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Poetry and Number in Graeco-Roman Antiquity

MAX LEVENTHAL

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Poetry and mathematics might seem to be worlds apart. Nevertheless, a number of Greek and Roman poets incorporated counting and calculation within their verses. Setting the work of authors such as Callimachus, Catullus and Archimedes in dialogue with the less well-known isopsephic epigrams of Leonides of Alexandria and the anonymous arithmetical poems preserved in the *Palatine Anthology*, this book reveals the various roles that number played in ancient poetry. Focusing especially on counting and arithmetic, Max Leventhal demonstrates how the discussion, rejection or enacting of these two operations was bound up with wider conceptions of the nature of poetry. Practices of composing, reading, interpreting and critiquing poetry emerge in these texts as having a numerical component. The result is an illuminating new way of approaching Greek and Latin poetry – and one that reaches across modern disciplinary divisions.

MAX LEVENTHAL is Bye-Fellow and College Lecturer in Classics at Downing College, Cambridge. He was previously the Thole Research Fellow at Trinity Hall, Cambridge and a British Academy Postdoctoral Fellow in the Faculty of Classics.

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MAX LEVENTHAL
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4 my family and friends, with love;

2 Alex, the 1 that counts the most.

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ACKNOWLEDGEMENTS

This book has had a considerably long gestation and several origins. I first began thinking about the intersection of poetry and number as a Master's student. The result was a dissertation on Archimedes' *Cattle Problem*, and it would eventually become an article in *Ramus* (2015), which is substantially reworked and expanded here as Chapter 3. I then pursued a doctorate on a different topic. Still, Leonides of Alexandria and his isopsephic epigrams constituted one distraction from the main task of my thesis; in fact, some of the material of Chapter 2 had originally been submitted to the *Cambridge Classical Journal* as an article. I thank the anonymous reviewers of that piece for their challenging but supportive feedback. A failed Oxford interview in 2008 bears special mention, too, since it was there that I first encountered Catullus *cc.* 5 and 7 – and I have been ruminating on those poems ever since. The beginnings of a postdoctoral position afforded me the time to write up these ideas while, once again, I should have been working on other things. Thus, this book is quite a different beast to one's typical first book in academia. It is the product of a lengthy obsession and not the direct result of my doctoral studies. Yet I hope and believe that the passage of so much time has imbued it with a certain intellectual maturity – of the kind which I did not yet possess as a fresh postgraduate – and has streamlined its arguments so as to avoid the bloatedness that is a residual characteristic of many a thesis turned monograph.

Although this is not the 'book of the thesis', I nevertheless owe a debt of gratitude to several supervisors and mentors, for the profound influence they have had on me as a scholar and as a person. Liba Taub supervised my Master's thesis and has been a continual source of support. She frequently saw the value of my thinking before I did and encouraged me to pursue many lines of enquiry that are now to be found in this book. In that sense, it could

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not have been written without her. Renaud Gagné supervised my doctoral thesis, and I am indebted to his inexhaustible generosity, which has been truly formative. Richard Hunter, my second supervisor, has read over more drafts of my various musings than I can recall; he has vastly improved them all with his knack for asking just the right question to make one reflect on both matters of detail and the larger picture. Tim Whitmarsh served as the internal examiner of my thesis along with Annette Harder, who served as the external examiner: their feedback was as constructive as it was honest. I have been fortunate also to have Tim as my postdoctoral mentor; his kindness, support and advice on all manner of subjects have been a real inspiration.

It gives me great pleasure also to acknowledge those colleagues and friends whose efforts have improved this final product. As well as Richard Hunter and the anonymous reviewer at *CCS*, drafts of this entire book were read by Jan Kwapisz, Arthur Harris and Sam Oliver, who all brought their own expertise to bear in enhancing its clarity and avoiding any infelicities. Likewise, individual chapters were read over and sharpened by Simon Goldhill, Talitha Kearey, Thomas Nelson, Floris Overduin and Ivana Petrovic. The Introduction in particular benefited from being exposed to the exacting eyes of the Postdoctoral Work in Progress Seminar (PWiPS) in Cambridge. I would also like to thank Francesco Grillo, Richard Hunter and Jan Kwapisz, who all shared their unpublished work with me.

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Cambridge has been a truly wonderful place to grow intellectually, and this is down to its enriching and lively community. If sometimes I have felt the weight of academia as a solitary endeavour pulling me under, it has been the friendship of Talitha Kearey, Thomas Nelson and, above all, of Hannah Price that has buoyed

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me up. I owe them so much. Of course, there is more to life than books (but not much more), and I want also to thank those friends outside academia who have kept me sane and have brought me great joy beyond the job: Sam Isaacs, Dan Keane, Raj Mistry, Joe Smallman, Sam Oliver and Hannah Price (again!).

The most personal debts, though, I cannot ever hope to repay. For their love, I am forever grateful to my parents, Sue, Michael, Ross and Kirsteen, to my siblings Rebecca, William and Robbie, and to my grandparents, Peter, Mary and Pam. But the deepest thanks go to my partner, Alex, whose incalculable love, support and immeasurable patience – when it comes to academic tribulations and more besides – have kept me going now for a full decade (but who's counting?).

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ABBREVIATIONS AND EDITIONS

Below is a list of abbreviation conventions and editions that I employ in this book. For all else I follow the abbreviations of names and works of Greek and Latin authors as given in the *Oxford Classical Dictionary.*

AB	Austin, C. and Bastianini, G. (2002) *Posidippi Pellaei quae supersunt omnia*. Milan.
AP	*Anthologia Palatina* (*Palatine Anthology*).
Broggiato	Broggiato, M. (2001) *Cratete di Mallo. I Frammenti: edizione, introduzione e nota*. La Spezia.
Cougny	Cougny, E. (1890) *Epigrammatum anthologia Palatina cum Planudeis et appendice nova epigrammatum veterum ex libris et marmoribus ductorum*, 3 vols. Paris.
FGE	Page, D. L. (1981) *Further Greek Epigrams*. Cambridge.
GP	Gow, A. S. F. and Page, D. L. (1968) *The Greek Anthology: The Garland of Philip and Some Contemporary Epigrams*, 2 vols. Cambridge.
Harder	Harder, M. A. (2012) *Callimachus: Aetia*, 2 vols. Oxford.
HE	Gow, A. S. F. and Page, D. L. (1965) *The Greek Anthology: Hellenistic Epigrams*, 2 vols. Cambridge.
IEG	West, M. L. (1989–92) *Iambi et elegi Graeci ante Alexandrum cantati*, 2nd ed., 2 vols. Oxford.
IMEGR	Bernand, É. (1969) *Inscriptions métriques de l'Égypte gréco-romaine: Recherches sur la poésie épigrammatique des Grecs en Égypte*. Paris.

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KA	Kassel, R. and Austin, C. F. L. (1983–) *Poetae comici Graeci*. Berlin and New York.
Kerkhecker	Kerkhecker, A. (1999) *Callimachus: Iambi*. Oxford.
Lightfoot	Lightfoot, J. (2009) *A Hellenistic Collection*. Cambridge, MA.
Mugler	Mugler, C. (1972) *Archimède*, 4 vols. Paris.
Pf.	Pfeiffer, R. (1949–53) *Callimachus*, 2 vols. Oxford.
SH	Lloyd-Jones, H. and Parsons, P. (1983) *Supplementum Hellenisticum*. Berlin and New York.
Sider	Sider, D. (2020) *Simonides: Epigrams and Elegies*. Oxford.

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INTRODUCTION

NUMBERS UP

I.1 Poetic Figures

This book explores Graeco-Roman poetry's engagement with and use of numbers. What I mean by this can best be explained by turning to Homer's self-presentation in the *Iliad*, where the matter of enumeration intersects with the question of poetic expression.

ἔσπετε νῦν μοι, Μοῦσαι Ὀλύμπια δώματ' ἔχουσαι –
ὑμεῖς γὰρ θεαί ἐστε πάρεστέ τε ἴστέ τε πάντα,
ἡμεῖς δὲ κλέος οἷον ἀκούομεν οὐδέ τι ἴδμεν –
οἵ τινες ἡγεμόνες Δαναῶν καὶ κοίρανοι ἦσαν.
πληθὺν δ' οὐκ ἂν ἐγὼ μυθήσομαι οὐδ' ὀνομήνω,
οὐδ' εἴ μοι δέκα μὲν γλῶσσαι, δέκα δὲ στόματ' εἶεν,
φωνὴ δ' ἄρρηκτος, χάλκεον δέ μοι ἦτορ ἐνείη,
εἰ μὴ Ὀλυμπιάδες Μοῦσαι, Διὸς αἰγιόχοιο
θυγατέρες, μνησαίαθ' ὅσοι ὑπὸ Ἴλιον ἦλθον·
ἀρχοὺς αὖ νηῶν ἐρέω νῆάς τε προπάσας.

(Homer *Iliad* 2.484–93)

Tell me now, you Muses who have dwellings on Olympus – for you are goddesses and are present and know all things, but we hear only a rumour and know nothing – who were the leaders and lords of the Danaans. But the multitude I could not tell or name, not even if ten tongues were mine and ten mouths and a voice unwearying, and the heart within me were of bronze, unless the Muses of Olympus, daughters of Zeus who bears the aegis, were to call to my mind all those who came beneath Ilion. Now I shall tell the leaders of the ships and all the ships.[1]

The passage addresses the presence in poetry of numerical as well as heroic figures. Faced with the prospect of describing the entirety of the gathered Achaean troops in the ninth year of the war, Homer turns to address the Muses again.[2] While it precedes the Catalogue

[1] The Greek text of Homer follows Allen (1920), with translations adapted from Murray and Wyatt (1999) for the *Iliad* and from Murray and Dimock (1995) for the *Odyssey*.

[2] Scholarship on the Invocation and Catalogue is vast. One traditional concern has been the historical period and geographical politics it encapsulates, see Allen (1921); Burr (1944); Hope Simpson and Lazenby (1970); Visser (1997). In terms of the make-up of the *Iliad*, it

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of Ships and the detailed counting up of the troops, it also follows on from Homer's series of similes variously describing the gathering. In the run of similes, the host's armour shines like a fire ravaging a forest, the troops appear like flocks of birds gathering in a meadow, like all the leaves and flowers in a meadow, and like a swarm of flies round a milk pail (*Il.* 2.445–73), and their organisation is then likened to goatherds ordering their flocks (474–7). The Invocation thus functions as a hinge, mediating between poetic modes: the similes' poetics of likeness and the Catalogue's poetics of enumeration. Yet it is not frequently observed that the passage is an extended reflection on the tension between poetic content (how many things you want to describe) and the poetic resources required to recount it (how many verses it will take). Prior to accounting for the ships at length in the Catalogue, in other words, the poet is exploring and commenting upon his *enumerative* abilities.

The role of the subsequent enumeration in the Catalogue depends on the interpretation of this passage. On the one hand, in contrast to the similes, which require no introduction or justification, the Catalogue's poetics of enumeration need the support of the Muses in order to be achieved. The ability to fully recall the host lies solely with the Muses. On the other hand, the Muses' support in recounting the entire host is in fact a condition (note the optative mood of μνησαίαθ'), and the poet turns instead to recounting only the leaders and the ships. The poet admits that the problem is one of poetic capacity. The implication of his claim that he 'could not tell or name the multitude, not even if ten tongues were his and ten mouths' (*Il.* 2.488–90) is that a great amount of content requires a concomitant extension of the poem, which, in this case, even a division of labour by a multiplication of mouths can do nothing to foreshorten. (Later Latin poets enact their own numerical expansion from ten mouths to a hundred, but

has often been considered a later insertion, more appropriate to the gathering of the troops at Aulis than to the troops on the Trojan plain in the ninth year of the war, see Allen (1921) 169–70; Wade-Gery (1952) 53–7; Jachmann (1958); Kullmann (1960) 63. For a more literary evaluation of the dislocation see Sammons (2010) 140–8. The following is a necessarily brief account of the passage which glosses over certain interpretative issues; see Chapter 3, Section 2 for more detail about the varying interpretations and for my approach.

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equally to no avail.)[3] His solution to the expected increase in extension is remarkable. The Catalogue accounts for the number of men per ship, the number of ships per leader and the number of leaders. So, in lieu of counting up the number of warriors who went to Troy (ὅσοι ὑπὸ Ἴλιον ἦλθον, 2.492), he allows for the audience to reach a total instead based on the leaders and their ships (ἀρχοὺς αὖ νηῶν ἐρέω νῆάς τε προπάσας, 2.493). Rather than being an exhaustive count, the number of the host can be inferred through what would now be called multiplication.

This strategy is used earlier in *Iliad* 2 by Agamemnon to calculate the relative sizes of the Achaean and Trojan forces. He imagines groups of ten Achaeans being served wine by one Trojan and concludes that not all the Achaeans would be served (*Il*. 2.119–28): the Achaeans outnumber Trojans by more than ten to one. Equally, one of the similes preceding the Invocation displays a similar thinking. The leaders are described as organising their troops like goatherds, and among them stands Agamemnon at a higher level above those leaders (474–83). In both cases, individual soldiers are organised into groups so as to make their conceptualisation more manageable, and these groups are then organised further: by Agamemnon when he compares the Trojans with the Achaeans, and again by Agamemnon who rules over the leaders who have already arranged their troops. The organisation that enables the poet to encapsulate the host for the audience is one which was understood both by figures within the poem and by its audiences (to whom the simile is directed). Of course, the use of multiplication is a traditional means of expressing quantity in Archaic epic.[4] What is so striking in *Iliad* 2 is that the poet has harnessed these resources in order to explicitly reflect on his capacity as a poet and how certain types of calculation shape the catalogue as a poetic form.

[3] Enn. *Ann*. 469–70 Skutsch; Hostius fr. 3 Courtney; Verg. *G*. 2.42–4 and *Aen*. 6.635–7. Ovid gives up the count and settles for 'many mouths' (*pluraque . . . ora*, *Tr*. 1.5.54). Gowers (2005) 171–3.

[4] For example at *Il*. 8.562–3 (1,000 fires, 50 men by each); 9.85 (7 Greek leaders, each with 100 men); 9.383 (200 warriors coming out of each of the 100 gates of Thebes); and 16.168–71 (50 ships for Achilles, 50 men at hole pins in each and 5 leaders).

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Later readings of the passage, moreover, focus on and respond to Homer's counting. In arguing that the scale of the Trojan War was not as great as often assumed, Thucydides makes his own count based on Homer's Catalogue (Thuc. 1.10.1–2). He first surmises there to be 1,200 ships, which is not far from the 1,186 ships that is reckoned in modern scholarship on the basis of the Catalogue's count. He then recognises that only the Boeotian contingent and Philoctetes' contingent are given explicit numbers of men per ship, at 120 and 50 men respectively, and conjectures that this is the upper and lower limit of the men per ship (Thuc. 1.10.4). From this he states – but does not calculate – that if one were to take the mean number of men per ship (85) the force would still be small at 102,000 men (Thuc. 1.10.5). Setting to one side whether this is in fact a small contingent by ancient standards, he brings to bear his own numerical abilities in reading Homer's Catalogue and so elevates the numerical aspect as a key point of interest.

Other readers, though, could come to different totals. The mythological handbook attributed to Apollodorus of Athens (a historian and geographer) concludes in the relevant chapter that 'the total number of ships was 1,013' (νῆες μὲν οὖν αἱ πᾶσαι ͵αιγ΄, Apollod. *Epit*. 14). Similarly, in the Latin mythological handbook attributed to Hyginus, the *Fabulae*, a count is made, although it is marred by textual corruption. The chapter gives the reckoning of the ships as 245 (*summa naues CCXLV*, *Fab*. 97.55) despite the individual numbers given in Hyginus' list adding up to 1,286 (which is a round 100 from the accepted 1,186). These counts of ships and people also guided later readers approaching Homer's Catalogue. A *scholium* to the beginning of the Catalogue directly invokes Thucydides' language and his method of taking the mean number of men per ship in explaining that Homer 'further, does have something to say about the multitude [of the host]' (καίτοι λέγει καὶ περὶ τοῦ πλήθους, bT-*scholia* on Homer *Iliad* 2.488) and that the reader is readily able to compute the total. The lack of a final sum in the poem, which in an original oral context may have contributed to a purposeful overload of information for the audience, became a prompt to engage numerically with epic for later readers encountering Homeric poetry on the page.

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These readings also fed into new poetic compositions and their reformulations of the poet and his work. To keep with the Catalogue of Ships, a more overt mathematicisation is found in the *Contest of Homer and Hesiod* and its reimagining of Homer's Invocation. When asked by Hesiod how many *men* sailed to Troy, he replies with a calculation much shorter in length than the Iliadic catalogue.

πεντήκοντ' ἦσαν πυρὸς ἐσχάραι, ἐν δὲ ἑκάστῃ
πεντήκοντ' ὀβελοί, περὶ δὲ κρέα πεντήκοντα·
τρὶς δὲ τριηκόσιοι περὶ ἓν κρέας ἦσαν Ἀχαιοί.

(*Contest of Homer and Hesiod* 143–5 Bassino)
(50 × 50 × 900 = 2,250,000)

'There were fifty hearths of fire, in each were fifty spits, and around each were fifty pieces of meat: three times three hundred Achaeans were around one piece of meat.'

The Homer of the *Contest* has progressed from the Catalogue that counts to the more complex calculation that is multiplication. For the audience(s) of the *Iliad*, it was necessary to estimate the number of men in each ship and add together the troops under each leader in order to reach a sum for the entire Achaean contingent, in the manner that Thucydides had theorised. The Homer of the *Contest* bypasses the need to display his counting, or indeed to place his counting abilities under any scrutiny. He reaches a number for the entire contingent in only a few lines where the Iliadic Homer had professed his inability to account for the multitude at all (πληθύν, *Il.* 2.488).[5]

A further reworking of the Catalogue in Latin focuses on the numerical abilities of the reader. The *Ilias Latina*, a Neronian-era poem attributed to Baebius Italicus, compresses the key events of the *Iliad* into 1,070 hexameter verses.[6] Its rewriting of the Catalogue is prefaced by its own second invocation – *Vos mihi nunc, Musae . . . referte* ('recount to me now, Muses', 161–2) – and it begins also with the Boeotian contingent: *Boeoti decies quinas egere carinas | et tumidos ualido pulsarunt remige fluctus* ('the

[5] I offer a more detailed analysis of this scene in the introduction to Part II.
[6] For his name and date see Scaffai (1997) 15–29. The Latin text also follows Scaffai, while the translations are my own.

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Boeotians drove ten times five ships and hit the swollen waves with their strong oarsmen', 169–70). In the following catalogue the sum of ships is outlined by a combination of multiplication as in the case of the Boeotians, simple addition as in the case of Agamemnon's 100 ships (171–3) and even subtraction as in the case of Eumelus, who sets off with one less ship than Telamonian Ajax's twelve (197–8). This poet, however, extends his redrafting also to give a total account of the ships: *his ducibus Graiae Troiana ad litora puppes | bis septem uenere minus quam mille ducentae* ('To the Trojan shore with these leaders there came twice-seven less than one thousand two hundred Greek ships', 220–1; 1,200 – (2 × 7) = 1,186). Both the *Contest* and the *Ilias Latina* draw in the reader, since the total number of soldiers or ships must again be achieved through calculations of different kinds. Yet, whereas Homer in both the *Iliad* and the *Contest* had allowed the sum to be inferred, in the *Ilias Latina* the reader can check their own calculating against the poet's final tally. It is a total, moreover, which matches the ships that Homer had enumerated. Homer's audiences summed up the number of ships and soldiers across the centuries and in turn tried out composing their own calculations.

A keen interest in Homeric numbering extends beyond the Catalogue. A close eye, for example, was also kept on the number of ships and people in readings of the *Odyssey*. Odysseus recounts to the Phaeacians that, following his contingent's escape from the Cicones, 'six fine-greaved companions from each ship died' (ἓξ δ' ἀφ' ἑκάστης νηὸς ἐϋκνήμιδες ἑταῖροι | ὤλονθ', *Od*. 9.60–1). This line was a subject of lively debate: already in the fourth century BCE the Homeric critic Zoilus found it unbelievable that Odysseus would have lost an equal number from each ship (*FGrH* 71 F 19); the Pergamene critic Crates responded in the second century BCE that it is, however, a believable *fiction* (fr. 48 Broggiato). Zoilus' suspicion of Odysseus' 'averaging out' of the number of perished crew was not shared by all readers. It is at least taken as an acceptable total for exegesis of subsequent passages. Later in the same book, Odysseus recalls that, on arriving at Aeaea, he numbered (ἠρίθμεον, *Od*. 10.204) his crew into two groups and sent one group of twenty-two with Eurylochus as leader to investigate the

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island (*Od*. 10.205–8), where they would meet Circe and would be transformed into pigs. The scholiast quotes that earlier passage, noting that 'since six from each ship have died, there remain 44, of which a half is 22' (ἓξ γὰρ ἀφ' ἑκάστης νεὼς ἀπολομένων περιελείποντο μδ΄, ὧν οἱ ἡμίσεις εἰσὶ κβ΄, *scholium* on Homer *Odyssey* 10.208). Just as Odysseus continues to count off the declining tally of his crew to the listening Phaeacians, so too ancient audiences of the *Odyssey* were keeping count.[7]

Homer's numerical ability is a cornerstone of his self-presentation as a poet in the *Iliad*, and the *Contest of Homer and Hesiod* shows that this remained a salient aspect of the figure of the poet; as will become clear in the introduction to Part II, the author of the *Contest* returns to the issue and builds his reimagining of Homer's enumerative capacities out of verses drawn from the Catalogue and surrounding context. Yet number in poetry is not only a matter that affects the profile of the poet: *reading* Homer's poetry meant observing the numbers and submitting them to analysis. This is a mode of poetic appreciation that is evidenced in the Homeric *scholia* and is set in high relief by the *Ilias Latina*'s translation and rewriting of the Catalogue. Its concluding total makes patent what was only implicit in *Iliad* 2, namely that the Catalogue is a form of organising information in poetry that calls for participation and specifically calculation on the part of the reader. Over the course of Graeco-Roman antiquity, in other words, numerical thinking and diverse forms of calculation played an important role within ancient poetics for both poets and audiences alike.

I.2 Poetry by Numbers

This celebrated passage of Greek poetry gives a prominent position to counting and calculation in verse, and subsequent readings of Homer likewise could be avowedly numerical. But the phenomenon is not peculiar to Homeric poetry and its reception. Poetic

[7] Two men are chosen to visit the Lotus-eaters and a third as herald (*Od*. 9.90); twelve ships' worth of men join Odysseus in hunting on the Cyclopes' island (9.159–60); after the Cyclops twice kills two companions (9.289 and 311), four men remain with Odysseus in the cave (9.335).

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engagements with numbers and with a whole range of calculations can be found throughout Graeco-Roman antiquity. Numbers of people, objects and events were calculated in poems on the basis of supplied ratios; the number of lines, poems or books of poetry were counted up; so too, the letters in a verse were treated as numbers and summed up (a practice called isopsephy; see Chapter 3); and counting was even used to evaluate a poem's worth. In this book, I will thus be casting a wider net to bring together all these cases of poetry in which numerical and arithmetical procedures play an active role.

Yet what the example demonstrates, importantly, is that examining poetic engagements with number provides a way into wider questions of aesthetics and poetic form. A shared culture of mathematical competency undergirds not only the poet's self-fashioning and the formation of his poems but also the subsequent approach to, and aesthetic judgement of, poetry. To get to grips with this mathematical competency and its particular applications within poetry and in divergent approaches to poetry is to gain a deeper understanding of how Greek and Roman poetry works. More specifically, this study provides a window on to the cognitive dimensions of poetry – that is, how it was processed in the mind of both composers and audiences – and what mathematics in addition contributed to its production and reception. In evaluating a range of intersections of poetry and number, I address ancient conceptions of poetry's fundamental workings as medium and cultural artefact and those aspects it was thought to share with mathematics. I focus on poets throughout antiquity who discussed and utilised mathematical operations with the aim of commenting upon their activities and upon the shape of their resulting poetic product. I also explicate the range of numerical analyses that were expected on the part of the reader in making sense of that poetry. Counting and calculating were more important for Greek and Roman poets than has generally been acknowledged. This book therefore contributes a chapter to Graeco-Roman literary history which argues for the critical place of number in the formation and development of poetic culture.

This endeavour is supported, in one sense, by the fact that poetry is numerical in its core structure: it is defined by its use of

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metre.[8] Both the composition and reception of metre require the ability to follow rules predicated on number and complex combinations of long and short syllables. Llewelyn Morgan has demonstrated the mathematical acumen that goes into Latin poetry: poets manipulated rhythms in sophisticated ways and expected audiences to notice unusual patterns.[9] An explicit awareness of the role metrical form plays is evident already in Hellenistic Greek poems. Boiscus of Cyzicus, for example, self-reflexively points to his poem in the obscure metre of the catalectic iambic octometer: 'the writer of a novel poem, [having] discovered the eight-foot line' (καινοῦ γραφεὺς ποιήματος | τὸν ὀκτάπουν εὑρὼν στίχον, *SH* 233.1), and in a similar vein Castorion of Soli advertises his *Hymn to Pan* as a poem where the words in any verse can be rearranged but the metre maintained (*SH* 310: see Chapter 4, Section 2 for further discussion). Musical theorisation in antiquity was predominantly geometric.[10] (For this reason, harmonics and the harmony of the spheres are concepts not addressed here.) In this respect, then, poetic metre is one aspect of ancient musical culture that is defiantly numerical in its counting out of beats. Yet numerical dexterity – as the reception of Homer's Catalogue shows – was evidently not confined to constructing and deciphering poetry's rhythmical schemes alone. A stark later example is the shape of Vergil's *Eclogues* and *Georgics*, which John Schafer has cogently demonstrated to be informed by a regular line per column division (35 and 40 lines respectively) corresponding to their original pagination: meaning is derived in part from the reader's awareness

[8] Cf. e.g. Gorgias (*Helen* 9) and Aristotle (*Poetics* 1447a25–b20). Herodotus identifies poetic works by the number of 'measures' (μέτρα) in them: Archilochus sang of Gyges ἐν ἰάμβῳ τριμέτρῳ (literally 'three-measure iambic', 1.12), and the Pythia gives an oracle to Croesus ἐν ἑξαμέτρῳ τόνῳ ('six-measure strain', 1.47). Whereas μέτρον in Greek could mean any sort of measure – dry or liquid, temporal or spatial – in Latin the association between poetic metre and enumeration is clearer. The term *numerus* is used to refer to poetic metres, but it also designates any countable quantity (that is, it is closer to the Greek ἀριθμός: 'number').

[9] Morgan (2010).

[10] There is an extensive bibliography here, but for a clear orientation of the place of geometry in Greek harmonics, see Creese (2010) introduction and chapter 1, where he demonstrates that the science of harmonics relies on geometry but also arithmetic. This is a Euclidean arithmetic, however, that is dependent on the magnitude of straight lines rather than on the manipulation of numbers alone, as in modern arithmetic and algebra.

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of the arithmetic shape of the text.[11] The substance of this book is dedicated to demonstrating that numerical thinking thus extended further, to reflecting on the stuff of poetry, its content and formal properties.

Despite the underlying numerical foundation of poetry and the rich seam of interpretation emanating from no less a source than Homer, numbers in poetry have been a focus of modern scholarship in only a limited way. Most approaches have been positivistic, treating numbers in these works as being used only to impart information or 'facts'. Catherine Rubincam, for example, has examined the use of numbers in Greek poetry as well as historiography, building on and responding to Detlev Fehling's critique of Herodotus' use of numbers.[12] Her study is indicative of a wider attitude towards poets' appeals to number and displays of counting. She provides statistics for the uses of numbers across Greek prose and poetry and the extent to which either might be called precise in their use of figures. The approach may in part work for historiographical prose – it is clear that Thucydides is positivistic when it comes to the Catalogue of Ships – but it is ill-suited to fully explaining a poet's engagement with number and the kind of poetic effect they wish to bring about.

