia*	8,153	188
	Epistula 84–85	3,082	169

To allow for easy investigation of the candidates within their context, we wrote a program to map them to the text. This allows us to print all candidates in bold, as illustrated by the excerpt from Epistle 85.20–23 below:

> Praeterea, si beata vita nullius est indigens, omnis **beata vita perfecta est eademque est** et beata et beatissima. Numquid dubitas quin beata vita summum bonum sit? **ergo si summum bonum habet, summe beata est.** Quemadmodum summum bonum adiectionem **non recipit quid enim supra summum erit?, ita ne** beata quidem vita, quae sine summo bono non est. Quod si aliquem 'magis' beatum induxeris, induces et 'multo **magis'; innumerabilia discrimina summi** boni facies, cum summum bonum intellegam quod supra se gradum non habet. Si est aliquis minus beatus quam alius, sequitur ut hic alterius vitam beatioris magis concupiscat quam suam; beatus autem nihil suae praefert. Utrumlibet ex his incredibile est, aut aliquid beato restare quod esse quam quod **est malit, aut id illum non malle quod illo melius est. Utique enim quo prudentior est, hoc** magis **se ad id quod est optimum extendet et id omni** modo consequi cupiet. Quomodo autem beatus est qui cupere etiamnunc potest, immo **qui debet? Dicam quid sit ex quo veniat hic** error: nesciunt beatam **vitam unam esse. In optimo illam statu ponit** qualitas sua, non magnitudo; itaque in aequo est longa et brevis, diffusa et angustior, in multa loca multasque partes distributa et in unum coacta. Qui illam numero aestimat et mensura et partibus, id illi quod habet eximium eripit. **Quid autem est in beata vita eximium? quod plena est. Finis, ut puto, edendi** bibendique satietas est. Hic plus edit, ille minus: quid refert? uterque iam satur

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[112]All texts were taken from TheLatinLibrary and LacusCurtius. See `https://www.thelatinlibrary.com/` and `https://penelope.uchicago.edu/Thayer/e/roman/texts/`. Although not the latest critical editions, the online availability allows us to process the texts with relative ease.

[113]Picking Caesar or Sallustius would have been less ideal, as these authors did not quote poetry in their texts (Dueck, "Poetic Citations in Latin Prose Works of Historiography and Biography", p. 172).

[114]Because of the size of Macrobius' text, all lines starting with four spondees were ignored to keep the number of candidates manageable.

Now we simply go through the four texts to search for interesting candidates[115]. The next sections will focus on the results of this task. In these sections, hexameter candidates are printed in bold in both the Latin text and the translation.

3.1   The ruin of Roman peace

The first candidate worth discussing is one from *De Clementia*, following directly on the quotation about bees we have seen in section 1.2[116]:

> *Ille est enim vinculum, per quod res publica cohaeret (…),*
> *Rege incolumi mens omnibus una;*
> *amisso rupere fidem.*
> **Hīc cāsūs Rōmānae pācīs ēxĭtĭum‿ērit**, *hic tanti fortunam populi in ruinas aget;*[117]

> Indeed, he is the link by which the state is united (...).
> While their king is safe, (they have) one mind for all,
> (but) when he has gone, they lose all hope.
> **Such misfortune will be the ruin of the Roman peace**, it will plummet
> the prosperity of this great people in ruin.

Many things work out great for this candidate: it has a powerful meaning, it is one independent sentence without syntactical or semantical problems and it follows directly on the quoted hexameters. It furthermore fits nicely within the theme of the prose: Seneca tries to learn Nero how to be a good leader. Any misfortune coming from the loss of a leader is worth remembering, a point which is driven home by the use of the rhythm. The scansion of the line is however not without problems. First of all, it is a bit militaristic with its four spondees. Still, this might not be a problem, as a rather serious point is being made. The scansions of *cāsūs*, *Rōmānae* and *pācīs* are all possible, as seen in Verg. *A.* 1.623, 12.166 and 3.543 respectively[118]. The word *ēxĭtĭum* is found in Vergil in *A.* 10.13 for example, though followed by an elision only in Stat. *Theb.* 4.613 and Sil. Ital. 5.44. This would not necessarily be a problem, as both Statius and Silius Italicus lived around the same time as Seneca. Truly problematic is *ērit*, who's first syllable has to be scanned as long for the line to work. However, no known line in the Pedecerto database is scanned that way as the *ĕ* is simply short. One could imagine Seneca changing a hypothetical hexameter to fit the needs of his prose. In this case, a different word could originally have taken the place of *erit*, either a verb or something else with an enjambment to the next line containing the verb.