In certain instances, scholars have identified the intriguing nature of poetry that foregrounds matters of counting and calculation, and they have sought to situate poets' engagement with number in a variety of ways. Reviel Netz examines works of Hellenistic poetry and their incorporation of scientific ideas in his 2009 book *Ludic Proof: Greek Mathematics and the Alexandrian Aesthetic*.[13] His study includes a brief discussion of Archimedes' intertwining of poetry and calculating in his *Cattle Problem* (see Chapter 3). For the most part, he is interested in how geometrical activities in antiquity can be fruitfully set beside wider literary practices. Archimedean treatises are interpreted as twisting narratives, the solutions of which are designed to dazzle

[11] Schafer (2017). In a similar vein, stichometric allusions have been observed in Latin poetry, where an echo of an earlier poem appears at the same line numerically; see Lowe (2013); Lowe (2014).
[12] Rubincam (2003). [13] Netz (2009).

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a reader, and he observes similar dazzling displays of sophistication and erudition in contemporary poets such as Aratus, Nicander and Callimachus. He has much less to say about what it meant for poetic forms to incorporate number. From a different perspective, Christine Luz collates and discusses games with literary form in Greek poetry, such as acrostics, pattern poems, palindromes and anagrams. She devotes a whole chapter to isopsephy in poetry, the practice of making verses of poetry add up to the same total when the individual letters are read as numbers.[14] Her study similarly lacks an exploration of the ways in which poets reflected upon the numerical component of their works. The same issue arises with Liba Taub's study of poetry as a genre of science writing in Graeco-Roman antiquity, where she examines both Archimedes' *Cattle Problem* and later versification of arithmetical problems.[15] She provides a clear intellectual and educational background to these poems, but what does not come into focus is the importance of these arithmetical poems for thinking about how readers and poets alike conceptualised the relation between poetry and number. Interest in the intersection of number and poetry, then, has arisen sporadically in various quarters but within the context of rather different analytical projects. What has yet to be described is the significance of numerical operations for an understanding of these various works *as poetry* and the contribution of numerical thinking to both their form and aesthetic programme.

An important starting point is to acknowledge the very strangeness of foregrounding number in poetry. Number as a means of describing the world could be understood as *least* requiring poetry as a medium of communication: numbers and calculations possess their own signifying system that is not, or not entirely, shared with spoken or written language. Poetry is at the opposite end of the spectrum. It is a highly stylised, semantically rich and expressive verbal form. But as Homer's Invocation and its reception demonstrate, points of intersection between the world of poetry and the world of number did not go unexamined. Rather, the combination of diametrically opposed systems of signification – words and

[14] Luz (2010) chapter 6.
[15] Taub (2017) chapter 1. However, Kwapisz (2020a) does move the analysis of the arithmetical poems forward. I engage with his work more closely in Chapter 4.

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numbers – sparked reflections on the capacity of the poet and the nature of poetry. Instead of poetry and numerical thinking being kept separate, later engagements with Homer's Invocation and Catalogue demonstrate an emerging poetics of number that explored the ways in which the poetic medium accommodated counting and calculating as well as the poet's intentions in doing so. My approach is thus to treat the various engagements with number that appear in Graeco-Roman poetry as constituting a productive tension and to examine how poets' representations of these mathematical operations implicitly and explicitly reflect on the implications of this intersection.

The two operations I focus on in this book are counting and calculation, although I do not mean to imply that they are different categories: any manipulation of numbers is calculation. For purposes of organisation and analysis I treat counting as the most basic operation. I call other, more complex operations, such as multiplication, 'calculation'. It is a hermeneutic distinction, but not a categorical division, between addition and arithmetic. 'Counting and calculation' is thus a *conjunctive* shorthand. Unsurprisingly, the sort of mathematical operation displayed is inextricably related to the thought the poet wishes to advance or the effect they wish to produce. Both counting and calculation can already be seen at issue in the examples with which I began. In *Iliad* 2, counting is a concern for Homer inasmuch as he identifies the insurmountable task of counting up such a large number and the poetic extension that it would require. Equally, later readers were attuned to the counting in the passage, which was for them a feasible task, whether it was the ships or individual soldiers who were to be counted. Readers may have had a keen eye for the numerical tally of what is described in poetry, then, but it was a critical interest brought to the fore already by the poet. Yet calculation is also introduced in the Invocation and Catalogue. The arithmetical operation of multiplication enables the poet to present unwieldly content in a more manageable form and to represent himself, not the external Muses, as in control of his narrative material. It is this aspect that the author of the *Contest* has taken to heart in his reworking of Homer's Catalogue as an explicitly arithmetical operation and one that does not (or need

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not) require any form of counting. The ability for arithmetic to bypass simple addition is evident also in the *Ilias Latina* with its concluding calculation that gives the sum of all the ships. Here the reader can even compare and contrast their addition of the different contingents with the final arithmetical account of the ships. The distinction between counting and calculating, elaborated neatly in these examples, provides the two-part structure of the present study, which organises diverse poets' numerical manoeuvres into a progression from the basic to the more complex. But it also responds to the two different roles of counting and calculating: they help poets achieve different aims, and they have different effects on their audience.

As I sketched out in the case of Homer's Invocation, the poet is aware of what effect counting can have on his poetry and – by implication – how this may be judged; he is forestalling any criticism of his Catalogue of Ships not being a full and exhaustive 'catalogue of soldiers'. Part I of the book, 'Counting and Criticism', addresses the phenomenon of counting in later Greek and Roman poetry where it too plays a crucial role in the poet's positioning of their work – or judgement of others' – in terms of both form and content. More specifically, it will focus on a programmatic discussion penned by the Hellenistic poet Callimachus at the opening of his *Aetia* and its influence on later poets.

Chapter 1 first examines Callimachus' well-known Reply to the Telchines in detail. Its aim is to bring out more fully Callimachus' emphasis on counting as a concern of his critics and to highlight how this connects to his wider attempt to use the Telchines as a foil for introducing (as a kind of response) his own aesthetic criteria. This same interest, I then show, is picked up and developed by later poets, who observe Callimachus' stress on the critical importance of counting but who turn their rejection of it to their own ends. Much less positive than the engagements with number discussed in this introduction, these later poets distance themselves from counting as a viable critical mode. Yet also in Callimachus' wake, counting is an aspect of their poetic world that they are unable to ignore. Paradoxically, they end up relying on counting as a possible means of appreciating poetry while simultaneously arguing for quite different criteria of aesthetic value.

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Chapter 2 follows up this conclusion with an analysis of the surviving poems of the Neronian-era epigrammatist, Leonides of Alexandria. Because Greek letters also stand for numerical values, words and whole verses can be counted up; his epigrams are composed so that the two couplets of his four-verse poems add up to the same total. What is so fascinating about these under-appreciated poems, I demonstrate, is that they reverse the trend of rejecting counting as a form of poetic appreciation seen in the previous chapter and instead combine this further type of counting in poetry with a repeated and concerted engagement with Callimachus. Rather than seeing counting as anathema to poetic evaluation as Callimachus had, Leonides engages in a project of presenting his epigrams as nevertheless adhering to Callimachean aesthetics. In Leonides' poems, Callimachus' pronouncements on aesthetics in the *Aetia* and elsewhere are turned to argue for the aesthetic value of his counting compositions.

Part II, 'Arithmetic and Aesthetics', moves from counting to arithmetical operations. Homer and the *Contest* show that multiplication was a form of calculation present in poetry from the earliest times and that it was perceived as such by later readers. However, later poetry sets more complex calculations within poetry (from the perspective of both the composer and the reader), where the ratios of a series of objects are given. In the modern West, such problems would typically be solved algebraically by rephrasing the ratios as a set of simultaneous equations. The form of calculation that the Greeks would have interpreted this to be, and the method they would have employed to solve it, is called logistic, an arithmetical category that will be explained in detail in the introduction to Part II. This second half of the book investigates the subjects of these poetic calculations, the poets' aestheticisations of the calculations and their reflections (both explicit and implicit) about how mathematical operations mould the form in which the 'stuff' of poetry is presented. This analysis will also address larger questions about what happens to the more typical aspects of poetry – especially the role of the reader – when a work is fashioned so as to express an arithmetical calculation.

Chapter 3 offers an in-depth study of the *Cattle Problem* attributed to Archimedes, which outlines the various ratios of the

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different-coloured herds comprising the Cattle of the Sun, figures familiar from Homer's description of them in *Odyssey* 12. The poem was supposedly sent to Eratosthenes, the head of the Alexandrian Library, a fellow mathematician and poet. The chapter begins by reappraising Archimedes' poetic abilities and demonstrates his keen awareness of generic conventions and literary debates as well as his sophisticated allusions to earlier poetic works. I then show that Archimedes, through extensive allusion to Homer's Catalogue of Ships in *Iliad* 2, puts forth a critical attitude both to the calculating capacities of the reader and the traditional capacities of the poetic medium. I subsequently propose that in setting an arithmetical problem for Eratosthenes, Archimedes has drawn inspiration from earlier poetry that incorporates arithmetic and addition in a range of intellectually and culturally competitive scenarios. In so doing, Archimedes signals the stakes of his challenge to Eratosthenes. Archimedes' message to Eratosthenes in the *Cattle Problem* is at once about the mathematical resources of poetry and about the inability of counting and calculation ever to completely encompass and sufficiently express the stuff, the content and the cultural value of poetry.

Chapter 4 examines a collection of arithmetical poems preserved in the fourteenth book of the *Palatine Anthology*, which are largely the product of the Greek Imperial period and of Late Antiquity. These generally overlooked works show later poets again seeking to cloak arithmetical problems in traditional poetic dress. As in the case of Archimedes' *Cattle Problem*, I highlight how the poetic form of these problems indicates the various ways that earlier poetry could be reinterpreted by later readers as containing the seeds of arithmetic. I also contend, however, that these works combine arithmetic and poetry as part of an aesthetic that is notably late antique in nature. The use of arithmetic within poetry becomes an additional strategy of gaining social distinction, on the part of the poet who is able to integrate the two and on the part of the reader who is able to solve the arithmetic. This in turn realigns responsibility for the creation of meaning: the readers themselves must engage with the poem, configure the pieces of the puzzle supplied by the poet and generate a solution. These are poems that predicate poetic appreciation on mathematical competence to

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a degree not seen in earlier works. I conclude the chapter by tracing the poems' afterlife, first in a collection attributed to one Metrodorus and then within the structure of *Palatine Anthology* 14. Here, I argue, it is possible to observe the cultural value placed on arithmetical poetry in the *longue durée*.

My analysis constitutes a series of readings of Graeco-Roman poetry in which counting and calculation are essential components of the works' medium and message. A continuous narrative could well have been taken further, from Homer all the way to modernity. Robert Curtius, for example, has expounded the close links between the poetry of Late Antiquity and the 'numbered compositions' of the Latin Middle Ages.[16] Similarly, the twelfth-century *Carmen de algorismo* (*Poem about Arithmetic*) is a significant point in this history, since the Latin poem popularised for the West the Arabic number system and its methods of computation (and it is not so distant in time from the Byzantine editors of the *Palatine Anthology* with whom the final chapter concludes).[17] Closer to the present day, scholarship is beginning to appreciate number in early modern literature such as Shakespeare, as well as in contemporary literature and poetry.[18] A prime case study of modernist literature would be Raymond Queneau's *Cent mille milliards de poèmes* (*One Hundred Thousand Billion Poems*) that comprises ten sonnets of fourteen lines. The corresponding lines in each sonnet share the same rhyme scheme and rhyme sound, so that any of the sonnets' lines can be substituted with any of the other nine equivalent lines, producing potential combinations of the order 10^{14}. Indeed, while it might be thought of as *avant-garde* from a contemporary perspective, it shares a fundamental principle with the combinatory poetics of late antique Latin poetry, as will become clear in Chapter 4 (Section 2). The story told in this book is evidently part of a much greater poetic phenomenon.

[16] Curtius (1953) 501–9.

[17] Reportedly composed by the polymath Alexander of Villedieu: see Halliwell (1839) 73–83; Steele (1916) Appendix II.

[18] See for example the contributions in the special volume of the *Journal of the Northern Renaissance* (2014) for early modern works, and for contemporary English literature see Connor (2016).

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Number is a topic to which Greek and Roman poets were repeatedly drawn. The Hellenistic period in particular seems to me – on current evidence – to be a formative time for poets being explicit and programmatic in their reflection of the place of number in poetry; this topic is then self-consciously picked up by subsequent poets in the Imperial period and Late Antiquity. Since over half of the Greek poems studied here were written under Roman rule, however, I have defined the time frame as ‘Graeco-Roman’ in order to encompass the fact that I address Greek and Latin poems, but also many Greek poems from the Roman Empire. Certainly, the corpus of texts examined here is also limited: not all Greek and Latin poets have something explicit to say about number, counting or calculation, nor have they marked the introduction of numbers into their verses. Thus, my individual chapters could be read in isolation, since each poet’s focus is relatively discrete and *sui generis*: Leonides and Archimedes, for example, have very different attitudes to the presence of number in poetry. Yet there is a distinct advantage to zeroing in on the narrower scope of Hellenistic and later poetry: by taking them together, a clear picture of a *concerted* poetics of number across antiquity can be discerned. As I set out in the Conclusion, there are recurrent patterns of thought which unite all these attempts to experiment with, to interrogate and to champion the presence of number in poetry, both within the two parts of the book and across them. Not only do poets employ counting and calculation as a means of exploring how poetry handles and presents material and the concomitant effect on poetic form, but they do so by returning to early passages that raise similar issues. What I hope this study as a whole reveals is that engagements with number emerge through the course of antiquity as a constituent aspect of the poetic tradition.

I.3 ‘Poetic Numeracy’ and Greek Mathematics

Poetry’s engagement with number is my primary focus in this book. Yet my analysis also has ramifications for the history of Greek mathematics. The late Classical and early Hellenistic period is crucial for the development of mathematics, if not as

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a discipline, then as a series of connected practices.[19] For François Lasserre, the age of Plato saw the flourishing of geometrical thinking, and David Fowler goes even further in arguing that Plato's Academy played a central role in the perpetuating of mathematics as an intellectual discourse.[20] By the end of the fourth century, Aristotle's pupils had produced various mathematical treatises and Euclid had produced the thirteen books of his *Elements*, which gathered and systematised earlier knowledge. Significant developments were made in the following century by Archimedes and Apollonius of Perga. Undoubtedly, these mathematicians built on much longer traditions now lost to the historical record (both those writing in Greek and the more distant contributions of, *inter alios*, the Babylonians). Nevertheless, this period saw the formation of mathematical literature, inasmuch as a habit developed of producing self-contained works written by identifiable authors. In each case, however, their core interest was geometry, the branch of mathematics that deals with the properties of points, lines, surfaces and solids and their relation to one another. When Fowler talks of the Academy's influence on the development of mathematics as a discourse, he is essentially referring to geometrical developments. As Reviel Netz has described, furthermore, ancient mathematical thinkers and mathematicians were a close-knit group, whose knowledge and practices were not necessarily known to those beyond the profession.[21] He builds on the sociological work of Pierre Bourdieu in arguing for a phenomenon of distinction and exclusion through cultural capital in ancient mathematical texts. Their dense form was attributable to the fact that the mathematician 'had to prove that his writings were a form of literature in their own right' and so produced a text that 'aimed at a few elite members and no one else'.[22] On these terms, the history

[19] Netz (1999) 292–8. For the rise in mathematical thinking, cf. Netz (1999) 274–5: '[u]p to and including the middle of the fifth century BC, not a single alleged reference to mathematics would bear scrutiny'; 'I therefore think mathematics, as a recognisable scientific activity, started somewhere after the middle of the fifth century BC.'

[20] Lasserre (1964); Fowler (1999).

[21] Netz (1999) 292–311: 'Greek mathematics is the product of Greek elite members addressing other elite members' (305); Netz (2002a) 215: 'Greek mathematicians formed an inward-looking group.'

[22] Netz (1999) 306.

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of Greek mathematics has often been written with the elite practices of geometry at its centre.

With regards to arithmetic, David Fowler puts forward the contemporary scholarly consensus at the opening of his study of early mathematics by declaring that 'my first characteristic of early Greek mathematics is negative: it seems to be completely non-arithmetised'.[23] Even Books 7–10 of Euclid's *Elements*, which deal specifically with arithmetic, are remarkable for their lack of numbers and the use instead of lines of varying magnitude.[24] Yet this is the picture that arises by focusing solely on the geometrical treatises that survive, which are, as Netz has noted, the product of an inward-looking elite. But it is possible to produce a broader history of Greek mathematics which extends beyond the traditional remit of Euclid, Archimedes and their kind. For Markus Asper, this has involved identifying two cultures of mathematics in Ancient Greece: practical, everyday mathematics directed towards applicability and the mathematics theorised in highly sophisticated, and undoubtedly elite, treatises.[25] Serafina Cuomo, on the other hand, has written extensively on mathematics as it was practised beyond the elite and challenges any simple delineation between the practical and theoretical.[26] So too, Reviel Netz has produced a provocation for further study into Greek numeracy that seeks to analyse the use of pebbles and counters in Greek culture and their implications for cognitive numerical habits spanning economic, political and symbolic domains: a so-called 'counter culture'.[27] Historians of mathematics in Graeco-Roman antiquity are thus turning their sights to numeracy as a practice separate from, as well as parallel to, geometrical proof. And in contrast to the circumscribed tradition of geometrical treatise, the study of numeracy covers a wide proportion of ancient society.

[23] Fowler (1999) 10. See the similar summary in Heath (1921) 1, 16.
[24] Fowler (1999) 222. [25] Asper (2009), esp. 128–9.
[26] Cuomo (2012) 1–2. See in general Cuomo (2007a); Cuomo (2007b), esp. chapters 2 and 4; Cuomo (2011); Cuomo (2013); Cuomo (2019). Her forthcoming monograph on ancient numeracy will advance this argument across a wide range of material, and it is eagerly awaited.
[27] Netz (2002b).

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Since my aim with regard to the history of Graeco-Roman poetry is to uncover a sustained and embedded critical engagement with counting and calculation, this book will also offer an intervention in this developing scholarly trajectory. In calling for a closer analysis of numeracy in his 'counter culture', Netz commented that 'a crucial feature of élite, literate Greek mathematics (by which I mean the kind of mathematics for which we have evidence in the literary tradition) is its marginalisation of the numerical'.[28] This book seeks to answer that call by proposing that poetry is an underexplored aspect of the literary tradition that does evidence a range of numerical practices and often underscores or comments on the place of counting and calculation in the wider cultural and mathematical *milieu*. And, by beginning in the late Classical and early Hellenistic period, the study expands the arithmetical aspect of ancient Greek mathematics in literate culture precisely at the point at which Greek mathematics is traditionally considered to be at its most geometrical. Of course, this will not be a comprehensive history of non-elite numeracy. I take literature to be an intrinsically elite pursuit in antiquity; in each chapter, it will be open for debate just how well known and accessible the poetic texts were. Since counting and calculating are the earliest rung on the educational ladder, though, all those who could appreciate the poetry would have probably had the skills to handle or at least attempt to handle the operations found therein. While the poems discussed in this book do not exhibit innovation in numerical or arithmetical thinking in the same way that Hellenistic geometrical works do, what this study will demonstrate is that the wider literate culture of antiquity did not marginalise the numerical.

[28] Netz (2002b) 346.

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PART I

COUNTING AND CRITICISM

Saying things takes time; writing things takes up lines. There is always a connection between the length of a verbal utterance (in time when spoken and in space when written) and what it seeks to describe. There is a certain connection between form and content. In the terms I will be using throughout this book, it is a relationship (as yet undefined) between poetic extent and poetic content. How was this relationship perceived in Graeco-Roman antiquity?

Part I focuses on number and counting as one way in which the interrelation of poetic extent and content was understood. Enumerations of poetry – whether of its length or its quantity – enabled an audience to conceptualise and develop an idea of what the appropriate interconnection might be between the 'stuff' that poems contain and the space that is needed to express it. Which is to say, counting becomes one aspect of articulating poetic criticism. My argument across the two chapters of Part I is that Graeco-Roman poets were well aware of the counting criticism that could be directed at their poetry and that they engage with counting as a form of criticism within their poems. Particularly significant is that programmatic statements of poetic principles and of aesthetics contain explicit appeals to counting. Poets incorporate counting and references to counting within their poetry as a means of pre-emptively negotiating the position of their own works and the work of others within the wider literary landscape. Enumeration, in short, plays an abiding role as a component of poets' self-advertisement of their distinctiveness, novelty or traditionality.

The story begins in Chapter 1 with the Hellenistic poet Callimachus of Cyrene and the influential prologue to his catalogue poem, the *Aetia*. There, he is emphatic in raising the topic of counting as criticism, only to reject it as a viable means of poetic judgement. In this chapter, I set out the argument of the passage more clearly in relation to poetic enumeration, its connection

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(implicit and explicit) to earlier scenes of criticism and the kind of poetic appreciation that Callimachus ultimately proposes. In place of enumerative strategies for assessing poetry, Callimachus proposes evaluating poetry's intellectual value, its σοφία (*sophia*, 'wisdom'). I then trace the later influence of this passage and how subsequent poets responded to Callimachus' rejection of counting and introduction of a criterion that does not involve numerical measure. It will become clear that while they are attuned to Callimachus' emphasis on appraising poetry rather by its refined intellectual calibre, they nevertheless continue to raise and enact enumerative accounts of others' work and of their own. Counting as an evaluative tool is certainly being rejected by these poets, but – paradoxically – their compositions equally evidence that it has become part of the Graeco-Roman discourse on poetic criticism.

Nowhere is this paradox developed more starkly than in the isopsephic epigrams of Leonides of Alexandria, the focus of Chapter 2. His poems take advantage of Greek letters' ability to signify numbers and be read as units, tens and hundreds. When the letters in his poems are interpreted as numbers, they yield couplets of equal numerical value. He makes a radical intervention into the debate about the validity of counting criticism by creating epigrams which are quite literally textual tallies. This compositional strategy is no marginal ornament to Leonides' otherwise accomplished poetry, a literary game to be observed then ignored. Leonides' epigrams, I demonstrate for the first time, actively engage with Callimachean poetics – in the *Aetia* and elsewhere – in arguing for the sophistication, the *sophia*, that emerges from a poetry which can be counted in the most literal sense. For all that Callimachus sought to make a justifiable and clear distinction between the world of numbers and the world of poetry, then, I show over the course of Part I that engaging with counting as a form of criticism was a poetic habit that proved difficult to kick.

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1

CALLIMACHUS AND HIS LEGACY

In this chapter I examine a poem by Callimachus and its legacy in Graeco-Roman poetry. Callimachus was a prolific Hellenistic author of poetry as well as prose. He was a voracious reader of earlier literature and versatile in his composition of new works, composing epigrams, hymns, iambics, lyric poems, an epyllion (miniature epic) and a catalogue elegy, all innovative in generic form and intellectual content. His poetry had a considerable impact on Augustan Latin poets, as did his cataloguing efforts at the Library of Alexandria on literary history and bibliography. There is no doubt that he is an important and influential poet.[1] My intention in this chapter is to demonstrate that one undervalued strand of this literary heritage is his involvement in the question of the place of number and counting in the literary evaluation of Greek, and so subsequently Roman, poetry.

This chapter begins by analysing the opening lines of Callimachus' *Aetia*, in which he addresses the Telchines and their criticism of his poetry and offers a response that outlines his own position. The Reply to the Telchines constitutes a significant and extended engagement with Hellenistic literary currents. It was well known, valued and imitated in antiquity, and it has been the focus of considerable modern scholarship.[2] My contribution to the interpretation of these heavily commented-upon lines will be to emphasise

[1] For his versatility and engagement with earlier traditions see e.g. Hunter (1989a); Hunter (1996); Hunter (1997); Acosta-Hughes (2002); Acosta-Hughes and Stephens (2002); Acosta-Hughes et al. (2011) part 3; Acosta-Hughes and Stephens (2012) and the edited volumes of Harder et al. (1993); Harder et al. (2004); Klooster et al. (2019). The commentary of Harder (2012) now stands as fundamental reference work that catalogues all Callimachus' literary interactions in the *Aetia*. For his influence on Roman poets see e.g. Wimmel (1960) and Hunter (2006); for his contribution to bibliography see Blum (1991).

[2] Cf. e.g. Verg. *Ecl.* 6.3–5, Hor. *Sat.* 1.10, Prop. 3.1 and 3.3, Oppian *Cyn.* 1.20–1. Wimmel (1960) 128–65. For further extensive bibliography on the Reply and the reception of individual phrases and verses see Harder (2012) II, *ad loc.*

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the presence of number and counting. I study both Callimachus' characterisation of the Telchines' attack and his response to their criticism, with the aim of showing that the Reply's debate about poetic form and content can be better understood by appreciating the role of counting. This will involve first looking back to depictions of poetic criticism that Callimachus has inherited, and more specifically to the contest between Aeschylus and Euripides in Aristophanes' *Frogs*, in order to more clearly appreciate his representation of the Telchines as critics and what their counting implied. I then discuss Callimachus' second address to the Telchines later in the Reply and demonstrate how his account of Apollo's advice to him as a youth is intended to replace length as a criterion with a measure of poetry that does not require number. One important aim of the Reply, in short, is Callimachus' attempt to extricate his poetry from criticism based on counting.

Having reappraised Callimachus' engagement with number and counting, I then focus on a series of further Greek and Latin works that follow Callimachus in his resistance to counting as a criterion of judgement, but that also develop their anti-numerical stance in new contexts. I first examine an epigram by Antipater of Sidon praising the poet Erinna and her style. In describing Erinna, I show, his epigram hews close to Callimachus and his emphasis on the non-numerical measure of *sophia* for poetry instead of numerical length. Antipater's rhetorical use of counting within the epigram, however, adds to the Callimachean aspects. He underscores that when poems are produced in large quantities, particularly short forms like epigram, their sheer multiplicity precludes an appraisal in any other terms than the numerical, which leads to their inevitable neglect. An excessive *number* of poems can be just as bad as a poem of excessive length: counting, Antipater implies, is helpful for neither.

I turn in the third section to select Roman receptions of Callimachus' engagement with counting. From an analysis of poems 1, 5 and 7 in Catullus' collection, it will become clear that Callimachus' stance with regards to counting as a form of criticism remained a salient intertext. Catullus moves from employing enumeration as a form of self-positioning in the clearly programmatic *c.* 1, towards the performative use of counting in *cc.*

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5 and 7 in order to (attempt to) reject criticism as a cultural practice in its entirety. Catullus turns the critics' tool against them. Later poets were not so brazen. An epigram by Martial with which I conclude the chapter shows that criticism could (be imagined to) extend to the number of books of poetry as well as the number of poems or verses. Martial's response, alluding to Roman predecessors rather more than to Callimachus, nevertheless fits neatly into this tradition as he attempts to square the Callimachean rejection of measuring poetry with the question, raised already by Antipater, of how many poems are *too many*. What I hope will become clear over the course of this chapter is that Greek and Roman poets found it important to follow Callimachus' lead and to avoid critics counting up their compositions.

1.1 Counting in Callimachus' Reply to the Telchines

Callimachus begins his *Aetia*, or one edition of it at least,[3] by giving voice to his critics, whom he represents as the Telchines, dwarf-like Rhodian metalworkers:

πολλάκι μοι Τελχῖνες ἐπιτρύζουσιν ἀοιδῆι
νῆιδες οἳ Μούσης οὐκ εγένοντο φίλοι,
εἵνεκεν οὐχ ἓν ἄεισμα διηνεκὲς ἢ βασιλ[η
. . . . .]ας ἐν πολλαῖς ἤνυσα χιλιάσιν
ἢ . . . ..].ους ἥρωας, ἔπος δ' ἐπὶ τυτθὸν ἑλ[ίσσω
παῖς ἅτε τῶν δ' ἐτέων ἡ δεκὰς οὐκ ὀλίγη.
. . . . .].[.] και Τε[λ]χῖσιν ἐγὼ τόδε· "φῦλον α[
. . . .] τήκ[ειν] ἦπαρ ἐπιστάμενον,
. . . . .]..ρεην [ὀλ]ιγόστιχος·

(Callimachus *Aetia* fr. 1.1–9 Harder)

[3] Pfeiffer (1928) 338–41 read the Reply autobiographically and argued that it must have been added to a later edition of the *Aetia*. Parsons (1977) 49–51 proposes that the Reply (fr. 1 Harder) and the Epilogue (fr. 112 Harder) frame the four books of the *Aetia*, following Callimachus' composition of Books 3–4 at a later date. Cameron (1995) 174–84 makes the case that the Reply began the first edition of Books 1–2. I would tend to follow the attitude of Schmitz (1999a) and Asper (2001) that the Reply is rather a foil to outline his aesthetic credo rather than strict autobiography, a position that few would hold today in any case. This, of course, does not resolve the question of when and for what version of the *Aetia* the Reply was composed, but my analysis here does not rely on any specific dating or version.

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Often the Telchines mutter against me, against my poetry, who, ignorant of the Muse, were not born as her friend, because I did not complete one single continuous song (on the glory of?) kings … in many thousands of lines or on … heroes, but turn around my *epos* a little like a child, although the ten-count of my years is not small. I in turn say this to the Telchines: 'tribe, well able to waste away your own liver … of a few lines'[4]

Regardless whether the Telchines represent historical individuals, in the poem they serve as a foil for Callimachus to introduce his own approach to poetry.[5] My interest here is the constellation of numerical terms which cluster in the opening lines and characterise aspects of the Telchines' literary criteria and concomitantly mark out Callimachus' lack of adherence to them. Callimachus' claim that the Telchines desired a single poem in many thousands of lines constitutes the core of my focus. It has been at the centre of considerable debate. While Callimachus' critics, he says, grumble at him for not composing something which sounds very much like epic, Alan Cameron argues forcefully that at issue in the prologue was not Hellenistic epic, either mythological or historical, but the different styles of contemporary elegy.[6] Such a proposal is supported by Callimachus' subsequent contrast of elegiac poets and their works (9–12; Mimnermus, Philetas, Antimachus(?)). The suggestion is weakened, however, by the emphasis on kings and heroes and the fact that '[k]ings, both contemporary and mythic, and heroes figure in virtually every fragment'.[7] If the Telchines criticise Callimachus' poem for its focus on kings and heroes it is not likely to be a representative of the kind of elegiac poetry that he alludes to in the following lines. It should be observed, though, that the Reply deals with a range of concerns at once – size (9–16), novelty (25–8) and aurality (29–34) – which are all represented as in some way responding to the four lines of criticism. There is an obvious mismatch between the brief criticism of the Telchines and Callimachus' much more extended response. Instead of seeing any one section of the response mapping directly and easily on to the

[4] Translations of Callimachus' *Aetia* are adapted from Harder (2012).
[5] For the biographical tradition see Lefkowitz (1980) and for the Telchines as a foil see Schmitz (1999a); Asper (2001).
[6] Cameron (1995) 328: 'It is contemporary elegy that was the bone of contention between Callimachus and his critics.'
[7] Acosta-Hughes and Stephens (2002) 242.

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Telchines' critiques, there is more to be gained by seeing their criticism as misguided because of the very framework within which it operates and then seeing Callimachus replace as well as reject and reformulate their criteria. My argument is that this is precisely what Callimachus does in the case of numerical criticism. By spotlighting first the literary history of the Telchines' enumeration and then setting it alongside more well-established aspects of Callimachus' programme, I wish to show how he deconstructs the idea of poetic judgement as a form of numerical measurement which can be applied to a poem's extent and then compared with its content. Instead he articulates a way of thinking about poetic form and content *beyond* enumeration.

1.1.1 *Aristophanes'* Frogs *and Models of Counting Criticism*

In Aristophanes' *Frogs*, Dionysus ventures to the underworld with the intention of retrieving Euripides, yet on arrival at Pluto's house it transpires that Euripides has challenged Aeschylus' claim to be the best tragedian. The ensuing poetic contest between Euripides and Aeschylus sees the two playwrights exchange representative verses from their plays as well as critique and attempt to undermine each other's poetic styles. The decision Dionysus must make at the end is to choose whomever he considers to be the tragedian best equipped to save Athens, and he chooses Aeschylus. The contest was important for the later tradition not just because of the focus on explicit poetic judgement within poetry itself, but also because of the range of criticism used to appraise and evaluate the tragedians' works. As has long been observed, the contest was one of a number of key intertexts for Callimachus in the Reply. He reconfigures those many images of poetry and its evaluative criteria in staging his own contest with, and response to, the Telchines.[8]

An underexplored aspect of the *Frogs* is the audience or critic as a counter of poetry. After each of the tragedians has outlined their own poetic credo, defended their verbal art and rubbished their

[8] See e.g. Wimmel (1960) 115 n.1; Clayman (1977); Cameron (1995) 328–9; Acosta-Hughes and Stephens (2002) 246–7; Nelson (2018) 245–51.

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opponent (907–1118), Euripides and Aeschylus turn to criticising lines from each other's prologues, with Dionysus as arbiter. When Aeschylus recites the opening of the *Oresteia*, Dionysus asks Euripides what aspects there are to criticise.

ΕΥ: πλεῖν ἢ δώδεκα.
ΔΙ: ἀλλ᾽ οὐδὲ πάντα ταῦτά γ᾽ ἔστ᾽ ἀλλ᾽ ἢ τρία.
ΕΥ: ἔχει δ᾽ ἕκαστον εἴκοσίν γ᾽ ἁμαρτίας.
ΔΙ: Αἰσχύλε παραινῶ σοι σιωπᾶν: εἰ δὲ μή,
πρὸς τρισὶν ἰαμβείοισι προσοφείλων φανεῖ.[9]
(Aristophanes *Frogs* 1129–33)

Eur: More than twelve.
Dion: But all of that is not more than three lines long!
Eur: And each one has twenty errors.
Dion: Aeschylus, I advise you keep quiet. If you don't, you'll stand to owe more than three iambic lines[10]

Presenting himself as an arch-investigator, Euripides tallies up the things which can be criticised and, when Dionysus notes that only three lines have been given, he accounts more specifically the line-to-mistake ratio. Euripides later enacts a different accounting of Aeschylus' plays: εἰς ἓν γὰρ αὐτοῦ πάντα τὰ μέλη ξυντεμῶ ('I will reduce all his lyrics into one [sort]', 1262); Euripides shows that all Aeschylus' lyrics are based on the same metrical pattern. In response, Dionysus joins in with the counting: καὶ μὴν λογιοῦμαι ταῦτα τῶν ψήφων λαβών ('and indeed I will take some pebbles and reckon them', 1263). Euripides will go on also to question the logic of Aeschylus' plays (1139–50) and even critique the collocation of verbs (1152–7). Aeschylus' criticism of Euripidean prologues, by contrast, is not concerned with counting mistakes or metrical patterns; he instead appends the bathetic '[he] lost his little oil flask' (ληκύθιον ἀπώλεσεν, 1208, 1213, 1219, 1226, 1233, 1238, 1241) to Euripidean lines. It no doubt made the audience laugh, but it is a playful undermining of his poetry rather than a poetic nitpicking. Aeschylus did have specific criticisms of Euripides earlier, such as his debasement of the art and the presentation of unworthy models for the audience (1013–17,

[9] The Greek follows Dover (1993).
[10] Translation adapted from Sommerstein (1996).

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1039–44), but when particular lines become the focus, he does not bring the same pedantic level of scrutiny as Euripides. Hellenistic poets were well versed in contemporary literary scholarship and composed their poems in such a way as to reflect literary critical interests.[11] From a later standpoint, Euripides' 'setting of reason and inquiry into the poetic art' (λογισμὸν ἐνθεὶς τῇ τέχνῃ | καὶ σκέψιν, 973–4) that was aimed at getting the audience to examine their household organisation more thoroughly (975–9) could be seen to present one model of Hellenistic poetic practices.[12]

The final weighing of Aeschylean and Euripidean verses presents an enumerative appraisal of poetry from a different perspective. Euripides chooses a 'heavy' line from his *Meleager* (531 *TrGF*), an 'iron-heavy club' (σιδηροβριθές . . . ξύλον, 1402), while Aeschylus chooses a battle line from his *Glaucus Potnieus* (38.1 *TrGF*) with two uses of polyptoton: 'for chariot upon chariot and corpse upon corpse' (ἐφ' ἅρματος γὰρ ἅρμα καὶ νεκρῷ νεκρός, 1403). Dionysus, no doubt influenced by Euripides' counting, reduces Aeschylus' polyptota into numbers: 'He put in two chariots and two corpses, which even a hundred Egyptians could not lift' (δύ' ἅρματ' εἰσέθηκε καὶ νεκρὼ δύο | οὓς οὐκ ἂν ἄραιντ' οὐδ' ἑκατὸν Αἰγύπτιοι, 1405–6). This supposed arbiter of the contest keeps straying into a rather strict numerical approach to poetic appreciations.[13] Aeschylus rejects this method; Euripides could throw himself, his family and all his books on the scales (1407–9), all Aeschylus needs is 'two lines' (δύ' ἔπη, 1410). It is not that Aeschylus is not interested in his verses being evaluated; indeed, he is eager for the weighing to occur since he sees it as the decisive form of judgement (1366–7). Rather, he is making the point that the weight of poetry is not equivalent to its verses, however many there are and however many numbers they are stuffed with. He implies instead that the weight comes from their style. Despite this form of measurement clearly favouring Aeschylus and his weighty

[11] For Hellenistic poetic responses to Homeric scholarship see Rengakos (1993).

[12] Hunter (2009) 21–5 sets out the affinities between the poet's questioning and early poetic scholarship and criticism.

[13] His interjection at 1400 to advise Euripides what to say is also emphatically numerical: 'Achilles has thrown two dice [probably meaning 'ones'] and a four' (βέβληκ' Ἀχιλλεὺς δύο κύβω καὶ τέτταρα).

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words in the *Frogs* – there is no tool for measuring 'lightness' . . . – it is not ultimately the basis on which the winner is chosen. It is the poets' respective advice and value to the polis which ultimately informs Dionysus' decision (1417–23). Consequently, the respective success of their poetry is defined neither against Euripides' counting up of errors nor against Aeschylus' weighing. These two forms of criticism can be applied to poetry but are not represented as conclusive within the logic of the play.

The contest in the *Frogs* thus provides Callimachus with two forms of poetic measuring: a weighing and a counting. As with other contrasts between Aeschylus' and Euripides' judgements in the *Frogs*, however, the incorporation of these two forms of criticism into Callimachus' prologue is not straightforward. Callimachus addresses three contrasting criteria that can also be observed in the *Frogs*: poetic fatness versus thinness,[14] sonic contrasts[15] and the measurement of poetry.[16] The contrast in the Reply between Callimachus and what the Telchines hoped for broadly draws on the distinctions between Euripides and Aeschylus as poets, the one being bloated and bombastic, the other streamline and subtle. There is, though, no consistency in the way the contrasts in *Frogs* map on to those in the Reply. Elsewhere in the prologue, Callimachus intertwines numerous images and intertexts, meaning that simple polarities of poetic style are undermined. For example, in contrast to the clear cicada there is the braying sound of the ass (30–1) but there is also the thundering of Zeus, which is not obviously negative or positive (20). Similarly, the paths that Callimachus is advised to follow are not wide but both untrodden *and* narrow (27–8). This seems to be

[14] Compare the fat tragedy slimmed down by Euripides after Aeschylus (941), and the 'big lady' of Mimnermus fr. 1.9–12 Harder. Euripides is a slender speaker (828, 956), and Apollo advises Callimachus to raise a slender Muse (fr. 1.24). For an extended exploration see Cameron (1995) 303–38; Asper (1997) 135–207.

[15] Aeschylus' poetry is loud-thundering (814), whereas Euripides' poetry is simply winged (1388). Callimachus rejects a requirement to thunder (fr. 1.20) and wishes to be 'winged' and produce a 'clear sound' (fr. 1.29). For more on the contrasts of sound here see Livrea (1996); Acosta-Hughes and Stephens (2002) 35–40.

[16] In the *Frogs*, Aeacus explains to Xanthias that Pluto is planning 'to make a trial and test of their skill' (ποιεῖν . . . κρίσιν | κἄλεγχον αὐτοῖν τῆς τέχνης, 785–6), and Euripides' and Aeschylus' lines are weighed (1365–1410). Callimachus wants poetic *sophia* 'judged by skill, not the Persian chain' (τέχνηι | κρίνετε, μὴ σχοίνωι Περσίδι, fr. 1.17–18), on which see more below.

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used to direct him to novelty of subject matter, but the contrast of wide and narrow also has stylistic connotation.[17] In engaging with earlier conceptions of poetry, he is often seeking to reconcile them or expose their contradictions at the same time as he is forging an image of his poetry's own uniqueness.

Euripides' counting and Aeschylus' weighing as a contrasting pair of scenes that address the measuring of poetry are likewise cross-fertilised in the Reply to characterise both Callimachus' poetry and the Telchines' poetic preferences. On the one hand, it is Euripides together with his fellow accountant Dionysus who considers the numerical mode to be a (meaningful) form of criticism. This is the position of the Telchines in the opening lines when they show their concern for the number of verses that Callimachus has composed. On the other hand, it is Aeschylus who wishes for his and Euripides' poetry to be judged in terms of their weightiness – a challenge that cannot help but favour Aeschylus. For Callimachus too, poems can be weighed against each other. Yet, in contrast to the weighing in *Frogs*, it is a slender work that paradoxically outweighs the larger. Callimachus states: ἀλλὰ καθέλκει | . . . πολὺ τὴν μακρὴν ὄμπνια Θεσμοφόρος ('But the nourishing Lawgiver by far outweighs the long . . .', fr. 1.9–10 Harder). While much is unclear in these fragmentary lines, on the basis of the *scholium* identifying a reference to a poem by Philetas in these verses (fr. 1b.12–15 Harder), it is probable that the 'nourishing Lawgiver', an epithet of Demeter, refers to Philetas' *Demeter*. On the same basis, it is also probable that the *Demeter* was meant to be a short poem that outweighed some longer poem, either by Philetas or by another poet altogether.[18] Poetry which is λεπτός (*leptos*, 'slender') like Euripides' words can succeed in a weighing contest just as Aeschylus' two lines would. Callimachus rejects Euripides' counting strategy for poetic evaluation and uses instead the idea of weighing as Aeschylus had suggested, but he also values slender Euripidean-style poetry rather than longer compositions. This adds a further level to the Reply's reception of Aristophanes' multiple conceptions of

[17] Harder (2012) II, 66–7.
[18] For an extended discussion of the possible interpretations and further bibliography see Harder (2012) II, 32-6.

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literary criticism in the *Frogs*. Callimachus may (in general) take over his poetic self-representation from the figure of Euripides, but in talking about the *Demeter* he utilises the mode of poetic judgement which was used by, and favoured, Aeschylus.

In seeking to elucidate this reconfiguration of Euripidean and Aeschylean poetic characterisations, Benjamin Acosta-Hughes and Susan Stephens have appealed to historical context. Callimachus' modification of the judgement that the weightiest wins highlights an interest in a different kind of wisdom or knowledge, where the subtle art of persuasion trumps the destructive art of warfare, a shift that they see as related to the political circumstances of the Ptolemaic state.[19] To my mind, the rejection of Euripides' counting and modification of Aeschylus' weighing together find an explanation much closer to home. Callimachus as a scholar was more than familiar with an enumerative approach to literary works. Organising the Alexandrian Library's collection, he produced the *Pinakes*, a list which gave an account of its holdings. He was concerned with placing texts into generic categories but also with the number of lines in a text. It was foundational for later bibliographical writings, although it survives only in fragments.[20] The form of entries is as follows:

τοῦ Χαιρεφῶντος καὶ σύγγραμμα ἀναγράφει Καλλίμαχος ἐν τῷ Παντοδαπῶν Πίνακι γράφων οὕτως· δεῖπνα ὅσοι ἔγραψαν· Χαιρεφῶν Κυρηβίωνι. εἶθ' ἑξῆς τὴν ἀρχὴν ὑπέθηκεν· "ἐπειδή μοι πολλάκις ἐπέστειλας." στίχων τοε΄. (Callimachus fr. 434 Pf. = Athenaeus 6.244a)

Callimachus also lists a prose treatise by Chaerephon in his *Catalogue of Miscellaneous Works*, writing as follows: Authors of descriptions of dinner parties: Chaerephon to Bran [the nickname of a parasite called Epicrates]. Then immediately afterward he appends its opening words: 'Since you often wrote to me'. 375 lines of text.

Broadly speaking, this form of categorising influenced how genres were defined, making categorical pronouncements regarding which list a work should be written upon. Since it was placed in the catalogue of miscellaneous works, Chaerephon's treatise was a composition that was hard to pin down generically. In creating

[19] Acosta-Hughes and Stephens (2012) 46.
[20] See Blum (1991) chapter 4 and chapter 5 on the reception of the *Pinakes*.

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the *Pinakes*, importantly, Callimachus *pioneered* the consistent and systematic counting up of lines. This makes the Reply all the more surprising: he characterises the Telchines as having the same enumerative habit which he himself had practised in the creation of the *Pinakes*.

It can be nothing but purposeful that a poet who recorded prologues and counted lines chose to respond in his prologue to an alleged interest in a poem's number of lines. This can best be explained as a conflict between poetic composition and criticism. Counting may well make sense in the context of the Alexandrian Library, where texts were being inventoried, catalogued and stored. It makes less sense for a composing poet. Later sources record that in the generation before Callimachus, Choerilus of Iasus in the retinue of Alexander was notorious for selling his verses for a fixed price per line (*SH* 333). Callimachus may thus have had something to prove, both because his patron was a Macedonian monarch and because his 'day job' was listing books and counting up the lines of texts. He may have wanted to emphasise that composition of poetry should not be 'by the line' either because of the financial reward from rulers or because of bibliographic practice. His caricature of the Telchines' counting represents them as making this precise mistake, of taking counting to be a tool of criticism rather than a bibliographic feature. Whereas Callimachus has a tendency in the Reply to align himself with Euripides' representation in *Frogs* – for example, in the slender, winged and airy nature of his poetry (cf. fr. 1.32–4 Harder and 1388, 1396)[21] – his deviation in respect of Euripides' counting makes it clear that *as a poet* he pays no heed to the number of verses, nor does he see it as an important criterion.

In responding to the Telchines' enumerative criticism, as Acosta-Hughes and Stephens have demonstrated, Callimachus draws on various images from earlier poetry through which poets articulated their poetics: his reference to the battle of the pygmies and the cranes comes from the *Iliad* (3.3–6; cf. fr. 1.13–14); the battle of the Medes and Massagetae, from an epic by Choerilus of Samos (*SH* 317; cf. fr. 1.15–16); the wagon and the

[21] Callimachus is also influenced by Plato's *Ion* 534b here; see Hunter (1989a).

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narrow path, from Pindar (*Paean* 7b.11–12); the fable of the ass and the cicada, from Aesop (e.g. 184 Perry; cf. fr. 1.29–34); and Aetna and Enceladus, from Euripides (*Heracles* 638–40; cf. fr. 1.35–6).[22] Whereas the Telchines judge using the bibliographic tool that Callimachus had invented for the Library, Callimachus himself advances an approach to poetry based on its imagery and on the terms in which poets themselves had viewed their works. The Telchines, since they are 'no friend of the Muse' (fr. 1.2), understand and appreciate poetry through a numerical criterion alone and not as a poetically and culturally generative process.[23] When it comes to his use of poetic images as well as his rejection of number in this Prologue, Callimachus is very much on the side of the poets. This aspect of the Reply clarifies Callimachus' reworking of Aeschylus' weighing alongside the rejection of the Telchines' counting which is so reminiscent of Euripides in *Frogs*. Despite his wish to have their respective verses weighed up, as I outlined above, Aeschylus corrects Euripides' assumption that the number, or numerical content, of the verses correlates with their weight. Aeschylus defines this poetic weighing as a judgement that does not correspond to the traditional measuring and numbering of an object's weight when set on a balance. In arguing against the application of bibliographic practice to poetic appreciation, Aristophanes' *Frogs* provides Callimachus with a model of counting criticism in Euripides but also with a model for measuring the value of a poem in a way that does not involve number.

1.1.2 *Apollo's Advice and a New Measure of* sophia

The opening lines of the Reply, then, see Callimachus distance himself from his bibliographical practice in the *Pinakes* and project counting as a form of literary criticism on to the figure of the

[22] See Acosta-Hughes and Stephens (2002) and Harder (2012) II, *ad loc.*

[23] This is not to imply that librarians are thus no friends of the Muse. Historically speaking it is probable that those who worked in the Alexandrian Library also had access to the connected Museum and its intellectual, collegiate environment. The practice of the librarian, though, is not the same as that of the critic or the poet. Callimachus, in my view, is arguing against the application of bibliographical treatments of texts to the criticism of poetry, not the practice of bibliography per se.

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Telchines. The poem by Philetas outweighing the longer poem in verses 9–11 presents in response a form of literary judgement that may seem to be related to measure but which does not involve enumeration.

A second address to the Telchines later in the Reply resumes the question of poetic form and how it ought to be judged. Here, Callimachus defines more clearly and positively the criterion he sees as the correct kind of poetic judgement; it is one where counting plays no part.

ἔλλετε Βασκανίης ὀλοὸν γένος· αὖθι δὲ τέχνηι
κρίνετε,] μὴ σχοίνωι Περσίδι τὴν σοφίην·
μηδ' ἀπ' ἐμεῦ διφᾶτε μέγα ψοφέουσαν ἀοιδὴν
τίκτεσθαι· βροντᾶν οὐκ ἐμόν, ἀλλὰ Διός."
καὶ γὰρ ὅτε πρώτιστον ἐμοῖς ἐπὶ δέλτον ἔθηκα
γούνασιν Ἀπ[ό]λλων εἶπεν ὅ μοι Λύκιος·
"..... ..ἀοιδέ, τὸ μὲν θύος ὅττι πάχιστον
θρέψαι, τὴ]ν Μοῦσαν δ' ὠγαθὲ λεπταλέην·

(Callimachus *Aetia* fr. 1.17–24 Harder)

Be off, destructive breed of Bascania, and hereafter judge cleverness by craft, not by the Persian *schoinos*. Do not expect a loud thundering song to be born from me. For when I put a writing-tablet on my knees for the first time Apollo Lycius said to me: '. . . poet, feed the sacrificial animal so that it becomes as fat as possible, but, my dear fellow, keep the Muse slender'.

Callimachus wishes to get away from the Telchines as critics and forge a new means of conceptualising poetic value, drawing on his patron god Apollo for support in the endeavour. This further characterisation of the Telchines implies that they are more interested in measure and extent than enumeration per se, although the two are of course connected. The Telchines' judgement is again of the same kind as Euripides' in *Frogs*. Euripides is a counting critic, but he also presents himself as the poet who taught the Athenians 'the introduction of subtle rulers and the set-squarings of words' (λεπτῶν τε κανόνων εἰσβολὰς ἐπῶν τε γωνιασμούς, 956). The implication of Callimachus' verses, that the Telchines would use the Persian *schoinos*, can be interpreted in two ways: as condemning poetic judgement that is interested in quantity alone, or that the *schoinos*, which is many *stadia* long, is condemned because of its *excessive* length. The Telchines are introduced in the Reply as

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interested in 'continuous' poems of 'thousands' of lines, which, in addition to representing them as interested in an enumerative form of poetic appreciation, suggests a focus on extremes of extent. The couplet following the mention of the *schoinos* in the above passage (19–20) provides some help in dealing with these two options. While Annette Harder seems to rule out an association between Zeus and Homer, I would instead follow those who see these lines as Callimachus distancing his own poetry from the grandeur of Homeric epic, without any negative implication for the thundering of Zeus or the Homeric style.[24] Such an interpretation, moreover, helps explain the progression of Callimachus' argument. At 17–18 there is a command to replace a criterion of measure with that of *sophia.* If the *schoinos* is bad because it is both a criterion of extent and one which is excessive, then the couplet rejecting thundering (19–20) deals with the imagined excessive quality of the poetry that the Telchines value, such as long epics, while the following four lines (21–4) deal with extent as a criterion per se by employing the language of fatness and thinness.

The image of fat and thin sacrifices seems also to have the contest in *Frogs* in mind, recalling Euripides' mention of inheriting the bloated τέχνη (*technê*, 'art') of tragedy from Aeschylus, which he then thins out (941). Callimachus is likewise thinking about his poetic practice and the type of qualities he wishes to embody when he describes the Muse that he has been instructed to cultivate as thin. Although it may initially appear that this contrast of fat and thin sacrifices is concerned with numerical measure, it is important to understand that this mention of a 'slender Muse' follows on from the discussion of his preference for poetry to be judged by *technê*. The γάρ at line 21 is explanatory: his promotion of poetic judgement not beholden to measure in 17–20 is *because* he cultivates a 'slender Muse' following Apollo's advice given at 21–4. In which case, slenderness cannot be a criterion susceptible to numerical measuring (as, for example, length and weight are), since this would make for a confused connection between the

[24] See Harder (2012) II, 54–5. The position I take is argued by, *inter alios*, Asper (1997) 196–8 and Petrovic (2006) 24–6.

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advice which Apollo gave the poet in his youth and Callimachus' immediately preceding dismissal of the *schoinos* as a criterion in favour of *technê*: his rejection of enumerative criticism would have arisen from the god's promotion of a numerically measurable aesthetic quality.[25] The resulting sense would be something like, 'do not judge poetry by length … although Apollo told me to cultivate a countable Muse'. The fact that sacrifices should be fat and poems slender, however, is not to say that the relationship between form and content should be abandoned, despite numerical measurement no longer being a criterion.

A roughly contemporary passage illuminates Callimachus' thinking, since it too extracts enumeration from the critics' toolkit (at least as an absolute concept) and has rather a speaker or poet's intellectual ability in its sights:

τὸν μὴ λέγοντα τῶν δεόντων μηδὲ ἓν
μακρὸν νόμιζε, κἂν δύ' εἴπῃ συλλαβάς,
τὸν δ' εὖ λέγοντα μὴ νόμιζ' εἶναι μακρόν,
μηδ' ἂν σφόδρ' εἴπῃ πολλὰ καὶ πολὺν χρόνον.
τεκμήριον δὲ τοῦδε τὸν Ὅμηρον λαβέ·
οὗτος γὰρ ἡμῖν μυριάδας ἐπῶν γράφει,
ἀλλ' οὐδὲ εἷς Ὅμηρον εἴρηκεν μακρόν.

(Philemon fr. 99 KA = Stobaeus 3.36.18)

Consider long-winded the man who says not even one of the things which is necessary – even when he says two syllables – but consider not to be long-winded the one who speaks well – even if he speaks very many things and for a long time. Take Homer as evidence of this; for he has written tens of thousands of lines for us, but not one person has said that Homer is long-winded.

This is a fragment of the comic poet Philemon, active in the decades preceding and following the start of the third century BCE. Since it is recorded by Stobaeus (fifth century CE) in his collection of excerpts (his *Anthology*), neither a secure context for the lines nor the identity of the speaker can be ascertained. As a fragment from a comic work aimed for the stage, though, these lines provide additional evidence for a debate about the

[25] Certainly Callimachus can be playful in his combination and collapsing of competing literary priorities and perspectives. It would be illogical in this case, however, for Apollo's advice to be contradictory when Callimachus' earlier words are said to be justified on the very basis of what Apollo had told him as a child.