Lastly, the combination of *casus* and *Romanum* is not seen in other poetic verses. The idea of *casus* and *pax* only later appears in Dracontius' *Romu.* 5.21 and Prudentius'

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[115]Sometimes candidates merge into each other, as seen from *est malit* to *est, hoc*. In this case, we need to take the list of candidates and check where the program thinks the candidates start and end. Three candidates were found here: *est malit aut id illum non malle quod illo*, *id illum non malle quod illo melius est* and *melius est utique enim quo prudentior est hoc*.

[116]Note that this text differs slightly from the one used in section 1.2, as the critical edition was not available online.

[117]Sen. *Cl.* 1.4.1–2.

[118]These and all subsequent verses are found via the Pedecerto and Musisque Deoque databases. See https://www.pedecerto.eu/public/ricerca/forma and https://mizar.unive.it/mqdq/public/ricerca/avanzata. Visited on 2022-06-01.

Psyc. 699. Although this makes it more unlikely that Seneca got inspired from other poetry, we cannot rule out the possibility that he noticed some version of the line in a street performance or in a nonextant source.

In conclusion, the hexameter in its current form does not work, though its location, message and possible fixes like switching *erit* for another word that does fit, do make it an intriguing candidate.

3.2   Indian honey

The next candidate is from Seneca's 84th epistle, where he discusses whether bees create honey or simply gather it as is from plants.

> *Aiunt inveniri apud Indos mel in arundinum foliis, quod aut ros* **īllīūs caeli‿āut īpsīŭs ărūndĭnĭs ūmor** *dulcis et pinguior gignat;*[119]

> They say that in India honey was found on the leaves of reeds, produced by a dew **peculiar to that climate, or by the juice of the reed itself**, which has a sweetness and richness;

Regarding the scansion, no real problems occur. The word *ărūndĭnĭs* occurs in ten hexameters in the same form as given here, for example in Ov. *Met.* 8.856, Lucan. 9.827 and Tib. 2.5.31. Subsequently *ūmor* is very common, being found in 156 verses (for example Verg. *G.* 1.88), with it being the last word 102 times, just as in this verse. Both *īllīūs* and *īpsīŭs* are possible, though the former less popular than alternative scansions. With three long syllables it is seen in Verg. *A.* 5.55 and Lucr. 4.326. The latter *īpsīŭs* is found in its current form in Catull. 67.23 and Verg. *Ecl.* 1.63, though never in the first foot like here. Lastly, *caeli* followed by an elision is seen in Verg. *G.* 2.345 and Verg. *A.* 8.528.

Syntactically the line is not complete, as it misses its subject *ros* and its verb *gignat*. However, enjambment from a hypothetical triple hexameter line is very possible, with the subject on the first line and the verb on the third. One could also read a half-line in *īpsīŭs ărūndĭnĭs ūmor*, with *aut* being added by the author as a way to clandestinely allow the referenced piece of poetry in this location, introducing it with a nod to his audience.

Overall, the candidate has a poetical flavour and would not feel out of place in any metrical description of a natural phenomenon. The idea of Seneca quoting any such poetry might be further strengthened by his use of *aiunt*. Introducing the sentence with this word could be a kind of Alexandrian footnote, flagging an instance of (poetic) intertextuality.

3.3   A description of character

For the third candidate we switch to Macrobius' *Saturnalia*, where the character and person of Virius Nicomachus Flavianus is described, who was the praetorian prefect of Italy in 390–392 CE and a close friend of Quintus Aurelius Symmachus.