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interrelation of poetic content and extent, beyond the elite, intellectual circle for which Callimachus was writing. Quite different from what Callimachus alleges the Telchines have to say about a 'single' poem in many lines, the contrast of the one and the many in Philemon playfully shifts from someone speaking at length but not saying a single important thing to Homer as someone who has written many thousands of lines but is not called long-winded by a single person. Still, Philemon's passage is important for understanding the articulation of Callimachus' poetic credo. In short: enumeration for the speaker is beside the point. Even if one speaks few and countable utterances (δύ' εἴπῃ συλλαβάς), if they do not say 'necessary' or 'essential' things (τῶν δεόντων) then they ought to be considered long-winded.[26] The speaker is not concerned with brevity, then, as Alan Cameron suggests in his important discussion of the passage, but is promoting a compact relationship between intellectual import and length, without making length (or indeed extreme brevity) a criterion per se.[27] The focus on 'not-long-windedness' in this fragment pushes poetic judgement beyond measurement precisely by making the 'two words' or 'thousand lines' ultimately irrelevant polar opposites. Callimachus' *sophia* operates in the same way as Philemon's 'necessary things': it is the nature and importance of the content which dictates its judgement: '[W]hat matters is *technê*, "poetic craft", however long the poem.'[28] Thus, all too well aware of the reductive potential of numbers, Callimachus in the Reply develops *technê* as a measure of poetry that does not require number. The measure is *technê*, and it is an indication of *sophia.* σοφία ('wisdom', 'cleverness') is an intellectual quality of a work that is dependent on its content and far more subjective than counting; to characterise a poem numerically would be precisely to ignore its

[26] As a comic text, of course, the speaker's account could have been intended to parody or mock an attitude towards speaking well and Homer as a prime example. There may be humour in presenting this view of literary evaluation, but I detect no contradiction or illogicality: the humour would not be derived from a mismatch of terms or ideas, but from the thesis itself. It is, in other words, an easily understandable and methodical approach to literary criticism, quite aside from the possibility that it is humorous.

[27] Cameron (1995) 335 n.154. His translation of σύντομος wavers between brief (336) and succinct (342).

[28] Fantuzzi and Hunter (2004) 69.

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imagery and language. Callimachus places poetic skill beyond the realm of the accountable and thus beyond the reach of the Telchines and their poetic tallying. He may be measuring up literature in the Library, but his Muse is not susceptible to mathematical measurement.

Callimachus' championing of a criterion of poetic value that does not reduce poetry to the numerically measurable demands a nuancing of the Telchines' criticism and Callimachus' response. Given that Callimachus will go on to reject length as a criterion altogether and focus instead on *technê* and the *sophia* it produces, it makes little sense to see his first response to the Telchines' enumerative approach as also being interested in absolute length. Unfortunately, the beginning of Callimachus' response, and especially the start of line 9, is irretrievable. Either a person or a poem could be being described as ὀλιγόστιχος ('of a few lines'), and there is a possibility that a negative adverb ('X is not of few lines') or even a conditional conjunction ('if X was of few lines') has been lost in the lacuna. The surest information, but by no means correct, is the comment of the scholiast: 'they criticise him because of the meagreness of his poems and because no length …' (με]μφομ(έν)ο[ι]ς αὐτοῦ τὸ κάτισ̣[χνον τῶν ποιη]μάτ(ων) κ(αὶ) ὅτι οὐχὶ μ̣ῆκος, fr. 1b.8–9 Harder). The fact that the scholiast understands the Telchines to be making two distinct points, that his poems are 'meagre' and that they lack a certain 'length', means that he cannot be referring to the content of lines 3–4 alone, where the Telchines' interest is only in length.[29] On this basis, I consider ὀλιγόστιχος to refer to a work by Callimachus – or less probably to Callimachus himself[30] – which does not live up to

[29] ἰσχνός, from which κάτισχνος is formed, refers to a thinness, leanness or meagreness and in stylistic terms may refer to a plain or unadorned style, cf. LSJ *s.v.* ἰσχνός 1, 2 and 5. It may be thought that the parallel of Ar. *Ra.* 941, where Euripides 'reduces' Aeschylean tragedy, means that κάτισχνος in the scholiast refers to a reduction of length, as suggested by Harder (2012) II, 92. However the corporeal bloatedness that is implied in Aristophanes' passage – on which see Sommerstein (1996) 239 – does not really align with a reduction in length but a thinning out of matter. I therefore take the scholiast to have two interests in mind, rather than that κ(αὶ) ὅτι οὐχὶ μ̣ῆκος elaborates κάτισχνος as a term signifying a reduction in length.

[30] I follow Harder (2012) II, 36, who notes the lack of evidence in Greek for the εην preceding ὀλιγόστιχος in the papyrus to be taken as a first-person singular imperfect as opposed to the common third-person singular: that is, ἔην is more likely to be 'it was' than 'I was'.

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the Telchines' expectations, but which verses 9–12 effectively defend by *comparanda*, not as a work of insufficient length and meagre poetic content, but as a short work that nevertheless has great poetic 'weight'. In other words, Callimachus avoids perpetuating the Telchines' critical frame of reference and thinking of ὀλιγόστιχος as a solely enumerative term and argues in 9–12 that works that are ὀλιγόστιχος can be brief but poetically powerful. Diogenes Laertius' later use of the term evidences a similar strategy. When talking about Herillus of Carthage's books, he comments that they are ὀλιγόστιχα and δυνάμεως δὲ μεστά ('full of force', 7.165). Again, what is important is the extension in relation to content; few lines does not necessarily imply meagre content.

What Callimachus is doing in the Reply then is articulating an aesthetics of scale. In an illuminating work, Jim Porter deals with the big question of Hellenistic poetry's concept of λεπτότης ('fineness', 'delicacy'), encapsulated by Callimachus himself with the declaration that 'a big book is big evil' (Καλλίμαχος ὁ γραμματικὸς τὸ μέγα βιβλίον ἴσον ἔλεγεν εἶναι τῷ μεγάλῳ κακῷ, fr. 465 Pf. = Ath. 3.72a) and with his criticism of Antimachus' *Lyde* as 'a fat poem and not lucid' (Λύδη καὶ παχὺ γράμμα καὶ οὐ τορόν, fr. 398 Pf.). Porter convincingly proposes that 'smallness' as an aesthetic criterion, in both Hellenistic art and poetry, is only one side of the coin. Instead, he reads a number of Hellenistic works as operating an 'organized aesthetic of *contrastive opposites*': the large set against the small.[31] Posidippus' epigrams on stones set finely wrought gems (e.g. 3–5 AB) against cyclopean boulders (19 AB), while Theocritus' *Encomium of Ptolemy Philadelphus* (*Idyll* 17) overflows with hyperbole in a short compass. Certainly, I am not the first to propose that Callimachus' wider outlook involves an aesthetics of scale.[32] Yet what I hope to have outlined here is that his focus on scale, on the variable relationship between extent and content, must be understood to go hand in hand with his rejection of counting criticism in the Reply. Counting has the worrying ability to reduce poems to their numerical aspects. Indeed, in the *Pinakes* works are presented as being defined

[31] Porter (2011) 285. [32] See Porter (2011) 294 and Squire (2011) 273.

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merely by a generic label, an opening line and a sum of lines.[33] This is a scaling down that could diminish the profile of a poetic work and its intellectual content. By doing away with numerical measure altogether and advocating for *technê* as the key criterion, Callimachus presents his own poetry (and those predecessors mentioned at 9–12) as enacting an aesthetics of scale where the effective contrast is between the (relatively) short compass of poems and their ability to be weighty and contain a great amount of *sophia*. Indeed, this *sophia* is not only explicitly theorised in the Reply but also demonstrated by the densely allusive texture of his verses. His response to the Telchines draws on the entire arsenal of poetic tradition. This exemplifies what a great amount of *sophia* in only a few lines might look like: his own complex matrix of images cannot simply be sized up or scaled down by numbers.

1.2 Erinna and the Epigrammatists

In the prologue to arguably his most famous poem, Callimachus thus makes a case for extracting enumeration from the practice of poetic criticism. What was the impact of his argument? In this section, I look at a single epigram by Antipater of Sidon, written as an epitaph for the poet Erinna, who is commonly dated to the late fifth or fourth century.[34] I show that Antipater, who was active roughly a century after Callimachus, has observed his aesthetics of scale and redeploys it in an equally polemic context to praise Erinna and her work.[35] I propose, moreover, that Antipater tailors Callimachus' concern with numerical forms of poetic judgement to the specific nature of Erinna's *Distaff*, a short hexameter lament, which is compared with the output of epigrammatists. In so doing, he expands the range of numerical criticism that one could apply to poetry to cover also the number of compositions (as well as the extent of individual compositions) and in response develops further imagery to support a poetic criticism without number that

[33] See also Porter (2011) 286–7 on scale in relation to the *Pinakes*, without a reference to number.

[34] See Neri (2003) 42–7.

[35] Antipater was probably active in the middle to late second century, and at the latest his epigrams were collected in about 125 BCE; see Gow and Page (1965) I, XV and II, 32.

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applies to the number of compositions. Callimachus' crusade against counting is being adapted to new contexts and criticisms.

Erinna was famous for having composed the *Distaff*, a 300-line poem which develops traditions of women's lament within the hexametrical poetic form (*SH* 401). She appears to speak in her own voice as she recalls childhood experiences that she shared with her girlfriend Baucis, whose premature death – perhaps shortly after her marriage (cf. 2 *HE* = *AP* 7.712) – Erinna subsequently laments. The distaff of the title appears within the text as an object upon which Erinna gazes (*SH* 401.44); it may have been a gift given to Baucis (cf. Theoc. *Id*. 28), or it may represent the work of spinning, which is all that is left for Erinna to do. She was the subject of numerous epigrams in the Hellenistic and Imperial period, and a number of those ascribed to Erinna may well be later imitations of, and homages to, her style.[36] Antipater of Sidon's epigram is one of the longer epigrams in praise of Erinna and undoubtedly the most complex in terms of its combination of images.

παυροεπὴς Ἤριννα καὶ οὐ πολύμυθος ἀοιδαῖς
ἀλλ' ἔλαχεν Μούσας τοῦτο τὸ βαιὸν ἔπος.
τοιγάρτοι μνήμης οὐκ ἤμβροτεν οὐδὲ μελαίνης
νυκτὸς ὑπὸ σκιερῇ κωλύεται πτέρυγι·
αἱ δ' ἀναρίθμητοι νεαρῶν σωρηδὸν ἀοιδῶν
μυριάδες λήθῃ, ξεῖνε, μαραινόμεθα.
λωίτερος κύκνου μικρὸς θρόος ἠὲ κολοιῶν
κρωγμὸς ἐν εἰαριναῖς κιδνάμενος νεφέλαις.

(Antipater of Sidon 58 *HE* = *AP* 7.713)

Erinna was of few words and not verbose in her songs, but this little *epos* has the Muse as its lot. For she had not failed to gain a memorial nor is she hindered by the shading wing of black night. But, stranger, we innumerable myriads of young poets, heaped, fade into oblivion. The small song of the swan is better than the cawing of jackdaws spreading out through the spring clouds.[37]

The poem is highly structured. The first couplet characterises Erinna and her work. The second describes the fortune of her

[36] Epigrams on Erinna as a poet: Asclepiades 28 *HE* = *AP* 7.11; Anon. 39 *FGE* = *AP* 7.12; Leonidas 98 *HE* = *AP* 7.13; Anon. 38 *FGE* = *AP* 9.190; Epigrams purportedly by Erinna: 1 *HE* = *AP* 7.710; 2 *HE* = *AP* 7.712; 3 *HE* = *AP* 6.352. For discussion on the authenticity of the epigrams see Neri (1996) 195–201.

[37] Translations of works found in *AP* are adapted from Paton (1916–18).

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work's afterlife. The third contrasts this fortune with the fortune of other poets. The fourth explains this comparison by analogy to the different sounds of the swan and the jackdaw. The first and the third couplet, to which I will soon turn, address matters of measurement. The second and fourth, by contrast, combine avian and meteoric images: black night and dark wings in the second, the croaking of the jackdaw that spreads through the clouds in the fourth. So too, the central couplets are marked by the antonyms of memory and forgetfulness.

An epigram by Antiphanes (no later than the mid-first century CE) rails against grammarians who are 'so proud of their Erinna, [and are] bitter and harsh barkers at Callimachus' command' (ἐπ' Ἠρίννῃ δὲ κομῶντες | πικροὶ καὶ ξηροὶ Καλλιμάχου πρόκυνες, 9.3–4 GP = *AP* 11.322.3–4).[38] Antiphanes does not explain the connection between the two, but what is clear is that allegiance to Callimachus in literary critical matters could lead to an appreciation of Erinna.[39] Kathryn Gutzwiller has recently argued that Callimachus' opening description of his poetic practice in the Reply – 'I turn around my *epos* a little' (ἔπος δ' ἐπὶ τυτθὸν ἑλ[ίσσω, fr. 1.5 Harder) – should be understood as a weaving image – 'I twist' or 'I spin my *epos*' – and that a probable influence was Erinna and her *Distaff*. Although Callimachus does not name Erinna in any extant work, it is quite possible that this shared representation of poetic composition brought the two together in Antiphanes' mind.[40] This seems also to be the case with Antipater of Sidon. On first reading, the epigram pointedly varies Callimachus' language and focus in the Reply. The 'foolish' or 'unpractised' Telchines who acted as a foil for Callimachus' poetics are matched by the youthful poets in Antipater who are dissolving into oblivion just as the Telchines had wasted away their own liver.[41] Verbally, Antipater's τὸ βαιὸν ἔπος ('little *epos*')

[38] Since he is included in the *Garland* of Philip, cf. *AP* 4.2.10.

[39] In the words of Gow and Page (1968) II, 114: Erinna is 'an unexpected example. Erinna's brief and comparatively lucid work gave little scope for the ἀκανθολόγοι [i.e. nitpickers].'

[40] See Gutzwiller (2020).

[41] It is unclear whether the Telchines were also poets, but later tradition thought so at least; cf. fr. 1b.2–7 Harder. Hunter (forthcoming) notes the possibility that ἀοιδῶν in line 5 could be understood as a feminine genitive plural referring to poems, 'countless

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resembles Callimachus' own ἔπος (fr. 1.5 Harder) and οὐ πολύμυθος ('not verbose') looks to invert a Callimachean usage of πολύμυθος ('verbose') to refer to the maiden Crethis in a funerary epigram (37.1 *HE*). The term ἔπος will hold a similar weight of reference when it is used by Crinagoras of Mytilene, late first century BCE, in an epigram on Callimahus' *Hecale*, in which it is identified as 'this chiselled *epos*' (τὸ τορευτὸν ἔπος τόδε, 11.1 GP). Antipater's description of Erinna's 'little *epos*' is modelled on Callimachus' presentation of his own compositional practice in the Reply.[42]

Two further epigrams exhibit similarities in the way they praise Erinna, but their differences are equally important.

ὁ γλυκὺς Ἠρίννας οὗτος πόνος, οὐχὶ πολὺς μέν
ὡς ἂν παρθενικᾶς ἐννεακαιδεκέτευς
ἀλλ' ἑτέρων πολλῶν δυνατώτερος· εἰ δ' Ἀίδας μοι
μὴ ταχὺς ἦλθε τίς ἂν ταλίκον ἔσχ' ὄνομα;

(Asclepiades 28 *HE* = *AP* 7.11)

This is the sweet labour of Erinna, but not great in extent, since it is by a maiden of nineteen years, but it is greater in power than many others. If death had not come quick to me, who would have had such a name?

Λέσβιον Ἠρίννης τόδε κηρίον· εἰ δέ τι μικρόν,
ἀλλ' ὅλον ἐκ Μουσέων κιρνάμενον μέλιτι.
οἱ δὲ τριηκόσιοι ταύτης στίχοι ἶσοι Ὁμήρῳ,
τῆς καὶ παρθενικῆς ἐννεακαιδεκέτευς,
ἢ καὶ ἐπ' ἠλακάτῃ μητρὸς φόβῳ, ἢ καὶ ἐφ' ἱστῶι
ἑστήκει Μουσέων λάτρις ἐφαπτομένη.
Σαπφὼ δ' Ἠρίννης ὅσσον μελέεσσιν ἀμείνων,
Ἤρινν' αὖ Σαπφοῦς τόσσον ἐν ἑξαμέτροις.

(Anonymous 38 *FGE* = *AP* 9.190)

This is the Lesbian honeycomb of Erinna. Though it is small, it is entirely mixed with honey from the Muses. Her three hundred lines are equal to Homer, though

thousands of recent songs heaped up', evocative of piles of unread papyri left to decay. This certainly cannot be discounted, especially given the allusion to epigram collections (see below), but as he admits, poets make more natural speakers of the epigram. νεαρῶν is a Homeric *hapax* characterising the Achaean troops as young children prior to the Catalogue of Ships (see below). If this intertext is operative in the epigram it further suggests that people and not poems are meant.

[42] Although, as Hunter (forthcoming) sets out clearly, this does not mean that Crinagoras uses ἔπος in the same way as does Callimachus: it must refer to a poem in the former, but it is difficult to take it as such in the Reply.

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by a maiden of nineteen years. Either at the spindle in fear of her mother or at the loom she stood applying herself as a handmaid of the Muses. As much as Sappho is better than Erinna in lyric metres, this much in turn is Erinna better than Sappho in hexameters.

Asclepiades was writing in the early third century BCE; the second epigram is of unknown date but is probably later.[43] Both epigrams, like Antipater's, share a focus on the contrast between the extent of Erinna's poem and its content. For Asclepiades, Erinna's poem is short in compass but nevertheless 'rather powerful' or 'forceful' (in a similar way to Diogenes Laertius' appraisal of Herillus' books; see above). For the anonymous epigrammatist, although her work is small, it is even able to match up to Homer himself. Asclepiades' poem shows, then, that an appreciation of her poetry as exhibiting a contrastive aesthetic of scale predated Antipater's epigram. Yet an interest which is present in these two epigrams but absent from Antipater's poem is quantification. Both give her age with the striking παρθενικῆς ἐννεακαιδεκέτευς fitted into the pentameter, presumably borrowed in 38 *FGE* from Asclepiades.[44] The anonymous epigram has counted up the lines of her *Distaff* for comparative purposes too: her verses are counted for a comparison with Homer (300) and her metre for a comparison with Sappho (ἐν ἑξαμέτροις, 38.8: lit. 'in measures of six'). As Callimachus had caricatured in his Reply, the Telchines were concerned with the number of his verses but also with his age and the fact that his 'decades are not few' (fr. 1.6 Harder). In addition to the Callimachean style of his epigram, it is further significant that, unlike Asclepiades and the anonymous epigrammatist, Antipater does not focus on the quantifiable aspects of Erinna and her poetry despite the aesthetic of scale that all have identified in her work. Antipater rather follows Callimachus' attitude as outlined in the Reply by not applying counting as a critical tool, even for positive evaluations. To Antipater, it would seem,

[43] Given the probable allusion to Asclepiades at 28.4 *FGE*; see below. For a discussion of Asclepiades' dates see Sens (2011) xxv–xxix; he may well have begun composing at the end of the fourth century.

[44] And ultimately, probably, from Erinna herself, who seems to mention her age in what can be discerned in the papyrus that has preserved a fragment of the *Distaff*: ἐννεα[και] δέκατος (*SH* 401.37).

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the precise number of her years and the number of her verses are not relevant.

However, this is not to say that Antipater does not have a point to make about numbers in relation to poetry. As Alexander Sens has shown, in the first and final couplets Antipater draws on Antenor's recollection of Menelaus' and Odysseus' rhetorical style in the Teichoscopia of *Iliad* 3.[45] Antipater's παυροεπὴς . . . οὐ πολύμυθος echoes Homer's description of Menelaus as '[speaking] few words but very clear, since he was not a man of many words' (παῦρα μὲν ἀλλὰ μάλα λιγέως, ἐπεὶ οὐ πολύμυθος, *Il.* 3.214). His newly coined παυροεπὴς ('of few words'), and Erinna as someone who does not 'miss out on' (ἥμβροτεν) a memorial, respond to the Homeric *hapax* describing Menelaus as 'not missing the mark in speaking' (ἀφαμαρτοεπής). The allusion to Menelaus suggests that Antipater followed Callimachus in espousing a critique that does not involve enumeration, but conceives of a relative relationship between content and extent that produces a contrastive aesthetic of scale: here, few but exacting words. In contrast to Menelaus, Odysseus in Antenor's view speaks 'words like winter snow' (ἔπεα νιφάδεσσιν ἐοικότα χειμερίῃσιν, *Il.* 3.222): Homer also contains the seeds of a criticism interested in quantity.[46] The third couplet sees Antipater rework this contrast between Menelaus and Odysseus into a contrast between Erinna as a singular success and the innumerable epigrammatists. The Iliadic scene gives examples of how successful different characters are at speaking and the content of their speech, whereas the contrast in Antipater has become one in which a single work is set against numerous works. This change is occasioned, I would tentatively suggest, by the simile of Odysseus' words being like winter snow in contradistinction to Menelaus as a speaker who is not verbose (οὐ πολύμυθος), where Odysseus' many words have been taken to imply a multiplicity of works. A further concern for judging between different styles and their relative success, then, is not

[45] Sens (2007) 376–81.

[46] A contrast the terms of which Antipater varies in the final image of the jackdaws' cry described not as winter snow, but as spreading out through the spring clouds.

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only the interrelation of content and extent in a way that exhibits one's *sophia,* but also the quantity of poetic output per se.

Consequently, Antipater may seem to follow in the Telchines' footsteps by making an evaluative statement by counting up and contrasting Erinna and the epigrammatists. However, his use of the adverb σωρηδόν points to a deeper sophistication. It brings to mind the philosophical *sorites* problem. Susanne Bobzien summarises it as follows:

> 'Does one grain of wheat make a heap?' – 'No'. 'Do two grains of wheat make a heap?' – 'No' 'Do three?' – 'No'. – etc. If the respondent switches from 'no' to 'yes' at some point, they are told that they imply that one grain can make a difference between heap and non-heap, and that that's absurd. If the respondent keeps answering 'no', they'll end up denying e.g. that 10,000 grains of wheat make a heap. And, they are told, that's also absurd.[47]

The problem is about definitions that have in-built vagueness; the image of the *soros* points to enumeration as wholly unsuitable for defining certain things. Indeed, the possibly fuzzy nature of counting, as well as numbers' unsuitability for delimiting certain quantities, is already embedded in the paradoxical ἀναρίθμητοι . . . μυριάδες (58.5); μύριας can mean 'ten thousand' and 'a countless amount' (LSJ *s.v.* μυριάς A.I). Having the *sorites* problem in mind on reading this epigram both raises the question of how many new poets are enough and how many too much, at the same time as it suggests that enumeration is not a useful metric: these μυριάδες are ἀναρίθμητοι. Just as Callimachus ultimately argues for the pointlessness of simply counting up lines, so this implied *soros* focuses rather on the poets as a large multitude, not requiring – or susceptible to – enumeration.[48]

An unmeasured multitude finds precedence elsewhere in *Iliad* 3. Antipater draws imagery from the opening of that book to depict the oblivion that Erinna might have faced. The opening similes depict the gathered Trojan contingent; the sound of their mass is 'like a clamouring flock of cranes' (ἠύτε περ κλαγγὴ γεράνων, *Il.*

[47] Bobzien (2002) 218. Cf. e.g. Cic. *Acad.* 2.93; Galen *Medical Experience* 16.1–2, 17.102; Sext. Emp. *Math.* 1.69.

[48] Also worth considering is Callimachus' νῆιδες (2). One meaning of the verb νέω is to heap. If later readers perceived this etymology in Callimachus' description of the Telchines, then νεαρῶν σωρηδὸν ἀοιδῶν could be read as Antipater's elaboration of Callimachus' anonymous critics.

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3.3) and the resulting dust cloud from the marshalling is 'a mist better than night for the thief' (ὀμίχλην | . . . κλέπτῃ δέ τε νυκτὸς ἀμείνω, *Il.* 3.10–11). Birds and blotting out the sunlight go together. Antipater's elliptical description that Erinna is 'not constrained by the shadowy wing of black night' brings together two aspects of this multitude, their flock-like behaviour and their ability to cast shadows. This image becomes more understandable on reaching the third and fourth couplets, where other poets are an immeasurable mass, whose poems spread like the cry of the jackdaws. A related simile from *Iliad* 17 clarifies the mention of the cry of the jackdaws in the epigram's final couplet.

τῶν δ' ὥς τε ψαρῶν νέφος ἔρχεται ἠὲ κολοιῶν,
οὔλον κεκλήγοντες, ὅτε προΐδωσιν ἰόντα
κίρκον, ὅ τε σμικρῇσι φόνον φέρει ὀρνίθεσσιν,
ὥς ἄρ' ὑπ' Αἰνείᾳ τε καὶ Ἕκτορι κοῦροι Ἀχαιῶν
οὔλον κεκλήγοντες ἴσαν, λήθοντο δὲ χάρμης.

(Homer *Iliad* 17.755–9)

And as a cloud of starlings or jackdaws flies, shrieking cries of destruction, when they see a falcon coming on them that brings death to small birds, so before Aeneas and Hector fled the youths of the Achaeans, shrieking cries of destruction, and forgot all fighting.

The repetition of κεκλήγοντες in this passage highlights the change in circumstances from *Iliad* 3: this time it is the Achaeans' turn to clamour. Antipater evokes the first line of the passage in his final couplet; the phrase ἠὲ κολοιῶν is found only here in this form and *sedes* in Homer, and κολοιός only appears once more in any form in Homer (at *Il.* 16.583). In a pointed contrast, the cloud (νέφος) of jackdaws has become the clouds through which they croak in Antipater's poem. Following the logic of this simile, if other poets are the mass of jackdaws, then Erinna is the falcon; she can turn lesser poets to flight. Antipater's mention of poetic oblivion (λήθῃ, 6), too, finds a model in the jackdaws, who forget about the lust of battle. This intertext provides a model for the swan *qua* bird achieving avian success over the host of other poets, whom Erinna leaves behind to be forgotten.[49]

[49] It may have been a pre-existing image for Erinna's song, if the anonymous epigram describing Erinna as having brought forth her song 'sounding with a swan-like voice'

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With the *Teichoscopia* in Book 3 already evoked by the epigram's opening lines, what Erinna now appears to have avoided in the second couplet is the effects of the gathering Trojan host at the opening of that same Iliadic book; she meets no flock of cranes nor is overshadowed by their battle cloud. Likewise, the opening lines of that book also make explicit the sonic contrast with the Greek army; the Trojans are like a clamour of cranes, but the Greeks 'came up to them in silence, breathing fury' (οἱ δ' ἄρ' ἴσαν σιγῇ μένεα πνείοντες Ἀχαιοί, *Il.* 3.8). There seems to be some analogical thinking on Antipater's part in the two scenes, or parts of them, which he has chosen to combine: just as Odysseus' words were a blizzard, so the cranes create their clamour 'as when they flee the winter storm and the unspeakable rain' (αἵ τ' ἐπεὶ οὖν χειμῶνα φύγον καὶ ἀθέσφατον ὄμβρον, *Il.* 3.4). In effect, Antipater uses these images from *Iliad* 3 to do two interrelated things. The allusion to Menelaus' rhetorical abilities and the contrast with Odysseus characterise two forms of composition in which one type of speech or poetry involves the production of multiple works. The allusion to the flock of birds and Erinna as the single swan make the distinction on the level of people, between the individual fighters and the multitude of the gathered troops, between the one and the many. Erinna has not been obscured by the countless flock of poets, as it were, because she composed a single powerful work rather than many works that are susceptible to being left among the uncountable multitude.

Such a reading is also reflected in the use of σωρηδόν. As well as recalling the *sorites* problem, σωρηδόν in the context of epigrams and epigram collections would evoke the shadowy Hellenistic *Soros*.[50] This epigram collection was either the first to collect Posidippus of Pella's poetry, or may have been the first to combine epigrams from different authors; in either case it would have been a well-known collection.[51] The adverb, together with the

(κυκνείῳ φθεγγομένην στόματι, *AP* 7.12.2 = Anonymous 39.2 *FGE*) can be dated before Antipater.

[50] I am indebted to Daniel Anderson for the discussions we shared about the possible connection between the *Soros* and the *sorites* problem.

[51] The proposal for the *Soros* as an anthology was first made by Reitzenstein (1893) 96–102. For more recent criticism and differing reconstructions see Cameron (1993) 369–76; Gutzwiller (1998) 18–19 and 155–6; Bing (2017).