> *Flavianum qui, quantum sit mirando viro Venusto patre praestantior,* **nōn mĭnŭs ōrnātū mōrūm grăvĭtātĕquĕ vītae** *quam copia profundae eruditionis adseruit:*[120]

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[119]Sen. *Ep.* 84.4.
[120]Macr. *Sat.* 13.

> Flavianus, who has shown how far he excels his admirable father Venustus, **no less in his lustrous character and sober way of life** than in his abundance of boundless knowledge:

In addition to the two dactyls found in the Indian honey hexameter by Seneca, this line adds another dactyl to the verse, resulting in three dactyls and two spondees, which gives the line a truly hexametric feeling. Although missing a verb, the line is a nice complete description of a person, quite apt for any great man with a stoic way of living.

Regarding the scansions of the words, *mĭnŭs* is widely used, for example in Enn. *Ann.* 154 and Hor. *Epist.* 2.1.170. *Mōrūm* and *vītae* always have two long syllables, as seen for example in Lucil. *Sat.* 1334 and Ovid. *Fast.* 3.383 for the former and Lucr. 1.105 and Prop. 1.7.9 for the latter. The use of *grăvĭtātĕquĕ* is odd however. Although *grăvĭtātĕ* can be found in multiple hexameters, for example Ov. *Met.* 1.30 and Lucr. 3.1054, no verses exist with *grăvĭtātĕquĕ*. Indeed, it does fit the hexameter pattern, but is stylistically not attractive. More interesting is the use of *ōrnātū*. While this specific form is used multiple times by Plautus, for example in *Trin.* 841 and *Mil.* 1282, it only appears in hexameters by later writers. To illustrate, the first appearance of *ōrnātū* is in the fourth century CE with Juvencus' *Euang.* 2.720, with Ausonius *Ecl.* 19.40 and with Claudianus' *in Eutr.* 1.200. Later with Dracontius' *Romu.* 7.145 in the fifth century CE and Corippus' *Iust.* 3.164 in the sixth.

This suggests that the hexameter, if a quotation, would most likely not be one from the classical era. It would be possible however to be a quotation from a contemporary source, as Macrobius wrote his *Saturnalia* around 400 CE, around the same time Juvencus, Ausonius and Claudianus lived and *ōrnātū* was apparently acceptable to be used in hexameters.

3.4   What we ought to do

For the fourth candidate we return to *De Clementia*, to the first paragraph of the second book. Seneca reminiscences about the time Nero had to write the names of two brigands who were to be executed, when the emperor cried: *vellem litteras nescirem*, wishing that he never learned how to write. Seneca praises this show of empathy and compassion. After the reminiscence, he continues with a strong list of things we ought to do to bring back the golden days of human innocence. It is at the start of this moral list that we find our candidate:

> *O vocem publica generis humani innocentia dignam, cui redderetur antiquum illud saeculum!* ***Nūnc prōfēctō cōnsēntīrĕ dĕcēbăt ăd aequum*** *bonumque expulsa alieni cupidine, ex qua omne animi malum oritur, pietatem integritatemque cum fide ac modestia resurgere et vitia diuturno abusa regno dare tandem felici ac puro saeculo locum.*[121]

> What an utterance, worthy of the universal innocence of mankind, to which the golden days should be returned! **Now in truth we ought all to agree to love righteousness** and goodness, having driven away lust for other things, from which every evil of the mind springs, (and) that piety and integrity along with honour and temperance should rise again, and that vice, having misused

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[121]Sen. *Cl.* 2.1.4.

its long-lasting reign, should at length give place to an age of happiness and purity.

The line starts slowly with three spondees, but ends more hexametrically with two dactyls. It furthermore contains the verb *decet* and the required infinitive in the form of *consentire*, as well as an object. Regarding the scansion, *cōnsēntīrĕ* is found in seven other hexameters, for example Lucr. 3.801 and Pers. 5.46. Furthermore, *profectō* is correctly scanned in its adverbial form, in contrast to the participle *prŏfectō*. However, the adverbial form is never found in any other hexameter. Lastly, *dĕcēbăt* is found in eighteen hexameters like in Verg. *A.* 10.613 and Ivv. 4.13, but, rather strikingly, it is only ever found as the last word of a verse.