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epigrammatist's first-person plural μαραινόμεθα, '*we* fade into oblivion', thus raises the possibility of a poetic *sorites* problem: how many epigrams make a book, perhaps; but also: how many epigrams are too much? Callimachus had sought to reject epic length in his Reply, whereas Antipater champions Erinna's poetry as refined and Callimachean by contrasting the *Distaff* with epigram. The image of a heaped mass of epigrammatists suggests that poems, like grains of sand, can get too small, at which point they paradoxically proliferate and together become an unmanageable and unaccountable multitude. Whereas the Telchines were interested in a single work of great length, Antipater is focused on the opposite extreme of poetic extent: he figures the *Distaff* as achieving Callimachus' non-numerical aesthetics of scale where epigram fails.

An equally important intertext for Antipater's epigram, as well as Callimachus' Reply, is Homer's Invocation to the Muses in *Iliad* 2. As Homer is clear to state: 'the multitude I could not tell or name' (πληθὺν δ' οὐκ ἄν ἐγὼ μυθήσομαι οὐδ' ὀνομήνω, *Il.* 2.488). He and the audience must settle instead for the catalogue counting up the ships, the leaders and the soldiers per ship but not the names of or stories associated with individual soldiers. Likewise, the great proliferation of epigrammatists has the same effect on Antipater in his role as a commemorator of poetry and poets. They are so many that only their numerical total can be captured in the poem; unlike Homer's Catalogue, though, their number is so large that it borders on the entirely uncountable. Erinna avoids the ignominy of oblivion. Antipater is able to recall and commemorate Erinna as a leading poet just as Homer, with the help of the Muses, was able to recall the leaders of the contingent and their stories. In conception, that is, Antipater models the distinction between Erinna and the epigrammatists on Homer's foundational expression of the effect that quantity has upon the ability to commemorate and his resolution that counting at least enables him to account for each soldier. I would also argue that Antipater signals his debt to Homer's concern for counting and commemoration in *Iliad* 2 within the epigram. As I have noted, the simile of a flock of screeching birds appears in *Iliad* 17, but it is imagery which is used to describe the Trojan troops at the opening of *Iliad* 3, and to describe the gathering Achaean troops in *Iliad* 2, in a run of similes

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immediately prior to the Invocation (*Il.* 2.459–65). The same image bookends Homer's roll call of both the Greek and Trojan contingents at Troy and thus forms a ring composition, which is a common feature of Homeric poetry. The particular contrast in this case is that similes describing a multitude are set in contrast to the counting up of a multitude. In characterising the epigrammatists as a shrieking flock, Antipater deploys imagery in his epigram that also contrasts with his counting, or inability to count, in the third couplet. In a more allusive vein, Antipater addresses the epigrammatists as νεαροί ('young'), which is a Homeric *hapax* taken from *Iliad* 2, in a scene where Odysseus compares the Achaean troops to 'youthful children' (παῖδες νεαροί, *Il.* 2.289), disheartened and longing for home. If the Homeric source of the term is observed in the epigram, then the reader is given a direct clue that Antipater sees the uncountable heap of epigrammatists as akin to the unnamed but numbered multitude of Achaeans at Troy who will also fade into oblivion. Antipater, then, not only follows in Callimachus' footsteps and carefully avoids numerical assessment of Erinna's poetic skill in his epigram. He also raises the idea, which can be traced back to Homer's Invocation, that counting as a form of description is all that remains when the poetic output is so large as to risk becoming unmanageable, and it is a counting that likewise obscures commemoration as well as a detailed treatment of a poet's *sophia.*

Antipater's epigram exemplifies the extent to which Callimachus' approach to numerical poetic criticism permeated Hellenistic literary discourse. His characterisation of Erinna bears all the hallmarks of a Callimachean appraisal that avoids number in favour of poetic refinement. Antipater combines Callimachus' interest in scale and the question of multiplicity in contrast to the singular – as shown by his allusions to *Iliad* 2 and 3 – in order to contrast Erinna's short (epyllion-like) hexameter lament and the mass of epigrammatists. This shift in generic focus attests to the malleable use of number and of Callimachean criticism in the literary landscape: what was once a concern used to justify Callimachus' poetics at the opening of an aetiological elegiac catalogue is now also extended to epigram and epigram collections. There is an engagement with Callimachus and Homer and

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the pairing of a poet who rejects numerical criticism with the poet who displayed his ability to count at length. Later readers are influenced by Callimachus' rejection of counting criticism, but they read it alongside other passages that also set poetry and counting in dialogue.

1.3 Roman Reckonings

Callimachus' influence on Roman literature was widespread and is well known in modern scholarship. My intention in this section is to show that his engagement with the question of how numbers and counting relate to criticism is not ignored by later Roman poets. Rather, they take up this concern and develop it, observing both how it relates to an aesthetic of scale, and also – as in the case of Antipater – adapting Callimachean themes to the question of quantity: *how many* compositions are poetically appropriate? I begin first with Catullus and some programmatic poems from his collection: *cc.* 1, 5 and 7. While his Callimachean allegiance is not in doubt, I wish to bring more clearly into focus his awareness and reworking of Callimachus' concern with counting.[52] Subsequently, I examine an introductory poem to Martial, Book 8. It addresses the number of poetry books that Martial has produced and what the implications are of this count for an appreciation of his poetry. What will emerge is two poets' attentiveness to, and rejection of, the range of reckonings that Roman readers could apply to their poetry books.

1.3.1 Catullus Kisses Goodbye to Criticism

Catullus *c.* 5 – *uiuamus mea Lesbia atque amemus* ('Let us live, my Lesbia, and love', 5.1) – is one of the most famous poems in Latin and arguably the most famous counting poem in antiquity. Together with *c.* 7, its focus on the numerical has garnered much attention. The substance of this subsection is devoted to arguing

[52] Scholarship has generally undervalued the Callimachean themes in *cc.* 5 and 7, or at least not advanced a coherent interpretation of them. The companion piece of Knox (2007) on Callimachus and Catullus makes no connection, nor do, e.g. Clausen (1970); King (1988); Hunter (2006). The major commentaries are equally sparse.

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that an underemphasised aspect of the poems is their engagement with counting as it relates to criticism. In particular, I wish to build on the work of earlier scholars and propose that *c.* 5, with the help of *c.* 7, reworks Callimachus' Reply to the Telchines and thus constitutes a programmatic statement about the nature of counting as a means of poetic appreciation and the extent to which it can be applied to his poetry and its erotic subject matter. I will tentatively suggest, moreover, that this problematisation of counting as a means to appreciate Catullus' poetry may be extended to the collection as a whole.

First, though, I discuss *c.* 1, Catullus' opening poem in the collection as found in the manuscripts, and the emphasis it places on Callimachean poetics and numerical appraisals of literature, at the same time as it introduces – albeit subtly – the erotic current that runs through the collection.

cui dono lepidum nouum libellum
arido modo pumice expolitum?
Corneli, tibi: namque tu solebas
meas esse aliquid putare nugas,
iam tum cum ausus es unus Italorum
omne aeuum tribus explicare cartis
doctis, Iuppiter, et laboriosis.
quare habe tibi quicquid hoc libelli,
qualecumque; quod, o patrona uirgo[53],
plus uno maneat perenne saeclo.[54]

(Catullus *c.* 1)

To whom do I give this new fine little book, recently polished up with dry pumice? To you, Cornelius; since you always used to think my trifles worth something, you who now dare of all Italians to unroll all the ages in three books – learned ones, by Jupiter, and laboured! So have for yourself this work such as it is, whatever it is worth; and may it, o virgin patroness, remain for more than one generation.[55]

Since Catullus presents his *libellus* as a gift, the poem probably prefaced at least one collection of his works. It has long been noted

[53] The term has long exercised critics; see Thomson (1978) 99 and 198–200 with discussion and further bibliography.
[54] Latin text following Mynors (1958), with emendations noted where I think they are required.
[55] Translation adapted from Lee (1991).

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that the poem, with its advertisement of the *libellus* as *lepidus*, translates the Callimachean interest in poetic refinement at the opening of the Reply – θρέψαι τὴν Μοῦσαν δ' ὠγαθὲ λεπταλέην ('[but], my dear fellow, keep the Muse slender'. fr. 1.24) – for the context of a Roman poetry collection. So too, the final line of Catullus' poem characterises his *libellus* in the same way that Callimachus' describes his own work at the conclusion of his first *aition* in the *Aetia*: ἔλλατε νῦν, ἐλέγοισι δ' ἐνιψήσασθε λιπώσας | χεῖρας ἐμοῖς, ἵνα μοι πουλὺ μένωσιν ἔτος ('Be gracious now and wipe your shining hands upon my elegies, so that they will remain for many years', fr. 7.13–14 Harder).[56] In terms of its programmatic effect, Bruce Gibson identifies how the poem 'anticipates and outmanoeuvres criticism' and that '[t]he basic technique is similar to that used by Callimachus in the *Aetia* prologue'.[57] Catullus diverges from this model somewhat in emphasising Cornelius Nepos' appreciation of his *nugae* rather than his (negative) criticism, although it is no simplistic positive appraisal: precisely what value he ascribes to the *nugae* is left pointedly vague (cf. *aliquid*, 4 and 8–9), and the fact that he 'used to' (*solebas*, 3) hold them in esteem begs the question of what, if anything, has changed in the present. Nevertheless, Catullus follows the broader structuring of the Reply by beginning with a response to someone else's appraisal of his existing poetry.

He also copies the critical frame of the Reply with regards to the extent of the *Chronica* and of his *libellus* in relation to their content. The single time span of all Roman history fits in Nepos' three books, while Catullus wishes his single *libellus* to last over an entire *saeclum*.[58] Just as the Telchines, Callimachus claimed, focus on the numerically measurable extent of the poem that they desired of him and its nature as a continuous work, Catullus

[56] On this point, see Acosta-Hughes and Stephens (2012) 221–2.
[57] Gibson (1995) 572–3.
[58] For history and time in *c.* 1 see Rauk (1997). If the lacuna at the end of verse 5 of Callimachus' prologue were to be filled by ἑλίσσω, then Catullus' description of Nepos as 'unfolding' (*explicare*) his works would set him more firmly as producing a history in the manner that Callimachus presents himself as composing at the opening of the *Aetia*. It is debatable whether Callimachus' representation in the opening lines referred to the composition of the *Aetia*, but for a later reader it is a plausible interpretation. See Cameron (1995) 340; Acosta-Hughes and Stephens (2001); Harder (2012) II, 7–9, all with further bibliography.

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likewise measures out the three books of Nepos' *Chronica* and identifies its continuous nature: *omne aeuum* glossing Callimachus' διηνεκές ('continuous').[59] Gibson interprets this as Catullus subtly and with playful irony critiquing Nepos' *Chronica*.[60] In effect Catullus adopts the pose of the Telchines when characterising the *Chronica*, despite the fact that he has scaled so much history into just three books, and so *learnedly*. In (re)presenting his own *libellus*, however, he evokes Callimachus' emphasis on slenderness as part of a contrastive aesthetic by reworking the connection between the one and the continuous and between time scale and the quantitative aspect of the text. The hope is that his single poetry book offered in response to or in exchange for Nepos' labouring over the *Chronica* will be impressive for the contrast between its small size and the length of time for which it survives. Catullus' collection, that is, begins with a demonstration of his ability to judge literary works through enumeration as the Telchines had, but also his commitment to a Callimachean slenderness and its contrastive aesthetic when it comes to accounting for his own poetry.

The final aspect of *c.* 1 that is important for my current discussion is its introduction of the erotic tone, which is then immediately developed in the infamously teasing *passer* poems.[61] *C.* 1 participates in what William Fitzgerald terms an 'erotics of poetry' that is directed at Catullus' readership. His overarching claim is that sexual provocation is a constituent element of Catullus' poetry and the relation constructed between poet and audience. What Catullus is doing is 'exploring an aesthetic relation that unsettles the rigid framework of Roman conceptions of power and position as they are metaphorised by sex and gender'.[62] On this view, the opening poem addressed to Nepos has flirtatious undertones. The

[59] Setting to one side the literary debates into which Callimachus may be intervening, it is accepted in more recent scholarship that διηνεκές at the least implies a 'continuous linear narrative', Cameron (1995) 343, or the 'telling of a story completely', Harder (2012) II, 20. This well suits the presumably annalistic (and exhaustive) shape of the *Chronica*.

[60] Gibson (1995) 570.

[61] There is a fairly extensive bibliography on these poems which circles around the question of whether the *passer* is simply a bird or symbolises the penis. See e.g. Jocelyn (1980); Skinner (1981); Hooper (1985); Jones (1998); Pomeroy (2003).

[62] Fitzgerald (1999) 34–5.

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book 'recently polished up with dry pumice' (*c.* 1.2) plays on the idea that bodies too could be polished with pumice and advertise effeminacy: 'Catullus' book has a teasing sexuality that is provocatively effeminate.'[63] By calling his Muse *patrona uirgo* (9), though, he pulls the rug out from under Nepos: the book may appear sexually available, but cannot be 'taken' in a sexual sense since it is virginal and so is to remain 'for more than one generation' (10).

The opening poem thus carefully introduces three aspects of Catullus' poetic world: his adherence to Callimachean criteria when appraising literature; his additional use of number and numerical measures of poetry as a tool of distinction; and his sexual positioning of himself and of his poetry vis-à-vis others. To put this another way, Catullus matches his drama of position through sexual language in the social sphere with a self-consciously literary positioning through both Callimachean poetics and enumeration. My argument is that *c.* 5 with the support of the 'response' in *c.* 7 combines these three aspects again in an equally programmatic way. It intertwines Callimachean motifs, counting and erotics in order to introduce his love for Lesbia explicitly and at the same time reject criticism of his account of that love affair. What is important about Catullus developing Callimachus' poetics and refusing to adopt counting as a critical measure is that he adheres to these principles at the same time that his poem performs counting within its verses. In so doing, *c.* 5 rehearses the collocation of motifs seen in *c.* 1, but is fundamentally different in its use of counting not as a tool of criticism, but a tool *against* it.

Here is the text and a translation of *c.* 5 and 7.

uiuamus, mea Lesbia, atque amemus
rumoresque senum seueriorum
omnes unius aestimemus assis.
soles occidere et redire possunt;
nobis, cum semel occidit breuis lux,
nox est perpetua una dormienda.
da mi basia mille, deinde centum,
dein mille altera, dein secunda centum,

[63] Fitzgerald (1999) 41.

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deinde usque altera mille, deinde centum;
dein cum milia multa fecerimus
conturbabimus illa ne sciamus
aut ne quis malus inuidere possit
cum tantum sciat esse basiorum.

(Catullus *c.* 5)

Let us live, my Lesbia, and let us love, and let us value all the rumours of rather severe old men at a single *as*. Suns will set and rise; for us, when our single brief light has set, night is one perpetual sleep. Give me a thousand kisses, then another hundred, then another thousand, then a second hundred, then yet another thousand, then a hundred. Then, when we have reached many thousands, we will confound them all so that we might not know, nor any evil person look with spite and know, how many the kisses are.

quaeris quot mihi basiationes
tuae, Lesbia, sint satis superque.
quam magnus numerus Libyssae harenae
lasarpiciferis iacet Cyrenis
oraclum Iouis inter aestuosi
et Batti ueteris sacrum sepulcrum,
aut quam sidera multa, cum tacet nox,
furtiuos hominum uident amores;
tam te basia multa basiare
uesano satis et super Catullo est,
quae nec pernumerare curiosi
possint nec mala fascinare lingua.

(Catullus *c.* 7)

You ask how many of your kissifications, Lesbia, would be enough and then some. As many as the great number of the Libyan sands that lie around silphiophoric Cyrene among the sweltering oracle of Jove and the sacred tomb of old Battus, or as many as the many stars that look upon the hidden loves of men when night is silent. To kiss you with that many kisses is enough and then some for deranged Catullus, which busybodies will neither be able to count up nor curse with their evil tongue.

The resonance between these two poems has long been noted: 7 is a 'pendant', a delayed reply, or a reworking of 5. Poem 5 begins with a call to love (1), which is made urgent by the observation of the brevity of life, a life critiqued by older generations (2–6). There follows the count of the many kisses Catullus orders Lesbia to give him (7–10). The poem concludes with the confounding of this freshly made account so that no evil onlooker may know the tally

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(11–13). Poem 7 begins by representing Lesbia in response having asked how many kisses would be sufficient for Catullus (1–2). He replies by offering two images of the innumerable – sands and stars – both of which he has nuanced and personalised beyond their (already) stereotypical usage (3–8): these are Libyan sands around Battus' tomb and stars that spy on clandestine loves.[64] In the case of the number of the stars, Catullus makes the theme particularly topical by resuming the theme of the night as a space for lovers (cf. 5.6 and 7.7). He concludes by reiterating that such an amount would satisfy 'mad' Catullus and mean that 'busybodies' will be not be able to count them up nor utter curses against them (9–12).

One early question was the type of counting Catullus represents. Harry Levy suggested that Catullus keeps the score of Lesbia's kisses upon the abacus, while Roger Pack, considering the abacus to be too mercantile for Catullus, proposed instead that he is counting on his fingers.[65] The issues with these two reconstructions notwithstanding, it is difficult to identify within the poem anything that demands a specific counting method, let alone one that is operative from a literary perspective.[66] I therefore leave the matter aside since it will not have an impact on the following interpretation. In a different vein, Francis Cairns designated *c.* 5 an *arithmetikon* and compared it to arithmetic poems found in Book 14 of the *Palatine Anthology*.[67] As will become evident in Chapter 4, the majority of those compositions postdate Catullus, and neither the term nor the genre would likely have been recognised by Catullus. A more useful historical contextualisation is the financial aspect of Catullus' counting, or rather, accounting. The views of an older generation are valued by Catullus in monetary terms, but so is the treatment of his own kiss count, *conturbare* (11) having the sense of 'to bring one's financial affairs into

[64] For sand cf. e.g. *Il.* 2.800, 9.385, Pind. *Ol.* 2.98, Callim. *Hymn* 6.253. For the stars as numerable cf. *Il.* 8.555–9, Callim. *Hymn* 4.175.

[65] Levy (1941); Pack (1956).

[66] On the one hand, such round numbers as Catullus deals with seem least to require the use of an abacus to keep score; on the other hand, Pack has to pull together sparse hand gestures from a range of disparate sources in order to even suggest that such a practice was commonly employed in antiquity.

[67] Cairns (1973).

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disorder', 'to go bankrupt'.[68] Catullus' defining of his relationship with Lesbia in this way draws on definitions of social interaction in economic terms that are part of his larger transactional outlook, observable most clearly in his 'contractual' approach to love (e.g. *cc*. 76.1–6, 109). Indeed, the sense of exchange is already present in the 'you ask: I answer' form of *c*. 7. At the very least, then, counting is operative in this poem inasmuch as it reflects an everyday, economic reality in the Roman world.

Especially relevant for my current purposes, though, is the connection between *c*. 5 and Callimachus' Reply, noted by Francis Cairns and Stephen Heyworth.[69] I delineate here the Callimachean resonances in the poems, before looking at the development of counting as a theme in the two poems. Catullus' designation of the upper limit of desired kisses turns, at the centre of *c*. 7, to the tomb of 'old Battus' (6). Contextually, his immediately preceding mention of Cyrene (4) means that he is referring to one of its kings named Battus, quite probably the first of that name and its founder (cf. Hdt. 4.150–9; Pind. *Pyth*. 5.87). Equally, however, since the patronymic *Battiades* is elsewhere used by Catullus to refer to Callimachus (*cc.* 65.16 and 116.2) – following Callimachus' own presentation of his genealogical connection to Battus (cf. epigrams 29 and 30 *HE*) – Catullus is making a connection to one of his poetic models. His choice to allude to Callimachus' place of birth and lineage in a pair of poems so reliant on enumeration, given Callimachus' own rejection of counting, is clearly a provocative move. But Catullus does more than refer to Callimachus by alluding to his heritage.

Consider again the opening of Callimachus' *Aetia*.

πολλάκι μοι Τελχῖνες ἐπιτρύζουσιν ἀοιδῆι
νῆιδες οἳ Μούσης οὐκ εγένοντο φίλοι,
εἵνεκεν οὐχ ἓν ἄεισμα διηνεκὲς ἢ βασιλ[η
. . . . .]ας ἐν πολλαῖς ἤνυσα χιλιάσιν
ἢ . . . ..].ους ἥρωας, ἔπος δ' ἐπὶ τυτθὸν ἑλ[ίσσω
παῖς ἅτε τῶν δ' ἐτέων ἡ δεκὰς οὐκ ὀλίγη.
. . . . .].[.] και Τε[λ]χῖσιν ἐγὼ τόδε· "φῦλον α[

[68] See e.g. Grimm (1963) 19; Wiseman (1985) 101–7. *OLD s.v. conturbo* I.3.
[69] Cairns (1973) 19, Heyworth (1994) 70–2; noted also by Henderson (1993) 243 and Wray (2001) 152.

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. . . . . .] τήκ[ειν] ἦπαρ ἐπιστάμενον,
. . . . .]..ρεην [ὀλ]ιγόστιχος·

(Callimachus *Aetia* fr. 1.1–9 Harder)

Often the Telchines mutter against me, against my poetry, who, ignorant of the Muse, were not born as her friend, because I did not complete one single continuous song (on the glory of?) kings . . . in many thousands of lines or on . . . heroes, but turn around my *epos* a little like a child, although the ten-count of my years is not small. I in turn say this to the Telchines: 'tribe, well able to waste away your own liver . . . of a few lines'

In *cc.* 5 and 7, Catullus responds to the opening of the Reply to the Telchines by reworking its key themes. First, Catullus' representation of those who would criticise his and Lesbia's love recalls the Telchines. In both cases, the poet is reacting to the chatter (cf. *rumores*, 5.2; ἐπιτρύζουσιν, fr. 1.1 Harder) of others who talk about him. So too, both sets of critics are connected with envy. The Telchines, as Callimachus will go on to say, are from 'the destructive race of Bascania' (Βασκανίης ὀλοὸν γένος, fr. 1.17 Harder). Bascania is a malign influence or jealousy that had the capacity to bewitch those who were the object of envy; it comes to be associated with the Evil Eye (LSJ *s.v.* βασκανία). Likewise, Catullus emphasises at the end of both poems the invidiousness of the supposed onlooker (*ne quis malus inuidere possit*, 5.12; *nec pernumerare curiosi | possint nec mala fascinare lingua*, 7.11–12).[70] Indeed, βασκαίνειν and *fascinare* derive from the same root (*OLD s.v. fascino*); Catullus may thus be etymologically alluding to Callimachus' 'race of Bascania'. The onlookers' interest, as with the Telchines, is to employ counting when prying into the poet's own affairs (*cum tantum sciat esse basiorum*, 5.13; *pernumerare*, 7.11). Catullus makes a connection between the critics' envy and enumeration, a connection which Callimachus had implied later in the Reply where the Telchines as the breed of Bascania seek to employ the *schoinos* to measure poetry.

It may be thought – despite these parallels – that this is rather a coincidence of broader themes related to the envy of the poet. But even setting the reference to Callimachus' Cyrenean lineage in *c.* 7 to one side, further phrases in *c.* 5 suggest that Catullus is

[70] I am taking both the *senes seueriores* and the imagined onlooker(s) as interchangeable figures of criticism.

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looking specifically to Callimachus' Reply and knowingly appropriating it for his own poetic needs. The Telchines' first criticism as presented by Callimachus is that he did not compose 'one long poem in many thousands of lines'. There is debate about how this comment relates to wider trends of criticism in the Hellenistic period.[71] The minimum that can be said is that their desire is for a poem which is both in some way 'singular' (ἕν) and 'continuous' (διηνεκές, fr. 1.3 Harder). This is a set of terms that Catullus reworks across the two poems to diverse effect. As has been observed, Catullus' statement *nox est perpetua una dormienda* (5.6) responds to the Telchines' desired poem, and indeed in later Roman poets *perpetuus* will come to signal an engagement with Callimachus' poetics in the Reply, such as in Horace's first book of *Odes* (1.7.6) and, famously, in Ovid's *Metamorphoses* (1.4).[72] The same terms are also loosely evoked by Catullus' evaluation of the *rumores* of the old men: they 'value them all at a single *as*' (*omnes unius aestimemus assis*, 5.3). The criterion of the singular can be decidedly negative when it refers to monetary value, but it is a criterion that the Telchines value in poetry: Catullus has used the Telchines' criticism to shut up his critics. This is also the case with his emphasis that *nox est perpetua una dormienda*. He again adopts the numerical aesthetics that the Telchines espoused only to use it against his own murmurers. A single continuous time span emerges as synonymous with the eternity that follows death, a simply unmanageable time frame that is meaningless for humans who occupy the repeated divisions of time into day and night (5.4–5). A time span that would be suitable for the Telchines would leave no space for the prying of the *senes*.

Yet, evidently, Catullus breaks away from the Callimachean model when his poem descends into a counting of kisses. In Callimachean terms, enacting enumeration in poetry is uncharted territory. This is part, I would argue, of Catullus' strategy of co-opting the Telchines' terms in his defence against his own (imagined) critics. As the Reply makes clear, counting is the interest of the critics. As John Elliott has shown, the Evil Eye is

[71] See Hunter (1989b) 190–5 and Cameron (1995) 340–5. [72] Heyworth (1994) 71.

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connected in many ancient Mediterranean and Near Eastern cultures with possessiveness and accounting: miserliness or excessive abstemiousness of one's own possessions incurs the influence of the Evil Eye, while those who are unwilling to share their own possessions are said to cast the Evil Eye on others.[73] It is this connection between the critics' envy and enumeration which Catullus draws out of the Reply. Callimachus banishes the destructive race of Bascania (ἔλλετε Βασκανίης ὀλοὸν γένος, fr. 1.17 Harder), after which he outlines the critical framework which ought to be adopted for judging his poetry, a framework which does not require measure. Catullus' strategy is to count up his kisses – or appear to – in a way which responds to 'all the rumours' (*rumoresque . . . omnes*), but which also strips the numbers of their signification. The hypnotic quality of 5.7–10 places the emphasis on sound and also responds to the Telchines' fame for witchcraft with an incantation of Catullus' own.[74] In any case, the conclusion to *c.* 5 makes explicit the distance between his own counting and the traditional world of accounts and their susceptibility to the Evil Eye, as he exhorts himself and Lesbia to 'throw into confusion' (*conturbabimus*) the account of their affair.

Catullus, then, employs his kiss count as a countermeasure. One thing he is aiming to ensure is that the affair lasts and continues for an extended period of time, a concern which also has its roots in the Reply. There, the Telchines measure up Callimachus' poetry and his verses but also count up the years of his life, seemingly making a connection between his age and the poetry he produces (fr. 1.5–6 Harder). Catullus' kisses replace the counting of lifespans with a counting that cannot be turned to express temporal extension. This resistance of erotics to measurement is resumed in 7, where the kisses that would satisfy Catullus are 'as many as the stars which watch over the stolen loves of humans, when night is silent' (*quam sidera multa, cum tacet nox | furtiuos hominum uident amores*, 7.7–8). This time,

[73] See Elliott (2016) II, 126, 147–8, with references.

[74] The Telchines were known for their envy-induced sorcery, Diod. Sic. 5.55. For more on the cantatoric nature of the poem see Schwindt (2016). This brand of counting and confusion may itself have a Callimachean root, since the etymology of Battus' name comes from the fact that he had a stammer (Hdt. 4.155). *Batti* at 7.6 may gloss the repetitive nature of the count in *c.* 5 as a Callimachean response.

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within which erotic clandestine liaisons occur, allows no criticism: there are no human onlookers here, only the eternal and innumerable stars. Catullus takes the Telchines' concern with age and counting and carves out a time which is not susceptible to envy and criticism, but which is also not the *perpetua nox* of *c.* 5. He opens up a new temporality for his love and for love poetry, moreover, that co-opts the Telchines' own conception of poetic unity of time: not 'one long poem on kings and heroes in many thousands of lines' but 'one long night for lovers with many thousands of kisses'.