As the combination of *decebat* and *consentire* is also not found in other poetry, it is unlikely that this candidate is a quotation. More likely would be Seneca employing some kind of prose rhythm here, adding a hexameter to catch the attention of the reader and alerting them to the importance of the following exhortation.

3.5 Two possible half-lines

The next candidate needs some thought. Remaining in *Noctes Atticae*, we read Aulus Gellius' discussion on the word *indutiae*, meaning *truce*. Having related about its usage in Marcus Varro and various Greek texts, Gellius cites Aurelius Opilius, a Roman physician and teacher of philosophy, rhetoric and grammar:

> *Aurelius autem Opilius in primo librorum, quos Musarum inscripsit, "indutiae," inquit, "dicuntur, cum hostes inter sese utrimque utroque* **āltĕri⌣ăd āltērōs īnpūnē⌢ēt sĭnĕ pūgna** *ineunt;"*[122]

> But Aurelius Opilius, in the first book of his work titled *The Muses*, says: "It is called a truce when enemies pass mutually back and forth **from one side to another safely and without strife**;"

Exciting is of course the finding of a candidate within a citation: we are listening to the words Opilius said. And although his works are no longer extant, it could be possible that he weaved poetry into his texts, which is then preserved in *Noctes Atticae*. Its content has a nice poetic ring to it, with an alliteration between *āltĕri* and *āltērōs* and one for *īnpūnē* and *pūgna*. The content too is usable in different contexts, making it a prime candidate to be a poetic quotation.

Scanning the line results in some problems however. We have a hiatus between *īnpūnē* and *ēt*, immediately disqualifying this hexameter as proper poetry. Luckily, the hiatus happens at *ēt*, providing a nice split between the two parts. If we look at the second half, we see two feet of a hexameter: *ēt sĭnĕ pūgnā*. This could be a half-line, making the candidate a combination of two or more lines. This idea only works if the first part could be considered part of a hexameter too, which is more difficult. If we look at *āltĕri⌣ăd āltērōs īnpūnē* in isolation, we start with a dactyl, followed by three spondees. Problematic about this is its unlikeliness to be the second half of a hexameter, as the fourth and fifth feet would both be a spondee. This could be solved by making *āltĕri⌣ăd āltērōs īnpūnē* the first part of a hypothetical first verse, adding a dactyl and a trochee,

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[122]Gel. 25.17.

and starting the second hypothetical verse with *ēt sĭnĕ pūgnā*. Here one could think of another adverb in addition to *īnpūnē* or something else entirely that fits the meter.

It would therefore be possible to save this candidate when we regard it as two half-lines, which would make it a very interesting piece of poetry from possibly Opilius within a citation by Gellius.

3.6   Discussion

Our program discovered around one thousand candidate hexameters in the four processed texts, which needed a qualitative investigation to see which ones were truly viable verses. Only a handful were. It is therefore worthwhile to discuss how to improve the program to search more accurately for poetic quotations.

If we focus on finding complete hexameters, the first thing we need is a context sensitive post-processor. To illustrate, such a program would allow us to reject candidates with female singular ablativi scanned as short. Moreover, candidates with verbs like *veniō* could be rejected if the scansion does not match the grammatical tense.

Another improvement could be to automatically check whether a candidate stretches across two clauses. One could tackle this problem by looking at interpunction like full stops and question marks. This is dangerous however, as such interpunction is created by the editor of a text and therefore inherently subjective. It would therefore be better to look at conjunctions and whether their location in the verse would make sense.

More relevant would be to check whether the candidate would be considered good poetry. The easiest thing to do would be to reject lines that have too many spondees. To illustrate, the program found many lines that started with four spondees, followed by a dactyl and a trochee. In addition to being a rather dull hexameter, it would be hard to notice the line as a hexameter in the prose. One could require a minimum number of dactyls to appear in the candidate for it to pass as one. Further pruning could be achieved by a post-processor that investigates whether a line would be pronounceable and would sound proper to our ears. This could be done by looking at the sequence of consonants and sonants making up the syllables and words. The computer would then check if the sequence is agreeable using a list of predetermined rules.

However, as chapter 1 showed, authors often cite syntactical entities, not metrical ones. If we return to section 3.1, we see Seneca quoting Vergil by citing the words *rege incolumi mens omnibus una; amisso rupere fidem*. However, the full lines read as:

> *observant. Rege incolumi mens omnibus una est;*
> *amisso rupere fidem constructaque mella*

We should therefore also search for half-lines and incomplete hexameters. This is difficult, as we would not have the entire context of the original line, which is needed by the current implementation of the LSTM and Pedecerto. These programs would need an extension to be able to cope with this. Luckily, Anceps could be more easily adapted for this task, as it allows for the specification of what we would consider a candidate. For example, we could specify a candidate as having one dactyl and one spondee. Of course, there are half-lines that cause problems, like *āmīssō rūpērĕ fĭdēm*. This quotation consists of three and a half feet. These half feet are harder to specify for Anceps and therefore more difficult to find accurately.

Lastly, it would be great to detect different meters. Currently, Pedecerto and the LSTM work best on hexameters and pentameters, with Anceps focusing on iambic trimeter. However, as many more meters exist, it would be relevant to check the prose for candidates in these meters. This would however require much more research towards automated scansion of other meters. Nevertheless, it would be extremely interesting to see its results.

Therefore, additional post-processing would make the qualitative analysis easier and quicker. Adding support for other meters and partial verses would truly expose the amount of hidden poetry within Latin prose texts.

Conclusion

As we have seen in chapter 1, many Roman authors were fond of including poetry in their prose texts. I hope to have sufficiently demonstrated that this fondness has been a great motivation to start a treasure hunt in promising prose passages for any additional and latent poetry with the help of computational tools. The spoils of this hunt have surely not disappointed as seen in chapter 3, which showed five possible poetic quotations within the rather limited selection of processed texts.

Returning to the research questions from the introduction, we can state that it is very possible to analyse prose texts for hexameters. The program created was capable of detecting known hexameter candidates in the text[123], as well as other promising possibilities as shown in chapter 3. Regarding the possible functions of the found candidates, we have seen a hexameter of warning, one of explanation, one of description, one of exhortation and two possible half-lines with hexameter patterns.

I hope that many more texts can be processed using the created program, which has been made available online[124], to possibly find many more exciting candidates and true quotations and fragments from fragmentary tragedies and other plays. As seen from the figure on page 25 with possible candidates from Epistle 85, many hexametric patterns were found, suggesting that Roman authors and their audiences were invested in the convergence of prose and poetry. The fact that so many metrical patterns exist without any marking implies that an audience did not need any notification of such phenomena, and that an author was able to use them freely. In other words, this thesis suggests that Latin prose contains more citations of poetry than are apparent to our modern eyes. We should therefore start to look actively for metrical quotations of any kind within Latin prose texts, as this would greatly improve our insight in the relationship Roman audiences had with poetry and the way they viewed and used poetic quotations.

To truly achieve this, the program created for this thesis needs future work, as described in section 3.6. To reiterate briefly, the program needs to be extended with post-processing tools to reject candidates based on syntactical errors and on our aesthetic experiences of poetry. More importantly however would be the functionality to detect half-lines and different meters. The many candidates from only looking for full hexameter lines suggests to me that a vast treasure of half-lines in all types of meters could be found. I hope furthermore that this research helps the automatic detection of clausulae and prose rhythm, which are also metrical patterns hidden in prose.

Plus ultra.

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[123]Which caused me much scattered hopes when analysing the candidates, only to find out that the so promising candidate was already a known quotation.

[124]See my Github repository: `https://github.com/Ycreak/Latin_scansion_with_neural_networks`.

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