This pre-emptive counting up and kissing goodbye to criticism, moreover, fits within Catullus' wider erotics of reading. For Fitzgerald, *c.* 5 represents a failed assertion of masculinity through its focus on foreplay rather than penetration, reminiscent of the *puer delicatus* or even the impotent.[75] Yet if the poet is all mouth and no trousers, there is good reason. As Benjamin Eldon Stevens has elucidated, speech and silence are recurring themes in Catullus and can be explained against the backdrop of Rome as *tam maledica ciuitas* ('so gossipy a city', Cic. *Cael*. 58): in the case of Catullus' kiss count: 'While a sexual oral activity like kissing precludes or occludes speech, causing a sort of inarticulacy, this is yet more desirable and valuable than articulate speech, which has been, in the poet's view, more truly perverted, put to use in worthless rumormongering and "bad, hexing speech".'[76] Such speech comes from those who, like the Telchines, would look upon Catullus and criticise, and they are characterised as orally polluted in that they have a *mala lingua*.[77] Rather than foreplay being failure, in Fitzgerald's terms, kisses are an empowering form of oral articulation that is not contaminated by the *mala lingua* of his critics.

Poems 1 and 5 therefore combine their use of Callimachean poetics with Catullus' focus of love affairs and erotic interactions. Eroticism is insinuated in *c.* 1, but by *c*. 5 such imagery has come to the surface, undoubtedly supported by the well-explored erotic undertones of the intervening *passer* poems. Still, *c*. 5 exhibits similarities with *c*. 1 that suggest a close dialogue. Both respond to appraisal and judgement of Catullus (Nepos of Catullus' *nugae*;

[75] Fitzgerald (1999) 53. [76] Stevens (2013) 55.
[77] Stevens (2013) 56 makes a further connection between *rumor* and *ir-rum-atio*.

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the old men of Catullus' love affair), and both are cognizant of singularly long spans of time (the single *saeculum* and *perpetua nox*). Both too engage with Callimachus at the same time that they introduce enumeration. The connection may be strengthened by the particular number of the kiss count: Nepos' *Chronica* stretches over three books, while Catullus counts up 3,300 kisses with 1,100 set over three lines (7–9).[78] Just as his *Chronica* contains all Italian history, there is the implication that Catullus' kisses also stand for the duration of the affair, all the kisses that must be made before that *nox perpertua* comes to them. Of course, the development in 5 is equally important. If Catullus demonstrates that he is able to wield counting as criticism in *c.* 1 then he rejects the possibility of accounting for love in *c.* 5, where the enacted enumeration is swiftly undercut by his confounding of the count they have made: love, and the acts of love, cannot be so easily accounted for.

To what extent can this counting and subsequent confusion be understood as programmatic for Catullus' collection? Counting plays an important role in Catullus' poetic outlook in other poems. He counts up volumes elsewhere in the collection: his friend Cinna takes nine years to produce his *Zmyrna* (*c.* 95.1–2), while one Hortensius, according to the most likely construction of the couplet, 'produces half a million verses in a year' (*milia cum interea quingenta †Hortensius uno*, 95.3).[79] Perhaps the most pointed case of numerical criticism on Catullus' part is in his poem on the poetry of Suffenus:

[78] Not unlike the count at Theocritus *Idyll* 17.82–4; see Chapter 3, Section 3. It is also remarkable that the focus on three parallels most modern divisions of Catullus' *libellus* into three distinct parts. Here is not the place to enter into discussion about the constitution of the collection as it survives. See Butrica (2007) for a guide to the history and transmission of the text and the debates about its parts. If Trappes-Lomax (2007) 35–6 is right in arguing that *o patrona uirgo* was originally *o Thaleia uirgo*, then this Thalia would be the ideal deity to preside over a three-part collection, since she is the third Muse listed by Hesiod (*Theog.* 77) and also one of the three Graces (*Theog.* 907).

[79] Catullus is also adept at measuring his metres. From the poem addressed to Calvus it is clear that he thinks himself to be well versed in metrics: *ludebat numero modo hoc modo illoc* ('[each of us] played with rhythms, now in this measure, now in that', 50.5). He shows his awareness of metrical practices elsewhere, when judging the book of poetasters that Calvus sends him for the Saturnalia, telling him to go back 'to the place from which [you] brought those faulty feet' (*unde malum pedem attulistis*, 14.22), alluding to, and parodying through its very metrical form, the poor versification he has encountered. The verse is not necessarily ingenious as Fordyce (1973) 139 suggests; the notable elision of *c.* 73.6 shows Catullus is able to play with the metre and the meaning of a line.

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Suffenus iste, Vare, quem probe nosti,
homo est uenustus et dicax et urbanus,
idemque longe plurimos facit uersus.
puto esse ego illi milia aut decem aut plura
perscripta, nec sicut fit in palimpsesto[80]
relata: cartae regiae, noui libri . . .

(Catullus *c.* 22.1–6)

That Suffenus, Varus, whom you know very well, is a charming fellow, and has wit and good manners. At the same time, he makes many more verses than anyone else. I bet he has got some ten thousand or even more written out, and not, as is often done, put down on used sheets: [but] imperial paper, new rolls . . .

Commentators have often observed how the poem sets form against content, material text against verbal artistry and appearance against sentiment, simultaneously highlighting how in a social context these contrasts can reveal people's lack of self-awareness.[81] The primary contrast is that Suffenus seems witty, but writes reams upon reams of poor poetry straight on to deluxe paper. Although verbally he shares many valued qualities with Catullus, such as *uenustas* and urbanity, when it comes to writing it down it all reads as doggerel.[82] Just as with Hortensius' many lines, Catullus diagnoses a central fault of modern poets as being their obsession with length and so sharing the Telchines' critical framework.[83] Equally, Catullus is aware that his own poetry can be counted. He implies, without providing a finite figure, that his verses are enumerable in a poem attacking his *puella*, calling together his hendecasyllables 'as many as there are' (*quot estis | omnes*, *c.* 42.1–2). In demanding that Asinius 'return his napkin' (*linteum remitte*, *c.* 12.11), he warns him just how many invective lines he will be sent: 'or expect three hundred hendecasyllables' (*aut hendecasyllabos trecentos | expecta*, 12.10–11). Enumeration

[80] And not *palimpseston*, following Thomson (1978) 259–60.
[81] See e.g. Selden (1992) 476–7; Krostenko (2007) 223–5.
[82] For *uenustas* and its opposites cf. e.g. *cc.* 3.1–2, 10.3–4, 12.5–9, 86.1–4, 89.2, with Wiltshire (1977). Urbanity is ascribed to 'spice' (*sal*) and 'charm' (*lepor*). For these and their opposites cf. e.g. *cc.* 13.5 and 86.4 and 10.4 and 32.2, with Seager (1974); Nielsen (1987); Fuqua (2002).
[83] Contrast *c.* 68b.41–6, where he describes to the Muses the support that Allius has offered him and asks in return that they spread his fame to 'many thousands [more]' (*multis | milibus*, 45–6). For more on the scale of gift-exchange in the context of poetry, see Chapter 3, Section 1.

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appears as a strategy of articulating his distance from other poets and literary figures, whether in judgement of their work, as seems to be generally the case, or as part of an invective characterisation of his own poetic retaliation.

It is only in *c.* 5, however, that counting is directed at Catullus' actions, and it is only in *c.* 5 that counting is resisted by first being performed and then confounded. The main difference is that Catullus is appraising literary works elsewhere, whereas in *c.* 5 it is Lesbia's kisses that are under threat of being enumerated. Nevertheless, it is a strong supposition based on his allusion to Callimachus and the Reply that this poem is drawing on a model of poetic criticism and responses to it. As I have suggested, too, the account of the kisses could be interpreted as an account of the love affair, an affair which plays out over the course of Catullus' *libellus*. What I propose is that Catullus is adapting the model of criticism in the Reply to his new poetic context, the literature of love. Catullus may count when appraising others' mythological poetry (Cinna's *Zmyrna*) or historical works (Nepos' *Chronica*), but when it comes to poetry about love, the same sort of enumerative criticism cannot apply. Putting the deeply personal into poetry leaves oneself and not simply one's work open to criticism, as will become clear in *c.* 16. There, Furius and Aurelius have in fact supposedly read *c.* 5 – *quod milia multa basiorum | legistis* ('since you have read my many thousand kisses, *c.* 16.12–13)[84] – and make too close a connection between what his poetry says and its relation to real life.[85] In *c.* 5, at the very point when the erotics of his collection transition from flirtatious insinuation to explicit surface meaning, Catullus also chooses to emphasise that his is a new kind of poetry, for which traditional measures of poetic evaluation, such as counting, will simply not do.

[84] It might be thought that this refers to Catullus' Juventius poem: 'if someone let me kiss for a while, I'd kiss up to three hundred thousand times' (*siquis me sinat usque basiare | usque ad milia basiem trecenta*, 48.2–3). See e.g. Quinn (1970) 143; Sandy (1971) 51. But I think that the connection with poetic criticism in *c.* 16 is more in line with the themes of *cc.* 5 and 7. De Vasconcellos (2015) has shown, furthermore, that 16 recalls 5 in its structure: the opening lines of both are balanced in the same way; *milia multa* are placed in the same *sedes* (5.10 and 16.12); 5, 7 and 16 all conclude with a reference to the 'bad' intent of the onlooker (5.12, 7.12, 16.13).

[85] On the play of poetry and the poetic persona see e.g. Martin (1992) 76–80; Selden (1992) 477–82, and for the erotic and/or sexual element see Fitzgerald (1999) 48–52.

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This argument about the interplay of the erotic, enumerative and literary critical aspects of *c.* 5 supports the modern image of Catullus as a descendant of the learned Alexandrians revelling in recherché references and intricate intertexualities *as well as* the first Roman lyricist to create for his audience the impression of intense moments of passion fervently transcribed on to the page.[86] In this particular case, paying attention to his reworking of Callimachean themes alongside the performance of counting shows Catullus to be a poet who is deeply aware of, and subtly thematises, the inconcinnity of applying an enumerative form of criticism to poetry so intimate, erotic and personal. A traditional form of poetic *aestimatio* is no match for the poet's *aestus*. Indeed, those modern scholars who have attempted to analyse Catullus' love by numbers, to adapt the title of Helen Dettmer's 1997 monograph (*Love by the Numbers: Form and Meaning in the Poetry of Catullus*), have thus singularly ignored the programmatics of *c.* 5.[87] In showing that his account is not something available for enumeration by the critic in *c.* 5, Catullus is making a claim also about the content of his love poetry: the inscription of love into the collection, just like its effect on the mind, is illogical, disordered and *incalculable*.

1.3.2 Counting up the Collection

My claim has been that Catullus' counted kisses are utilised as a means to defend against critics not only of his love for Lesbia, but also of his literature about love. I concluded that *c.* 5 and its dialogue with the equally Callimachean *c.* 1 makes it possible that the resistance to counting as a form of poetic criticism extends to the Catullan collection as a whole. Here I wish to show that his use

[86] For these traditions of reading Catullus, see the summary of Fredricksmeyer (1970) 431–5.

[87] Dettmer (1997). Her monograph, however, is simply the most explicit formulation of a wider project to find and impose order on the Catullan book. See Ellis (1867) 221–304: *Catulli carmina ratione quadam arithmetica diuidenda esse* ('The poems of Catullus ought to be divided up according to a certain arithmetical logic', 221). In more recent times, Skinner (1981) pushed the question to the fore, as did the special volume of *Classical World* from 1988 in which she brought together a number of scholars to discuss structure; see Skinner (1988). Numerical accounting for the collection can still be seen in e.g. Hutchinson (2012).

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of enumeration, and the reworking of Callimachean themes, has a noticeable afterlife which constitutes slender but positive evidence for Roman readers' awareness of the interweaving of counting and poetic criticism. I present just one example of a later engagement with the ideas that Catullus first raised in Latin. The most notable development will be that, while in Callimachus' Reply there is no mention of books or their number, a programmatic wariness about the enumeration of poetry has transformed into a focus on the numbering of books, a movement which I have suggested began with Catullus.

Martial is not a love poet, but he is a keen reader of Catullus.[88] He is also a poet for whom numbers always matter. As Victoria Rimell has explored in depth, Martial's interest in enumeration arises from his imperial and urban context. Exchanges of gifts, favours and poems require a keen mathematical eye in order for the reader to keep track of who values whom at what, while the operations forming and forcing the many into the 'one' is the reflex of the Roman Empire's 'ecumenical' attitude.[89] Here, though, I focus in on a programmatic poem that crystallises the concerns which I have been tracing about numerical criticism and applies it to the question of how many books of poetry ought to be produced.

'quinque satis fuerant: iam sex septemue libelli
  est nimium: quid adhuc ludere, Musa, iuuat?
sit pudor et finis: iam plus nihil addere nobis
  fama potest: teritur noster ubique liber;
et cum rupta situ Messalae saxa iacebunt
  altaque cum Licini marmora puluis erunt,
me tamen ora legent et secum plurimus hospes
  ad patrias sedes carmina nostra feret.'
finieram, cum sic respondit nona sororum,
  cui coma et unguento sordida uestis erat:
'tune potes dulcis, ingrate, relinquere nugas?
  dic mihi, quid melius desidiosus ages?
an iuuat ad tragicos soccum transferre cothurnos
  aspera uel paribus bella tonare modis,
praelegat ut tumidus rauca te uoce magister

[88] See Swann (1994) and Lorenz (2007).
[89] Rimell (2008) chapter 3, with extensive references to Martial's enumerating epigrams.

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oderit et grandis uirgo bonusque puer?
scribant ista graues nimium nimiumque seueri,
quos media miseros nocte lucerna uidet.
at tu Romano lepidos sale tinge libellos:
agnoscat mores uita legatque suos.
angusta cantare licet uidearis auena,
dum tua multorum uincat auena tubas.[90]

(Martial 8.3)

'Five had been enough. Already six and seven books is too much. What is the benefit, Muse, of playing still further? Let decency be the end. Fame can add nothing further for us. My book is a commonplace everywhere. And when Messala's site lies as broken stone, and Licinius' tall marble is dust, I will still be read and many visitors will take my poems back home with them.' So I concluded, and the ninth Muse, with her hair and dress all perfumed, responded as follows: 'You ingrate, are you able to give up your sweet trifles? Tell me, what more idle thing will you do? Will it please you to swap the comic boot for the tragic buskin or to thunder harsh war in equal rhythms; that the overblown schoolmaster in rough voice read you out, and the grown girl and good lad despise you? Too serious, too grave men write such things – miserable men whom the lamp looks upon in the middle of the night. But you dip your books in Roman spice and refinement. Life must read and recognise its habits. By all means be seen to sing on a slender reed, as long as your reed beats the trumpets of the many.'[91]

Martial's books seem not to have been titled but simply numbered, and in joking about their numbering he shows he is well aware of their ordering.[92] This epigram makes that numbering programmatic. (The following poems in the book also return to the question of counting: 8.7, 9, 10, 13.) Surely if one is counting books, eight is too many? Martial already has his eternal imperishable fame. To this counting critique the ninth Muse responds: stick with epigrams, serious themes are not for you.[93]

In response to his concern about an excessive number of books, the ninth Muse justifies the importance of (being suited to) a more playful poetic mode with two clusters of allusions. First, verses

[90] The Latin follows Shackleton Bailey (1990).
[91] Translation adapted from Shackleton Bailey (2006).
[92] Cf. 2.93, 5.2, 10.2. For thorough discussion of the order and names of books, see Coleman (2006) xxv–xxvii.
[93] 5, 6, 7 and 9 are mentioned, but 8 is conspicuously absent. Since it is the ninth Muse who responds (in line nine!), perhaps she is waiting for the future book dedicated to her, just as Lucian suggests that Herodotus' nine books were each dedicated to one Muse (*Herodotus* 1).

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17–19 refer to Catullus' poetry. As commentators have observed, the *lepidos . . . libellos* cannot but recall *c.* 1.1, and *sal* ('spice', 'charm') is a quality Catullus specifically describes his poetry as having at *c.* 16.7.[94] While these references to *c.* 1 have been noted, it has gone unobserved that 17–18 also rework Catullus' imagery in *cc.* 5 and 7. The image inverts Catullus' own valuing of the overly serious at an *as* and the night as a time within which lovers love. Here, serious topics make severe old men work through the night – not unlike Callimachus' Aratus (cf. 56.4 *HE* = *AP* 9.207.4) – while the lamp, more often the witness to lovers' trysts, must make do with looking over them.[95] Whereas Catullus had marked out a time within which severity is to be abandoned, Martial presents the effect of serious poetry as reversing those manners and so reversing Catullus' poetological programme: the mark of a witty, charming poet is that his *dulces nugae* are reserved for the daytime alone. Second, in verses 21–2 the ninth Muse simulates the advice in Vergil's sixth *Eclogue*, where Apollo warns Tityrus to avoid composing epic – 'the shepherd, Tityrus, ought to feed his sheep fat, but speak a drawn-out song' (*pastorem, Tityre, pinguis | pascere oportet ouis, deductum dicere carmen*, *Ecl.* 6.4–5) – which itself evokes Callimachus' Reply.[96] Martial's poem thus concludes by alluding to a number of poems which in different ways draw on a Roman Callimacheanism to negotiate their poetics.

Although Martial does not directly point to the numerical concerns of those intertexts, it is nevertheless clear that he is

[94] Newman (1990) 110; Schöffel (2002) 117.

[95] There is a tradition of the lamp looking over the affairs of lovers in the epigrams of the Greek Anthology, cf. e.g. *AP* 5.8, 128, 165–6, 197. It is attested already though in Aristophanes' *Ecclesiazusae* 6–16.

[96] For the evocation of Callimachus here see fr. 1.21–4 Harder and e.g. Clausen (1964) 193–5. Martial's *angusta . . . auena* gives the qualities of the song which Apollo had advised at *Eclogue* 6.4 to the reed with which Tityrus was playing at the opening of the *Eclogues* (1.2). A further reason for connecting the lines to *Eclogue* 6 specifically is related to the Muse who addresses Martial. The emphasis on comedy (cf. 13) suggests that the comic Muse Thalia is meant, and Schöffel (2002) 107–8 provides further reasons to think that Thalia is meant. Thalia is also the Muse who inspires Tityrus' playful song in *Eclogue* 6: Martial makes Thalia voice what Vergil has Apollo command regarding genre. If the Catullan emendation of Trappes-Lomax (2007) 35–6 is followed (*o Thaleia uirgo*, p. 64 n.78 above), then Martial is drawing together a number of earlier poetic directives associated with that Muse.

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mobilising their poetics to legitimise his production of a large number of books. Callimachus' slender Muse cannot be appraised by a numerical criterion, but Martial employs Vergil's 'translation' of that passage in *Eclogue* 6 to make a numerical point in his final line. Composing such finely wrought and slender poetry, Martial suggests, is acceptable if it is witty and refined enough to compete with the works of epic. Yet since he contrasts the singular *auena* with the many of the *multorum . . . tubas* (22), it is clear this is an unequal fight and is not simply an issue of the scale of poems, whether large or small. The question Martial leaves unresolved at the close of the epigram is: how does his single refined 'reed' compete with the grand works of many people? The nature of his works offers two answers that are not mutually exclusive. As Rimell has shown, the one/many distinction/s informs his attitude towards books of epigrams; they are full of many smaller compositions, but ultimately constitute a unified whole.[97] His work beats the many since a single book of his is itself a multitude of different poems. This reading of the final lines explains how epigram can compete with loftier genres, but it does not clearly answer the opening rhetorical question of how many epigram books are sufficient. By the same token, though, if an epigram book can be understood as a unity or a unit, then books too can be added together to form a multitude. The ninth Muse's answer to the question of how much is *too* much borrows from Martial's own thinking. With a conception that seems to reverse Antipater's attitude to epigram collections (see above), Martial makes it the adding of *books* together that enables the genre to compete with the likes of epic, just as adding poems together is what makes a good book.

Martial acknowledges the criticisms that might arise from the number of books he has written and seeks out earlier passages in Latin literature in order to respond. The epigram shows Martial following in Catullus' (and Vergil's) footsteps, engaging with Callimachus' poetic positioning in the Reply (whether at first hand or more probably through Roman receptions) and turning it towards a goal that he had not intended and which is manifestly in contradiction to his poetics, under the guise – it seems – of

[97] Rimell (2008) 115.

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continuing to reject grand epic themes. Where Callimachus had argued for poetic judgement beyond number, a Muse without numerical measure, Catullus and Martial co-opt the discourse of number in the Reply and turn it towards the ends of both framing and defending their multiple book projects. This is not to say, however, that they had not absorbed Callimachus' articulation of an aesthetics of scale as an alternative to numerical measures of poetry; both Callimachus and Martial show a clear awareness of the slenderness advocated by Callimachus. Their engagement with number as well is thus a purposeful move. Despite Callimachus' efforts to banish enumeration from poetry's critical discourse, Roman poets of the first centuries BCE to CE demonstrate that the habit has not been shaken and they produce ever more sophisticated ways of responding to readerly reckonings.

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2

LEONIDES OF ALEXANDRIA'S ISOPSEPHIC EPIGRAMS

Chapter 1 analysed Callimachus' explicit rejection of counting as a form of poetic criticism and traced out the responses to that intervention in subsequent Greek and Latin poetry. Where Callimachus had sought to introduce a poetics that does not require numerical measurement since it focuses instead on the *sophia* – the sophistication – of the poem, later poets nevertheless found it necessary to address counting forms of criticism alongside an emphasis on their own slender poetry. Against the backdrop of Chapter 1's diachronic study, this chapter examines in details the output of a single Graeco-Roman poet of the mid-first century CE and his engagement with counting as a form of poetic criticism: Leonides of Alexandria and his isopsephic epigrams.

The practice of isopsephy is when the letters of the Greek alphabet are read according to their numerical value: α = 1, β = 2, . . . θ = 9; ι = 10, κ = 20, . . . ϙ = 90; ρ = 100, σ = 200, . . . ϡ = 900.[1] A certain word or phrase is then summed up according to the series of numbers it signifies and that phrase is then made numerically equal to another phrase. Literally, it is the making of pebbles – that is, accounts – equally. For example, Suetonius preserves the following apparently well-known isopsephic statement: Νεόψηφον· Νέρων ἰδίαν μητέρα ἀπέκτεινε ('A new count: Nero killed his own mother', *Nero* 39.2), where 'Nero' and 'killed his own mother' both add up to 1,005: an equivalence that reveals the nature of the emperor. While isopsephy

[1] Qoppa (ϙ) and sampi (ϡ), as well as digamma (ϝ = 6), were obsolete in written Greek by the time that isopsephy had become a popular form, but they were kept as part of this system of numerical notation. Moreover, the old form of digamma, ϝ, was rarely used for 6. Instead, the more common form was two gammas set together with one reverted and sometimes at a 90-degree angle; see Tod (1950) 135. This symbol was then conflated with the stigma, ϛ, which came to be the typical notation for 6 from the time of Byzantine manuscripts onwards; see Jannaris (1907) 39. The precise development of this alphabetic system is debated. Tod (1950) 138 observes that it seems to be a late Hellenistic development in Attic, whereas Chrisomalis (2010) 134–44 and Mendell (2018) 200–3 provide some evidence for Hellenistic (and earlier) uses of the system.

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was a pastime loathed by Aulus Gellius (*NA* 14.6.4–5), it was popular enough for isopsephic guides to be written on papyrus and isopsephic constructions to be indicated in inscriptions: it can be shown to carry a variety of meanings in different contexts, such as enumerating the name of a god or deciphering words in dreams.[2] Within the breadth of isopsephy as a game of numerical and alphabetic equivalences, it could be employed in poetry, as was the case with the epigrams composed by Leonides of Alexandria. Isopsephy in this context aimed to produce epigrammatic couplets of equal value or lines of equal value in a single distich.

In modern scholarship, Leonides has received short shrift. Johannes Geffcken's 1925 *Realencyclopädie* article on the epigrammatist describes him as a 'conceited versifier', a 'miserable *artiste*' and 'one of the most unpleasant little Greeks of the age'.[3] In his *Further Greek Epigrams*, too, despite placing the textual integrity of Leonides' epigrams on a stronger footing, Denys Page could still comment that the poems would be 'contemptible to readers nowadays'.[4] What is all the more surprising is that both scholars in addition do much to highlight Leonides' literary imitations of other epigrammatists and the political circles in which he moved.[5] It is the mix of isopsephic 'parlour game' and epigram which has drawn out the critics' disdain.[6] In recent years, however, analysis of literary play has become a serious business. Acrostics, palindromes and anagrams are now situated in a culture experimenting with multiple potential directions of reading,[7] and pattern poems or *technopaignia* are frequently read against the long and

[2] See *POxy.* XLV 3239; Artem. 4.24, 3.45. For a summary of uses see Luz (2010) 247–325 and Ast and Lougovaya (2015).

[3] Geffcken (1925): 'eingebildeter Verseschmied', 'kümmerlicher Künsteleien', 'Einer der unerfreulichsten Graeculi der Zeit'.

[4] Page (1981) 504.

[5] The extent of his Julio-Claudian patronage is unclear; the only evidence is the epigrams: addressed to Caesar (probably Nero or Vespasian) 1, 7; Agrippina 8; Poppaea 32 *FGE*. Page (1981) 505 judges him as equal to Antipater of Thessalonica, better than Antiphilus and Parmenion and sometimes indistinguishable from Leonidas of Tarentum.

[6] See Page (1981) 505. Counting the couplets is 'a labour which even the most sympathetic critic has resented' (504). This may not be unbiographical.

[7] Luz (2010) 1–77 offers a clear overview. Indispensable is Squire (2011) 216–28: 'acrostic materializes an intensified concern with the graphic and multilinear qualities of papyrus poetry: writing is understood not just as spoken word, but also a graphic script' (224).

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vibrant tradition of ekphrastic epigrams.[8] Similar benefit can be gained by re-evaluating the cultural importance of isopsephic epigrams.[9]

My strategy in this chapter is thus to read Leonides' use of isopsephy in epigrams as a development of the aesthetics of scale that I outlined in Chapter 1. That is, I take Leonides' fashioning of verses that contain large numerical accounts to address the same critical concern about how much content can be fitted into a limited extent that arose in Callimachus' Reply and in Antipater of Sidon's praise of Erinna. In this case, isopsephic epigrams advance an aesthetics of scale through the dual significance of Greek letters. This contrast of the large and small has its roots in Hellenistic mathematics and poetry, too. Apollonius of Perga was a younger contemporary of Archimedes working in Alexandria under Ptolemy Euergetes.[10] Preserved in what remains of the second book of Pappus' *Collection* is Apollonius' method for multiplying numbers that are an integer multiple of ten between 1 and 9. The method divides each of the numbers into their 'base' and powers of ten for ease of computation; for example, the base of 400 is 4 and of 30, 3. Once all the numbers are separated in this way, the bases are multiplied, then also the powers of ten, and finally the two are multiplied together to reach final sum.[11] Apollonius exemplified this method of multiplication for the reader by multiplying the letters in a hexameter line.[12]

[8] Luz (2010) deals with each of type of letter game, including Leonides' epigrams. For pattern poems see Luz (2010) 327–53; Squire (2010a); Kwapisz (2013a).

[9] Nisbet (2003) 202–8 and Livingstone and Nisbet (2010) 119–21 do raise and discuss Leonides and his epigrams. The former only considers matters of identity and Page's editorial style, while the latter only mentions Leonides as part of an introductory volume on epigram. They do not ask how isopsephy relates to poetry.

[10] According to Eutocius in his *Commentary on the Conics* [i.e. Apollonius']; see Heiberg (1974) 168.

[11] See Heath (1921) 1, 54–8 and Hultsch (1965) 2–29.

[12] This is one of two lines given in Pappus' text. The other is equally literary: Μῆνιν ἄειδε θεὰ Δημήτερος ἀγλαοκάρπου ('Sing, goddess, the wrath of Demeter, bringer of beautiful fruit', Pappus *Collection* p. 23.2). It is a clear adaptation of *Il.* 1.1 and, according to Pseudo-Justin Martyr (*Coh. ad Graec.* 17c2), it was from an Orphic poem. Perhaps its significance is that the line yields a large number just as Demeter is instrumental for large agricultural yields; for a similar connection between calculation and agriculture see Chapter 3, Section 3. I concur with Hultsch (1965) 26, Heiberg (1974) 124 and Netz (2009) 52 that the verse is probably not by Apollonius.

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Ἀρτέμιδος κλεῖτε κράτος ἔξοχον ἐννέα κοῦραι (Apollonius of Perga fr. 37 Heiberg = Pappus *Collection* p. 22.9)

Nine maidens, praise the most eminent power of Artemis (1, 100, 300, 5, 40, 10, 4, 70, 200, 20, 30, 5, 10, 300, 5, 20, 100, 1, 300, 70, 200, 5, 60, 70, 600, 70, 50, 5, 50, 50, 5, 1, 20, 70, 400, 100, 1, 10)

The verse, presumably of Apollonius' own devising, creates a context in which an opening invocation yields the sum of 196,036,848,000,000,000.[13] This produces an unusual form of isopsephy in poetry; one would typically expect the verse to be 'counted' by means of addition. As Netz has shown, Apollonius' non-utilitarian numerical practice here can be understood as part of Greek mathematicians' interest in shocking and amazing their readership and in generating a 'carnival of calculation' as much as in producing a new notational form for multiplications.[14] His choice of a hexameter line – and one invoking the Muses at that – takes a new approach to the interrelation of content and extension. The nine maidens of Apollonius are not only the nine Muses, but also the nine 'bases', the numbers 1–9, which form the basis of his multiplication method. In another case of an aesthetics of scale, these nine Muses generate large totals. Apollonius is not simply producing a new system more capable of delivering what poetry only rhetorically gestured at, he is testing traditional poetry's numerical capacity: just how much could a poem, and even a single line, contain? It turns out that the shortest of poems, not even past their invocatory verse, can compress large sums.

Isopsephy, however, was also a mode of reading poetry. Aulus Gellius records that a friend of his had listed all the verses of Homer where two consecutive lines had the same total (*NA* 14.6.5), but he does so only to disparage it as among those things

[13] Perga possessed a wealthy sanctuary to Artemis; cf. Cic. *Verr.* 2.1.95. Heiberg (1974) 124 connects this method with the *Okytokion* of Apollonius (fr. 36 Heiberg) known from other sources and labels the fragment above as such. Huxley (1967) connects the term Ὠκυτόκιον with the use of ὠκυτόκος to describe the moon, an avatar of Artemis. If the former can be proved, then this is a stronger reason for thinking that his line is patriotic.

[14] Netz (2009) 47–53 and 59. As Acerbi (2003) has shown, Apollonius seems elsewhere to have Hellenistic combinatorics in mind, the domain of mathematics in Greek antiquity in which 'numbers can be found only by an iterated sequence of complicated calculations' Netz (2009) 20. The carnival of calculation may thus inform Apollonius' wider arithmetic outlook.

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which appear learned but are neither entertaining or useful (*NA* 14.6). He does not quote examples, but the later tradition has recorded some pairs (e.g. *Il.* 7.264–5 and 19.306–7).[15] There is also evidence that isopsephic reading was applied to Euripidean drama. In the late first or early second century CE, Aelius Nicon, father of the physician Galen and a successful architect at Pergamum, had an isopsephic treatise on geometry inscribed upon a building which propounded the relation between the cone, sphere and cylinder.[16] A further inscription (*IGRom.* 4.506), quite probably part of the same project, introduces the architect and contains a hymn, in which lines 2–4 directly echo and modify for the new context Euripides *Phoenissae* 3–5. Such an adaptation would have required first counting up Euripides' verses. The same can be said for the subsequent readers of the inscription, too: the literary game involves both scrutinising the verses isopsephically to confirm the numerical equivalences and examining their meaning in order to identify the Euripidean borrowing.

The earliest evidence for the critical games that could be had with such a mode of reading is found on a mid-third-century BCE inscription at the necropolis of Hermoupolis Magna in Egypt, comprising an iambic epigram for the Egyptian sage Petosiris upon his grave and a later response.[17]

Πετόσειριν αὐδῶ τὸγ κατὰ χθονὸς νέκυν,
νῦν δ' ἐν θεοῖσι κείμενον· μετὰ σοφῶν σοφός.
κεφάλαιον τούτων τῶν ἰαμ̣βείων
εἰς ἀ̣ργύριον λόγον [δραχμαὶ] ,ητογ΄·
τούτου δὲ αὐ̣τ̣οῦ, ,βψκ΄.

(*IMEGR* 125 = *SEG* 8.624–5)

I speak of Petosiris, a corpse in the earth, while now he lies among the gods: a sage among sages.
The summed amount of these iambics is 8,373 silver drachmas.
And of this, 2,720.

[15] From the *Anecdota Graeca* edited by Jean François Boissonade; see Luz (2010) 251–2.
[16] For an in-depth discussion of Nicon and his mathematical inscriptions see Thomas (2007) 92–103.
[17] See Bernand (1969) 495–8 for further bibliography and discussion. The two hands are distinct, but the general similarity of style suggests that the response was written up soon after the poem.

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Following the epigram, at some later date another hand has given its numerical value, reading the letters as numbers, and has suggested that this is the cost in drachmas of the epigram. The following inscription, whether written by the second hand or another, pokes fun at this counting by appending 'and of this': it does not gloss the total amount of the previous statement (i.e. 3–4: κεφάλαιον . . . ,ητογ΄), but self-referentially points to the amount of that very statement.[18] The final line exposes the entire absurdity of counting the numerical value of epigrams, here possibly to critique the cost of public epigrams (think, perhaps, of the 15,000 bushels of wheat given to one Archimelus for a single epigram, Ath. 5.209b). It is an operation that could be applied to texts *ad infinitum*. The final line 'that sums itself' represents the result of such thinking: a text which is only there to make up the numbers. By the time Leonides composed his isopsephic epigrams, then, there was a pre-existing habit not only of experimenting with poetry that could contain large totals within a verse, but also of literary responses and criticism involving isopsephy (and criticism of that criticism, if my interpretation of the final line is to be followed).

My aim here is to examine Leonides' 'accounting' compositions and the literary critical positions with which he engages. More specifically, I trace how Leonides reinterprets and redeploys themes from Callimachus' poetry. As Chapter 1 demonstrated, Callimachus engaged in literary polemic which aimed to carve out a poetics not susceptible to numerical forms of criticism. This precedent, I propose, provides a foil for Leonides' representations of his own poetic products. In Section 1, I analyse a number of Leonides' epigrams and their allusions to Callimachus or use of Callimachean themes. I argue that Leonides responds to the Reply to the Telchines and its aesthetics of scale, but that he reintegrates numbers into the literary equation. The addition of numbers into his poems allows for short, compressed compositions which contain 'large accounts', and he gestures to this fact by also compressing Callimachean statements into his epigrams. The second and

[18] ,ητογ΄ signifies 8,373, which is the sum of the iambics, while τούτου δὲ αὐτοῦ adds up to ,βψκ΄ (2,720): 3–4 add up to 5,847.

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third sections offer an extended discussion of a single epigram and its Callimachean resonances. Epigram 33 *FGE* describes the novelty of Leonides' isopsephic poetry and alludes to Callimachus' *Hymn to Apollo*. Section 2 analyses the opening couplet and how it relates to other receptions of Callimachus' poetics. I also propose that Leonides places himself in a Callimachean literary tradition, at the same time as correcting Callimachus' reception elsewhere and offering a potential context for his own playful poems. Section 3 examines the second couplet and argues that Leonides programmatically reframes Callimachus' approach to poetic measurement by reinterpreting the image of the stream which concludes the *Hymn to Apollo*. By making Callimachus count, so to speak, he enters into a contemporary debate over poetic refinement and argues that enumerating epigrams are very much a Callimachean product. In response to his modern reception, I show both that Leonides is a sophisticated epigrammatist and that his poems attempt to grapple with a wider discussion about the interrelation of counting and criticism.

2.1 Callimachus Compressed

This section surveys a number of Leonides' epigrams which respond to Callimachus, tracing out where and to what end Leonides signals his enumerating verses through Callimachean intertexts. At the same time, I hope to demonstrate that, while Callimachus remains a constant through these poems, Leonides also shows himself well aware of, and seeks to upturn and innovate upon, the preceding traditions of epigrammatic poetry. It will further become clear that the 'Nile-born' Leonides adopts the stance of the earlier Alexandrian poet in negotiating his own position in relation not to the Ptolemies, but to the imperial family at Rome. His emulation of Callimachean themes extends to their political as well as poetic aspects.

First, an epigram by Leonides which looks to move programmatically from his typical two-couplet epigram form to a single couplet.

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εἷς πρὸς ἕνα ψήφοισιν ἰσάζεται, οὐ δύο δοιοῖς·
οὐ γὰρ ἔτι στέργω τὴν δολιχογραφίην.

(Leonides 6 *FGE* = *AP* 6.327)
(Line 1 = 2 = 4,111)

One [line] equals one in its *psêphoi*, not two to two. For I no longer love writing at length.

The couplet brings together various Callimachean passages. Leonides' dislike for writing at length combines two expressions of aesthetic judgement found in Callimachus' epigrams.

ἐχθαίρω τὸ ποίημα τὸ κυκλικὸν οὐδὲ κελεύθῳ
χαίρω τὶς πολλοὺς ὧδε καὶ ὧδε φέρει·
μισέω καὶ περίφοιτον ἐρώμενον, οὐδ' ἀπὸ κρήνης
πίνω· σικχαίνω πάντα τὰ δημόσια.

(Callimachus 2.1–4 *HE* = *AP* 12.43.1–4)

I hate the cyclic poem, nor do I enjoy the path which carries many this way and that. I hate the beloved who goes around, nor do I drink from the fountain. I loathe everything public.

μικρή τις, Διόνυσε, καλὰ πρήσσοντι ποιητῇ
ῥῆσις· ὁ μὲν "νικῶ" φησὶ τὸ μακρότατον,
ᾧ δὲ σὺ μὴ πνεύσῃς ἐνδέξιος ἦν τις ἔρηται
"πῶς ἔβαλες" φησί, "σκληρὰ τὰ γιγνόμενα".
τῷ μερμηρίξαντι τὰ μὴ ἔνδικα τοῦτο γένοιτο
τοὖπος, ἐμοὶ δ', ὦναξ, ἡ βραχυσυλλαβίη.

(Callimachus 58 *HE* = *AP* 9.566)

A short speech, Dionysus, is fine for an accomplished poet. For while one says 'I win' as the lengthiest thing, the other, on whom you do not breathe favourably, if asked 'how did it go?', says 'things are tough'. Let that be the story of the one worrying about unjust things, O lord, but for me: concision.

The first epigram begins with a statement of poetic preferences, which then expands out to include other public goods. The target, introduced in the second couplet, is the beloved, who will be explicitly named and attacked in the third couplet (not given here). The second epigram contrasts the concision of the successful and unsuccessful poet: one says enough in two syllables, while the loser goes on at length about his luck. The use of μακρότατον recalls its application by Philemon in Chapter 1, where long-windedness was not a matter of length but unnecessary extension of speech. The same sense should be understood here: 'I win' is all

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that is necessary. The finally irony of the epigram is that the speaker, in recapitulating his opening claim about the poetic value of short speech, produces the verbose form βραχυσυλλαβίη.[19] The epigram poses the question of whether the speaker practises what he preaches. Leonides manages to invert both sentiments in reaching the same poetic ends of valuing refinement: Callimachus' coinage βραχυσυλλαβίη is replaced by Leonides' contrasting coinage δολιχογραφία ('writing at length'), and Callimachus' verb of hating is replaced with a positive verb expressed in the negative.[20] This innovation is itself Callimachean, since Leonides specifically echoes Callimachus' claim of smallness by replacing one long six-syllable noun with another equally long. Leonides' allusion 'corrects' Callimachus (i.e. smooths away the irony) with a word which both *enacts* and *means* writing at length: a six-syllable noun in a two-line epigram creating another contrast of the large in the small.

A further intertext is significant here. The single couplet form recalls Callimachus' single couplet epigram on Theris.

σύντομος ἦν ὁ ξεῖνος, ὃ καὶ στίχος οὐ μακρὰ λέξων
Θῆρις Ἀρισταίου Κρὴς ἐπ' ἐμοὶ δολιχός.

(Callimachus 35 *HE* = *AP* 7.447)

Short was the visitor, for which reason the line 'Theris, Cretan, son of Aristaius', though not intending to be long-winded, is long on me.

There are two points of contact with Leonides' epigram. The concluding δολιχός ('long'), which tends to refer to length in either space or time, is echoed by Leonides' δολιχογραφία. Its use is not confined to Callimachus, but its position in the pentameter is found elsewhere only in Leonidas (72.6 *HE* = *AP* 7.726.6) and Dioscorides (5.4 *HE* = *AP* 5.55.4) before Leonides, which if nothing else guarantees it as a Hellenistic usage. The allusion to Callimachus is strengthened, though, by the fact that only in the case of Callimachus' epigram is there the same self-reflection on

[19] For the further significance of short speech see Acosta-Hughes and Stephens (2012) 57–62.

[20] Cf. LSJ *s.v.* βραχυσυλλαβίη and δολιχογραφία. The use of δολιχογραφία here recalls an epigram of Parmenion, an epigrammatist from Philip's *Garland*, who claims that the Muses do not like many-lined epigrams and that one should not seek the δόλιχον ('long-course', 11.2 GP).

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the act of writing. In addition to the emphatic placing of δολιχός, there is also the concern with the small being paradoxically long by comparison to something else. In the case of Callimachus' epitaph, the comment seems to be that the short three-word name with demonym and patronym is still too long for a man of such short stature or short in speech. In the same way, when Leonides introduced the equivalence of one line to one, the two-to-two equivalence is what he appears to be describing as δολιχογραφία (cf. οὐ γὰρ ἔτι στέργω). In its form, rhetoric and allusiveness, then, Leonides' couplet looks to Callimachus' own couplet attesting to a penchant for short, concise compositions. Equally, he is able to distil Callimachean contrastive aesthetics further through his isopsephy: at the same time as Leonides cuts down his epigrams from two couplets to one and aims at literary smallness, the epigram's account remains in the thousands (8,222 in the present case).

A second isopsephic epigram continues to display a contrastive aesthetic by alluding to a pre-existing epigrammatic convention.

ἄλλος ἀπὸ σταλίκων, ὁ δ' ἀπ' ἠέρος, ὃς δ' ἀπὸ πόντου,
Εὔπολι, σοὶ πέμπει δῶρα γενεθλίδια·
ἀλλ' ἐμέθεν δέξαι Μουσῶν στίχον ὅστις ἐς αἰεί
μίμνει καὶ φιλίης σῆμα καὶ εὐμαθίης.

(Leonides 4 *FGE* = *AP* 6.325)
(Lines 1 + 2 = 3 + 4 = 5,953)

One sends you birthday gifts from the hunting-nets, another from the sky, a third from the sea, Eupolis. But from me accept a line of the Muses, which will survive forever, a sign of friendship and good learning.

This poem for Eupolis enacts a 'compression' of epigram in epigram. The opening line alludes to a tradition inaugurated by Leonidas of Tarentum (66 *HE*) in which a fowler, a hunter and a fisherman dedicated gifts to the god Pan. Fifteen variations on the theme are preserved in the *Palatine Anthology*, each following a set of rules concerning content: 1) the dedication is to Pan; 2) the fowler must be called Pigres, the hunter Damis and the fisherman Cleitor; 3) they should be brothers; 4) they should dedicate their tools; 5) they should end with a prayer for success.[21] As with numerous other epigram series which survive, literary innovation

[21] See Page (1981) 88.

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within thematic limits is the aim.[22] Leonides, however, is acutely aware of this tradition in his reworking. Following the 'three hunting brothers' theme, a reader might expect the address to be to Pan. He redirects the traditional address instead towards his friend as the literary brothers reach out to send him gifts on his birthday. More pointedly, though, in the second couplet Leonides outlines his own gift as a 'line of the Muses', where στίχος is most naturally taken as a singular (LSJ *s.v.* στίχος II.a).[23] Rather than indicating his epigram as a whole, Leonides is probably referring to his opening hexameter which not only resonates against the 'three hunting brothers' tradition, it scales down those epigrams of two or three couplets; encapsulating in a single line gifts from everywhere, from land, sea and sky. Here the isopsephic reading matches up to the literary game: just as Leonides can fit a whole epigrammatic tradition into one hexameter, those who have εὐμαθία see how he fits large and equivalent tallies into his two couplets.

Once again, though, Callimachus is also likely to be one of Leonides' intertexts. The term εὐμαθίη is particularly significant, and it is programmatic for one of Callimachus' epigrams.

εὐμαθίην ᾐτεῖτο διδοὺς ἐμὲ Σῖμος Μίκκου
  ταῖς Μούσαις, αἱ δὲ Γλαῦκος ὅκως ἔδοσαν
ἀντ' ὀλίγου μέγα δῶρον.

(Callimachus 26.1–3 *HE* = *AP* 6.310.1–3)

Simos son of Miccus gave me to the Muses and asked for learning; and they, like Glaucus, gave it, a great gift in exchange for a little one.

The speaker in this epigram is Dionysus in the form of a statue, who goes on to lament that his dedication to the Muses by Simos, supposedly in a classroom, has meant that he has to hear the same trite line from Euripides' *Bacchae*: 'the lock is sacred' (ἱερὸς ὁ πλόκαμος, 6: Euripides *Bacchae* 494). With typical irony, Callimachus' final line queries just what this dedicatee is doing

[22] The classic study of epigrammatic variation on a theme is Tarán (1979). Squire (2010b) teases out the poetics of epigrammatic replication and mimesis in epigrams on Myron's cow (*AP* 9.713–42, 793–8 and Posidippus 66 AB).

[23] Cf. 2 *FGE*, mentioned briefly below, where analogously δίστιχον probably refers to only one couplet, although it is in any case corrupt; see Page (1981) 515. See also 33 *FGE* below, where δίστιχα refers to the two couplets.

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with his 'great gift'. These lines, however, describe the contract between the Muses and the dedicatee with literary pretensions: a gift must be offered. Referring to the encounter of Diomedes and Glaucus in *Iliad* 6, he does not have the mention of the generation of the leaves in mind, but Glaucus' exchange of his gold armour for Diomedes' bronze (234–6). In that passage, Homer points out the relative value in numerical terms – 'gold for bronze, a hecatomb for nine oxen' (χρύσεα χαλκείων, ἑκατόμβοι' ἐννεαβοίων, *Il.* 6.236) – while Callimachus is more interested in the contrast of large and small. Callimachus' passage is reworked by Crinagoras in concluding his dedicatory epigram on a finely wrought pen sent to one Proclus on his birthday.

πέμπει Κριναγόρης, ὀλίγην δόσιν ἀλλ' ἀπὸ θυμοῦ
πλείονος, ἀρτιδαεῖ σύμπνοον[24] εὐμαθίῃ.

(Crinagoras 3.5–6 GP = *AP* 6.227.5–6)

Crinagoras sends [this to you], a little gift but from a greater heart, an accompaniment to your recently learnt scholarship.

Crinagoras is reworking Callimachean themes.[25] The contrastive aesthetic has been inverted here, with the gift itself being small, but the impetus of friendship behind it being great. The term εὐμαθίη has been moved from the programmatic first position to the equally programmatic final position in the epigram. This move looks to have been inspired by its only use (on present evidence) between Callimachus and Crinagoras in Meleager's epigram on the coronis, the diacritical mark which ends a text: 'I sit enthroned at the boundary of learning' (σύνθρονος ἵδρυμαι τέρμασιν εὐμαθίας, 129.8 *HE* = *AP* 12.257.8). Crinagoras takes Meleager's 'learned' ending and combines it with Callimachus' gift-giving opening theme. Apollonides, Crinagoras' younger contemporary, echoes the position in the pentameter when he describes the consul Laelius, about to become a poet and write in the book 'of the Muses' (Μουσάων, 22.3 GP), seeing in a jay atop a tree 'a token of learning' (σύμβολον εὐμαθίης, 4). Leonides thus follows a later

[24] I print σύμπνοον here instead of Gow and Page's σύμπονον, following the arguments of Ypsilanti (2018) 79.

[25] Although this goes unmentioned in Maria Ypsilanti's recent commentary; cf. Ypsilanti (2018) 78–9.

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Hellenistic tradition of reworking Callimachean epigrammatic themes. Whereas Crinagoras' finely wrought object is small in contrast to his great intent, Leonides follows Callimachus (and Apollonides) in identifying the Muses as enabling great artistry to inhere in short compositions.

The epigram responds to the theme of εὐμαθία in poetry introduced by Callimachus and developed by later epigrammatists, but I also want to propose that Leonides is building on themes found most clearly in Callimachus' twelfth *Iambus*. First, both are presents for birthdays. *Iambus* 12 celebrates the birth of the daughter of Leo, a friend of Callimachus. It is set on the seventh day after her birth, a traditional time at which the Amphidromia occurs, where the child is circled around the hearth and given presents. Whereas Leo's daughter has been born recently, it is more likely that Eupolis is older (cf. φιλίης σῆμα).[26] Second, the Muses are invoked in connection with Leonides' composition, much as the speaker in *Iambus* 12 addresses the plural 'goddesses' (θεαί, 18) – and then one specific goddess: τῇσδ' ἐτῆς εὐχῇ[σι .]..ᾳεισομαι | Μοῦσα ('with these true prayers ... I will sing, Muse', *Ia.* 12.19–20 Kerkhecker) – before offering his poem. Third, both describe in a poem the act of giving poetry as a gift. During the Amphidromia celebrations, Callimachus offers Leo's child the gift of a poem. The poem recounts the gathering of the gods for Hebe's birthday, at which each offers a present. Each god provides wonderful gifts, but Apollo bests them all by offering the gift of song, which he describes as being superior to the material gifts of the others.[27] There emerges a clear structure where Leo's daughter's celebration mirrors Hebe's and so Callimachus' gift echoes Apollo's.[28] Similarly, Leonides contrasts the material gifts of the three brothers, sourced from all sections of the cosmos, with his own isopsephic poetry. Although it is unclear due to the state of the text – Apollo says only that 'mine is the best gift for the child' (ἡ δ' ἐμὴ τῇ παιδὶ καλλίστη δόσις, 68) – the

[26] The diegete to the *Iambus* records that 'this was written for the seventh [day] for the daughter born to Leo' (τοῦτο γέγραπται εἰς ἕβδομα θυγατρίου γεννηθέντος Λέοντι, IX 25–7); the numerical nature of the ritual may have resonated with Leonides.

[27] For a summary of the narrative discernible from the fragments, see Kerkhecker (1999) 218–22 and Acosta-Hughes (2002) 104–22 with translation.

[28] The structure is noted at Kerkhecker (1999) 222 and Acosta-Hughes (2002) 120.

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contrast with the other gods' presents is specifically that his will not perish. Likewise, Leonides' composition will 'remain forever' (ἐς αἰεί . . . μίμνει). Equally, however, the gifts which the other gods give to Hebe are described by the speaker as παιχνία ('toys', 'games', 27 and 33), and Apollo alludes to their gifts in a negative fashion by connecting material possessions, especially those made of gold, to human corruption and the disrespecting of the gods. Leonides seeks to reconcile these two attitudes of *Iambus* 12 in this epigram. His isopsephic epigram improves upon material objects and will last through the ages, but he also conceives of the epigrams as a form of toy: in 2 *FGE* his composition is 'a two-line plaything of clever eloquence' (δίστιχον εὐθίκτου παίγνιον εὐεπίης, 2). In addition to an emphasis on εὐμαθία in relation to a contrastive aesthetics of scale, Leonides draws on the Callimachean theme of the superiority of poetry as a gift over material goods (see 8 *FGE* below), but he manages to offer poetry from the Muses which is nonetheless also a 'toy'.

A slightly more straightforward epigram represents itself as a birthday present for Agrippina. Its themes recall those in the previous epigram by Leonides and confirm the location of the second couplet as a site for 'Callimachean reflection' on the preceding couplet.

ἄλλος μὲν κρύσταλλον, ὁ δ' ἄργυρον, οἱ δὲ τοπάζους
πέμψουσιν, πλούτου δῶρα γενεθλίδια·
ἀλλ' ἴδ' Ἀγριππείνῃ δύο δίστιχα μοῦνον ἰσώσας
ἀρκοῦμαι δώροις ἃ φθόνος οὐ δαμάσει.

(Leonides 8 *FGE* = *AP* 6.329)
(Lines 1 + 2 = 3 + 4 = 7,579)

One will send crystal, another silver and some again topaz, birthday gifts of wealth. But look, having only made two couplets equal for Agrippina, I am content with this gift which envy shall not conquer.

This poem operates, as the Milan Posidippus now illuminates, in a rich tradition of epigrams responding to precious stones which dates from the Hellenistic period, a tradition which often develops a metapoetic tone by setting material against literary value.[29] It also echoes the structure of 4 *FGE*, with the three terms in the

[29] See Petrain (2005).

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opening hexameter and the contrast with Leonides' gift in the second couplet; it compresses an epigrammatic theme or commonplace into the first line and offers it as a gift in the second. The second couplet comments on the novelty.

As Jan Kwapisz has recently suggested with regards to this epigram, there is additional playfulness in referring to precious gems.[30] The etymology of isopsephy alludes to the material context of accounting in the ancient world, and Leonides seems to play with the meaning of ψῆφος here; the extravagant precious gems of the opening line contrast with Leonides' own implied ψῆφοι in the background. An emphasis on poetic longevity set in contrast to the force of envy (or Envy), furthermore, parallels the reworking of *Iambus* 12 in 4 *FGE* by means of a further allusion to Callimachus. As I will argue in Sections 2 and 3, Leonides makes an extended and sophisticated allusion to the end of Callimachus' *Hymn to Apollo*. In this epigram, Leonides looks to supplement a key term which is absent from 33 *FGE*. In the *Hymn to Apollo*, Callimachus succeeds in banishing Blame to where Envy has already fled (113), and 33 *FGE* focuses on sending Blame away (see below). In the context of a self-arranged epigram book, Leonides, gesturing overtly to his isopsephic innovation, would again be warding off criticism by resuming the Callimachean mode encountered earlier (or at least, elsewhere) in his collection. Leonides' compositional novelty brings a charm which ensures Agrippina's fame, while equally his poetic defence against potential 'private criticism' (φθόνος) now also extends to his royal addressee. As in many Callimachean passages (e.g. *Aetia* fr. 1 Harder), Leonides' pre-emptive strike in this epigram ensures his novel, royal gift is not left open to criticism: he produces tough-as-rock poems that are worthy gifts for the imperial family.[31]

A fourth epigram takes gifts to the imperial family in a different direction.

θύει σοι τόδε γράμμα γενεθλιακαῖσιν ἐν ὥραις,
Καῖσαρ, Νειλαίη Μοῦσα Λεωνίδεω·

[30] Kwapisz (2017) 185.
[31] In a real sense, too, it may be thought that the isopsephic technique would prevent textual corruption, since this would immediately be clear from the unequal tallies.

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Καλλιόπης γὰρ ἄκαπνον ἀεὶ θύος· εἰς δὲ νέωτα
ἢν ἐθέλῃς θύσει τοῦδε περισσότερα.

(Leonides Epigram 1 *FGE* = *AP* 6.321)
(Lines 1 + 2 = 3 + 4 = 5,699)

The Muse of Egyptian Leonides offers this epigram to you, Caesar, on your birthday. The offering of Calliope is always smokeless. But next year, if you wish, she will sacrifice even more than this.

Leonides figures his epigram as a gift and the giver as the Muse of poetry herself. This epigram is no mere plaything; it is (styled as) a signal of the Muse's wish to acknowledge and celebrate Caesar's (probably either Nero's or Vespasian's) birthday. The opening of line 3, importantly, looks to echo a fragment of Callimachus.

ἄκαπνα γὰρ αἰὲν ἀοιδοί
θύομεν

(Callimachus fr. 494 Pf.)

We poets always offer smokeless sacrifices . . .

The imagery appears elsewhere in Greek literature, but Leonides' line is notable for its closeness of form, not to mention its closeness in time.[32] Its preservation in the epitome of Athenaeus (1.8e) does not reveal whether it originally had a political context. What does seem likely is that it is part of Callimachus' use of sacrificial imagery in order to frame his poetry as also a gift to the gods. In the Reply to the Telchines, Apollo appears to Callimachus and offers him advice.

τὸ μὲν θύος ὅττι πάχιστον
θρέψαι, τὴ]ν Μοῦσαν δ' ὠγαθὲ λεπταλέην·

(Callimachus *Aetia* fr. 1.23–4 Harder)

feed the sacrificial animal so that it becomes as fat as possible, but, my dear fellow, keep the Muse slender

Apollo's command sets up a contrast between two different offerings to the gods, a poetic composition and ritual sacrifice, and in particular marks the differing criteria of quality.[33] Leonides mixes the terms of this Callimachean parallelism in his opening line: what is being 'sacrificed' or offered is this very epigram.

[32] For further references see the *apparatus* of Pfeiffer (1949) *ad loc.*
[33] For the religious background to this see Petrovic (2012) 296–7.

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Two things are remarkable about the allusion. First, if Callimachus in the fragment also advances a parallelism that sets poetry and sacrifice as two means of pleasing the gods, then Leonides changes this religious claim into a political statement, as the Muse now sacrifices to a ruler. Once offerings were given up to the gods, now both appear subservient to the emperor. Second, if the Reply to the Telchines is also recalled when reading Leonides' epigram, then line 4 toys with Apollo's directive and Callimachus' parallel of sacrifice and song. In the future Leonides promises to sacrifice 'greater things', 'more excessive things', or adverbially 'more greatly', 'even more' (LSJ *s.v.* περισσός, literally 'beyond the regular number'). For a sacrificial offering, this is a boon for the gods and so for Caesar. Yet as Leonides makes clear in the first line, what is 'sacrificed' or offered is the poem. A promise for a greater *poem* appears to contradict Apollo's order as represented in Callimachus. Leonides' isopsephic epigrams, however, with their contrastive aesthetics of scale operating through the dual significance of Greek letters, can metaphorically bypass this contrast between a large sacrifice and a slender poem. With verses adding up to thousands, he can produce slender poems which are also large offerings. It is fascinating in this respect that a further epigram by Leonides explicitly mentions a sacrifice to Caesar (likely Nero) which specifies 100 oxen to be slaughtered (29 *FGE* = *AP* 9.352; 1 + 2 = 3 + 4 = 7,218). As Page notes, 'hecatomb' was rarely an actual sacrifice of so much and Leonides' specificity here suggests an important occasion.[34] By the same token, of course, it might be read as responding to 1 *FGE*. Leonides promised more. 29 *FGE* delivers by making a 'hecatomb' (a word itself notably absent) true to its numerical claim, vastly improving on the singular offering of 1 *FGE*, while on the isopsephic level, the count goes up from 5,699 to 7,218. What is important to note about 1 *FGE*, and potentially also about 29 *FGE*, is how Leonides pulls Callimachus' self-description in fr. 494 Pf. in two directions. Callimachus' imagery is redeployed in order to underscore the contrastive aesthetics of Leonides' innovative isopsephic epigrams, but also in order to strike up

[34] Page (1981) 533.

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a relationship with the imperial family. Leonides' allusion in 1 *FGE* suggests Callimachus as a model of poetic self-presentation with respect to one's literary production but also with respect to a poem's function within a broader set of political concepts related to the ruling power – in this case the emperor as a divinity to whom people ought to sacrifice.

The dual poetic and political aspects of Leonides' poetry and Callimachus' influence on both finds its most complex expression in another epigram to Caesar (either Nero or Vespasian).

τὴν τριτάτην Χαρίτων απ' ἐμεῦ πάλι λάμβανε βύβλον,
Καῖσαρ, ἰσηρίθμου σύμβολον εὐεπίης,
Νεῖλος ὅλως καὶ τήνδε δι' Ἑλλάδος ἰθύουσαν
τῇι χθονὶ σῇι πέμψει δῶρον ἀοιδότατον.[35]

(Leonides Epigram 7 *FGE* = *AP* 6.328)
(Lines 1 + 2 = 3 + 4 = 7,372)

Caesar, once more accept from me this book, the third of the Graces, as a token of eloquence equal in number; the Nile will in any case also send it straight through Greece to your land, a most poetic gift.

In this opening to a third book of isopsephic epigrams (after 6 and 33 *FGE*, perhaps?), Leonides gifts his work to Caesar, transmitting his poems from Alexandria to Caesar's land (either Rome or Italy broadly speaking; cf. Ἰταλίδαις, 'Italians', at 21.2 *FGE*). A number of intertexts come into view when reading this poem, which open up both a numerical and political relationship between poet and addressee.

On first reading, Leonides makes a connection between reading and counting with his reference to a third Grace. In the same way that his handling of εὐμαθίη showed that his reception of Callimachus is mediated through subsequent epigrammatists, 7 *FGE* similarly recalls an epigram which opens with an accounting that was composed by Antipater of Thessalonica, an Augustan poet patronised by L. Calpurnius Piso.

[35] The epigram is corrupt in the MSS. I have printed the corrections which Page (1981) 518–9 suggests but does not print, even though he made the sense perfectly acceptable and the couplets equal. I diverge from that, however, in that instead of παρ' in line 1 I print ἀπ' as recorded in the *codex Palatinus*, which, although not mentioned in Page's correction, is required to reach the 7,372 that he was working towards.

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τέσσαρες αἰωροῦσι τανυπτερύγων ἐπὶ νώτων
  Νῖκαι ἰσηρίθμους υἱέας ἀθανάτων,
ἁ μὲν Ἀθαναίαν πολεμαδόκον, ἁ δ' Ἀφροδίταν,
  ἁ δὲ τὸν Ἀλκείδαν, ἁ δ' ἀφόβητον Ἄρη
σεῖο κατ' εὐόροφον γραπτὸν τέγος, ἐς δὲ νέονται
  οὐρανόν. ὦ Ρώμας Γαῖε πάτρας ἔρυμα,
θείη ἀνίκατον μὲν ὁ βουφάγος ἁ δέ σε Κύπρις
  εὔγαμον, εὔμητιν Παλλάς, ἄτρεστον Ἄρης.

(Antipater of Thessalonica 46 GP = *AP* 9.59)

Four Victories lift on their wide-winged backs an equal number of children of the Immortals. One [holds] war-confronting Athena, one Aphrodite, one Alcides, one fearless Ares, on your fine painted ceiling; and they are heading to heaven. O Gaius, bulwark of your country Rome, may the ox-devourer make you invincible, the Cyprian happy in marriage, Pallas wise in council, Ares unflinching.

The presence of such a rare form as ἰσήριθμος ('equal in number') in the first pentameter in both epigrams is too specific to be a coincidence.[36] In Antipater's epigram, four gods supported by Victories and painted on Gaius' house roof are described as gifting him the qualities in which they themselves excel. The gift in Leonides' epigram is more modest: only one Grace, as opposed to the attributes of four gods, and instead of these Victories transporting the gods heavenwards, Leonides sends his gift directly to Caesar. It seems that Leonides took inspiration from an earlier epigrammatist who also addressed his poem to a member of the Julio-Claudian family. Antipater's description, moreover, recalls an epigram by Callimachus describing the Graces.

τέσσαρες αἱ Χάριτες, ποτί γὰρ μία ταῖς τρισὶ κείναις
  ἄρτι ποτεπλάσθη κἤτι μύροισι νοτεῖ.
εὐαίων ἐν πᾶσιν ἀρίζηλος Βερενίκα,
  ἅς ἄτερ οὐδ' αὐταὶ ταὶ Χάριτες Χάριτες.

(Callimachus 15 *HE* = *AP* 5.146)

Four are the Graces; for one besides those three has just been fashioned and is still wet with perfume. Happy Berenice, resplendent among all, without whom the Graces themselves are not Graces.

[36] They are in the same *sedes*, but this is the only possible place for the word in the pentameter. Nevertheless, the word could have been placed in the hexameter. I thus take the corresponding placement as intentional.

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Antipater's opening word echoes Callimachus' epigram, but he varies the vision: not four statues of the Graces, but an image of four Victories.[37] Whereas Callimachus equates Berenice with a Grace, in effect deifying her, Antipater chooses instead to figure Gaius as receiving certain divine attributes. If, according to Gow and Page, the epigram can be dated to around I BCE, then perhaps this is due to Augustus' tight control over the imperial cult and the deification of rulers while he was still alive.[38] Leonides here follows Callimachus in his mention of the Graces in the opening line, in a metrical position (across the second and third feet) that has an association with the counting up of Graces in epigram. Meleager makes repeated play on the number of Graces, using the same opening position twice (39 *HE* = *AP* 5.195 and 74 *HE* = *AP* 9.16), and further epigrams by him and others suggest Callimachus' poem could readily come to mind.[39] If Leonides' third Grace does not in fact directly point a reader to Callimachus' epigram, it nevertheless places the poem in an epigrammatic tradition of counting up Graces that has Callimachus as its origin point.

By describing a third Grace while looking to other epigrams with four as well as three goddesses in their opening verse, Leonides makes the reader count on a level additional to his isopsephic tally. And it is worth being clear about what ἰσήριθμος refers to in Leonides' epigram. On one level, the three Graces are the object of comparison for which his book offers a token of equal-numbered eloquence. At another level, an 'eloquence which is equal in number' or an 'equal-*numbering* eloquence' refers to Leonides' own isopsephy. Understanding ἀριθμός as 'worth' or

[37] For other possible variations on Callimachus' epigram cf. *AP* 5.95, 5.183, 5.357, 9.585.

[38] Gow and Page (1968) II, 57.

[39] Meleager plays with the three-ness of the Graces also at 30, 32, 43 and 47 *HE*. It may be thought that Meleager is more likely to be (re-)echoing this theme in reference to his earlier Menippean prose work the *Graces*, but the doubling of a form of χάρις at the end of the final pentameter at 32, 40 and 47 *HE* suggests that Callimachus' epigram is nonetheless intended to be evoked. For a similar argument see now Gutzwiller (2019) 110–11. *AP* 5.95 is undated (although interleaved between epigrams by Rufinus and Meleager), as is 9.515 (between epigrams by Crinagoras), but both nonetheless are focused on enumerating the Graces. The same can be said of *AP* 9.609a and 9.680. This is not, though, a universal rule: Rhianus 1 *HE* opens with the Graces in a humorous context addressing a boy's backside, and Tymnes 4 *HE* deals with a bird dear to the Graces.

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'rank' (LSJ *s.v.* ἀριθμός I.5.), it might also reflect Leonides' self-evaluation on a more concrete level, either in relation to Caesar or to the Romans more generally, or in relation to the other epigrams that develop the Callimachean tradition of counting up Graces. This ambiguity would allow for further interpretive games for the reader, sending them to, *inter alios*, Antipater then Callimachus counting up their respective Graces and Victories, asking them to interrogate what the very idea of things being ἰσήριθμος means.

Leonides also sets out the cultural stakes of his poem, but in a less obvious and more allusive fashion. His last three verses together draw phrases and imagery from Callimachus' *Hymn to Delos* in representing the transfer of his poetic book to Rome. First, there is the term ἰσήριθμος. In the hymn, Apollo prophesies how the Galatians as ὀψίγονοι Τιτῆνες ('late-born Titans', 174) will attack the Greeks ῥώσωνται νιφάδεσσιν ἐοικότες ἢ ἰσάριθμοι | τείρεσιν ('rushing on like snowflakes, or in numbers equalling the stars', 175–6).[40] Granted, here the alpha is short in contrast to the long etas in the epigrammatic examples, and similarly the word appears in the final position, unlike the position in Leonides and Antipater. As Chapter 3, Section 3 will further evidence, however, ἰσήριθμος does have a certain currency in Hellenistic poetic passages relating to numbers, and as a close reader of Hellenistic poetry it is plausible that Leonides is alluding to such a usage.[41] The similarity between Leonides' and Callimachus' use is that both index a contact of cultures: Greeks and Galatians, Romans and Greeks. In advancing his Egyptian identity in the face of a Roman audience, the Nile-born Leonides – as he repeatedly tells his reader (1.2, 29.1–2, 30.4, 32.2 *FGE*) – presents his gift as measuring up to Roman expectations in a world where it is now the Greeks and not the Galatians that are the subdued people.

Second, there is the fact that the Nile sends the book through Greece on its way to Caesar's land. In Callimachus' hymn, Delos (in her former guise as Asteria) offers herself as a location for Apollo's birth after Leto's search for a place willing to receive her. Leto rests by the river Inopus, 'which the earth sends forth most

[40] See Mineur (1984) 172.
[41] Cf. Archimedes *SH* 201.24 and Lycophron *Alexandra* 1258.

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abundantly at the time when the Nile in full flow comes down from the Ethiopian heights' (ὅν τε βάθιστον | γαῖα τότ' ἐξανίησιν, ὅτε πλήθοντι ῥεέθρῳ | Νεῖλος ἀπὸ κρημνοῖο κατέρχεται Αἰθιοπῆος', 206–8). Callimachus here refers to the belief that the river Inopus had a subterranean connection with the Nile, just as the river Arethusa in Syracuse was considered by some to have been fed by the Alpheius in the Peloponnese.[42] He uses the site at which Apollo, the god of song, is to be born in order to connect Delos as part of 'Old Greece' with the new Greek territory of Egypt from which he writes. The belief brings Callimachus' own context and praise of Apollo into a much closer (geographical) relation with the god's origins. In what survives of Leonides' poetry, the overriding audience is presented as Roman and the poet as Egyptian; there is nothing marked as Greek in the epigrams whether topical or reworking commonplace themes. Leonides could have simply sent the poetry from Egypt to Rome, but he does not. I therefore take it as probable that the trajectory which connects the Nile with Greece, before moving to Caesar's land, is motivated by the implicit reference to that geographical belief mentioned in Callimachus' hymn. Leonides signals his debt to Callimachus' geographical bridging of Egypt and Apollo's Delos and at the same time adds Rome as the final stop on this journey in order to reflect the new political context of his Alexandrian poetry, which is in dialogue with Rome as well as with old Greece.

Third, there is the superlative adjective ἀοιδότατος ('most poetic') in line 4, which as Page notes has a certain Hellenistic currency.[43] It is employed later in the *Hymn to Delos* to describe the swans: ἀοιδότατοι πετεηνῶν ('the most musical of birds', 252). They circle seven times around Delos as Apollo is born, having come from Maeonian Pactolus in Asia Minor. The numerical frequency of this act is marked by the use of ἑβδομάκις ('seven times'), 'an absolute *hapax eiremenon* in Greek'; perhaps Leonides noticed the striking phrase that captured the numerical

[42] For further references concerning the belief and bibliography see Mineur (1984) 186. The myth of Alpheius following the nymph Arethusa and so flowing into the Syracusan river was known already to Pindar (*Nem.* 1.1) and was developed by Ovid (*Met.* 5.573–641). Strabo considers them to be similar(ly unbelievable) geographical theories (6.2.4).

[43] Cf. e.g. Theoc. *Id.* 12.7 and Dioscorides 36.6 *HE.* Page (1981) 519.

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nature of their action.[44] As the swans left Pactolus and flew to Delos, so Leonides' own most poetic gift leaves Egypt and makes its way to Rome, and not to the heavens as in Antipater's epigram. What emerges – in admittedly allusive fashion – is that Leonides modifies three points of cultural and geographical contact and connection in the *Hymn to Delos* and does so in order to signal his own poetic transfer between two cultures, two empires and two capitals. Suggesting such a transfer through Callimachean models once again places him as a new Callimachus within these shifting geographies of power.

Even more tentative but nevertheless worth noting is the ending of the first pentameter. It has a particularly Callimachean ring; σύμβολον ('token') followed by a noun in the genitive and preceded by a further noun or adjective modifying the latter noun occurs first in extant epigram in Callimachus' epigram on Aratus: χαίρετε λεπταί | ῥήσιες Ἀρήτου σύμβολον ἀγρυπνίης ('hail, subtle discourses, the token of Aratus' sleeplessness', Callimachus Epigram 56.3–4 *HE* = *AP* 9.507.3–4). In the epigram, σύμβολον ἀγρυπνίης ('token of sleeplessness') is a conjecture, whereas *AP* reads σύντονος ἀγρυπνίη ('concise sleeplessness') and a version preserved in two of the Aratean *Vitae* reads σύγγονος ἀγρυπνίης ('sibling of sleeplessness').[45] In recent times, Selina Stewart has proposed σύντομος ἀγρυπνίη, and it is indeed easy to see how it might fit with Callimachean ideas of concision, as well as how it might have been corrupted to σύγγονος and σύντονος in transmission.[46] I continue to read σύμβολον ἀγρυπνίης, however. This reading of such a widely read epigram provides a good explanation for the stylistic habit in subsequent epigrammatists of having a pentameter, often the final one, end with similar phrasing built around σύμβολον, something not shared by σύντονος or σύγγονος.[47] Leonides is certainly one of these later epigrammatists following Callimachus' style, but there may be

[44] Mineur (1984) 208.

[45] The conjecture was proposed by Ruhnken; see Gow and Page (1965) I, 71. It is endorsed by both Pfeiffer (1953) *ad loc.* and Gow and Page (1965) II, 209. σύντονος is argued for by Cameron (1972) and more extensively at Cameron (1995) 374–5.

[46] Stewart (2008).

[47] Cf. e.g. τρισσᾶς σύμβολα καλλοσύνας (*AP* 5.195.2, Meleager); ξυνῆς σύμβολα σωφροσύνης (12.158.6, Meleager); ὑμετέρης σύμβολον ἡλικίης (5.118.4, Marcus

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something more to its use. Leonides presents himself as having formerly been a devotee of astronomy and only recently become a poet (21 *FGE* = *AP* 9.344) and in another poem gifts 'an imitation of the skies' (οὐράνιον μείμημα, 32.1 *FGE* = *AP* 9.355.1) to Poppaea Augusta, the wife of Nero. It would be particularly apt for a poet who thinks of himself also as an astronomer to present his poems as a symbol of his own literary skill in the language that Callimachus had used for Aratus' *Phaenomena*, the quintessential poem of astronomy.

In each epigram, there is a question of just how close Leonides' imitation of Callimachus is and to what extent it is mediated through intervening epigrammatists. Nevertheless, the cumulative evidence makes it probable that Leonides is engaged in a concerted programme of allusions to the famous Alexandrian poet and his aesthetics. It is, moreover, a playful engagement in that Callimachus' aesthetic pronouncements are juxtaposed with poems that can be counted in the most literal of senses. And I do not think this is an accident of survival or of the selection of Leonides' poems preserved in the later collections. My proposal in the following two sections is that one epigram in particular demonstrates that Leonides' aim is specifically to reformulate Callimachus' poetics and to introduce counting back into poetic criticism.

2.2 Cups and Sources

One of Leonides' epigrams above all others deserves closer inspection: it provides a programmatic Callimachean introduction to a book of isopsephic poetry and engages in contemporary reflections on the influence and nature of Callimachus' poetics.

οἴγνυμεν, ἐξ ἑτέρης πόμα πίδακος ὥστ' ἀρύσασθαι,
ξεῖνον μουσοπόλου γράμμα Λεωνίδεω·
δίστιχα γὰρ ψήφοισιν ἰσάζεται. ἀλλὰ σύ, Μῶμε,
ἔξιθι κἠφ' ἑτέρους ὀξὺν ὀδόντα βάλε.

(Leonides 33 *FGE* = *AP* 9.356)
(Line 1 + 2 = 3 + 4 = 7,673)

Argentarius); βαρβαρικᾶς σύμβολα ναυφθορίας (7.73.2, Geminus); Φιλιππείης σύμβολον ἠνορέης (9.288.2, Geminus).

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We open, so as to draw off a drink from another spring, the unfamiliar writing of Muse-serving Leonides. The couplets are equal in *psêphoi*. But away with you, Blame, sink your sharp tooth into others.

The epigram introduces the poet and the strange nature of his work in the first pentameter, yet it is the initial hexameter which figures it as a programmatic piece (οἴγνυμεν, 'we open'). Its wording is a cause for comment. For Page, the reader ought rather to expect οἴγνυμεν ... πίδακα ('we open a spring').[48] I would prefer to read οἴγνυμεν as governing γράμμα and to understand the rest of the hexameter as providing the metaphor for that action. To draw a drink from a stream is an idea attested in Posidippus' poem on a shrine to the Nymphs in honour of Arsinoe: ἡ δ' ἀφ' Ὑμηττοῦ πέτρος ἐρευγομένη πόμα κρήνης | ἐκδέχεται σπιλάδων ὑγρὰ διαινομένη ('the stone of Hymettus, gushing from the caves, receives a drink from the spring, glistening with water, 113.10–11 AB = *SH* 978.10–11). It is perhaps more clearly seen in an epigram preserved in the *Paradoxographus Florentinus*, a collection roughly contemporary with Leonides: the poem inscribed above the spring commands any thirsty goatherds 'to draw a drink from the spring' (τῆς μὲν ἀπὸ κρήνης ἄρυσαι πόμα, Anon. 143a.3 *FGE*).[49] A drink as an image for poetry is at least as old as Pindar, who at the end of *Nemean* 3 sends to his patron, Aristocleides, his 'cup of song' brimming with honey and milk (πόμ' ἀοίδιμον, 79). At the same time, of course, the syntax encourages wordplay on the idea of partaking of a new vintage from the jar or cup which one opens: an equally programmatic image.[50] Leonides here draws on both cups and streams in metaphorising his novel composition. This and the following section intend to trace out the Hellenistic and Callimachean aspects of these images and how they are used to present but also justify the presence of isopsephy in his epigrams.

[48] Page (1981) 536. [49] For the dating see Page (1981) 451.

[50] πόμα could be understood as a version of πῶμα in the sense of 'lid' or of 'cup', cf. LSJ *s. v.* πῶμα A and B. I can find no instances of a lid covering a stream, so I think that the most likely play would be on the opening of a new draught rather than of a lid or covering to a spring.

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First, let me state what I see to be the key connection to Callimachus. Christine Luz has proposed that in the epigram – a point surprisingly missed by Page – ἐξ ἑτέρης . . . πίδακος echoes the end of Callimachus' *Hymn to Apollo*.[51] Likewise, on my reading it is the mention of a πῖδαξ in line 1 and the address to Momus in lines 3 and 4 which I take to be an allusion to the hymn, where Apollo responds to the criticisms that Phthonos whispered in his ear. Here is Apollo's response and Callimachus' concluding line:

ὁ Φθόνος Ἀπόλλωνος ἐπ᾽ οὔατα λάθριος εἶπεν
"οὐκ ἄγαμαι τὸν ἀοιδὸν ὃς οὐδ᾽ ὅσα πόντος ἀείδει."
τὸν Φθόνον ὠπόλλων ποδί τ᾽ ἤλασεν ὦδέ τ᾽ ἔειπεν·
"Ἄσσυρίου ποταμοῖο μέγας ῥόος, ἀλλὰ τὰ πολλά
λύματα γῆς καὶ πολλὸν ἐφ᾽ ὕδατι συρφετὸν ἕλκει.
Δηοῖ δ᾽ οὐκ ἀπὸ παντὸς ὕδωρ φορέουσι μέλισσαι,
ἀλλ᾽ ἥτις καθαρή τε καὶ ἀχράαντος ἀνέρπει,
πίδακος ἐξ ἱερῆς ὀλίγη λιβὰς ἄκρον ἄωτον."
χαῖρε, ἄναξ· ὁ δὲ Μῶμος, ἵν᾽ ὁ Φθόνος, ἔνθα νέοιτο.[52]
(Callimachus *Hymn to Apollo* 105–13)

Phthonos spoke secretly in Apollo's ear: "I do not love the poet who does not sing as much as the sea." Apollo kicked Phthonos with his foot and said the following: "Great is the flow of the Assyrian river, but it drags all filth from the earth and much refuse in its waters. Bees do not carry water to Deo from everywhere, but from a small stream, pure and undefiled, which comes from a holy spring, the highest choice of waters." Greetings, lord. But as for Blame, let him go where Envy dwells!

Apollo's contrast of the large Euphrates and the small stream has typically been read as reflecting Callimachus' preference for small and refined poetry over long epic.[53] Its use by Leonides would certainly make a pointed introduction to a collection of epigrams, the genre *par excellence* for poetic smallness and refinement. On the one hand, the allusion in a programmatic epigram at the start of the collection to Callimachus' programmatic conclusion would emphasise literary continuity through its very subject matter; (the spirit of) Callimachus' poem 'flows' naturally into Leonides' own works, like the water from a stream into a cup. On the other hand,

[51] Luz (2010) 256–8. [52] The text follows Williams (1978).
[53] See e.g. Williams (1978) 85–97; Köhnken (1981); Traill (1998); Stephens (2015) 98.

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Leonides marks his innovation while alluding to his predecessor: a notably Callimachean stream in its allusiveness, it is nevertheless different and new.

Leonides, though, was not the only epigrammatist to allude to Callimachus' *Hymn to Apollo* passage. Antipater of Thessalonica lambasted those poets who drink κρήνης ἐξ ἱερῆς . . . λιτὸν ὕδωρ ('the simple water from the holy fountain', 20.4 GP = *AP* 11.20.4). Instead he pours libations to Archilochus and Homer; his cup οὐ δέχεθ' ὑδροπότας ('does not receive water-drinkers', 6). In reference to Callimachus' reception in this epigram, Peter Knox has argued persuasively that this contrast between water and wine as inspirational sources does not seem to exist before Antipater. Rather, his epigram is innovative in alluding to Callimachus' stream – possibly also to Hippocrene on Helicon from the *Dream* at the beginning of *Aetia* 1 – as a pedantic mode of bookish poetry and, in opposition, wine as the force behind the 'authentic' poetry of Archilochus and Homer.[54] Antipater reframes Callimachus' metapoetic images; what was a matter of the source's purity has been turned into its nature *qua* water. Writing in the wake of Antipater's epigram, Leonides would have likely encountered both this negative approach to, and other more faithful readings of, Callimachus' poetics. This observation helps makes sense of Leonides' opening line, which is not simply a Callimachean stream, but a 'drink' from it. Contrary to Antipater of Thessalonica's allusion, Callimachus was not teetotal, as he emphasises in his own epitaph.

Βαττιάδεω παρὰ σῆμα φέρεις πόδας εὖ μὲν ἀοιδήν
εἰδότος, εὖ δ' οἴνῳ καίρια συγγελάσαι.
(Callimachus 30.1–2 *HE* = *AP* 7.415.1–2)

You set your feet beside the tomb of Battus' son, who knows well both song and how to join together in laughter over wine at the right time.

More than this, though, in another passage of the *Aetia*, Callimachus depicts himself drinking at a symposium. The fact that, like himself, his drinking companion from Icus, Theugenes, enjoys small cups (ὀλίγῳ δ' ἥδετο κισσυβίῳ, fr. 178.12 Harder)

[54] Knox (1985). For a biography of Antipater see Gow and Page (1968) II, 18–21.

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has also been read as intimating Callimachus' preference for poetic refinement over excessively large works, oxymoronically making small Polyphemus' monstrous κισσυβίον ('rustic cup') in the *Odyssey* (9.346).[55] Later on in the same passage, Callimachus states that wine needs both water and conversation mixed into it and so exhorts that the two symposiasts 'add it to the harsh drink as an antidote' (βάλλωμεν χαλεπῷ φάρμακον ἐν πόματι, fr. 178.20 Harder) – a line which also alludes to Odyssean drinking, this time recalling Helen adding a drug of forgetfulness to the drink served up to Menelaus and Telemachus at a banquet in Sparta (*Od*. 4.220). Far from Callimachus having a 'prohibition poetics', for him wine requires dialogue and, not unsurprisingly in the *Aetia*, this leads to Theugenes providing an *aition* for an Ician ritual. Callimachus' πόμα is just as much a source as the stream on Mount Helicon that he arrives at in the first book of the *Aetia* (fr. 2 Harder), the latter of inspiration, the former of information. That Leonides' epigram opens with a 'drink from another spring' reconciles two aspects or, rather, two possibly conflicting readings, of Callimachean inspiration. The use of ἀρύω in the result clause is particularly apt, then, since it denotes both the pouring out of wine and the drawing off of water from a stream (LSJ *s.v.* ἀρύω). The reader is invited to think that the poetics of the opening epigram, and so the collection, responds to a multitude of Callimachean poses and passages, not only to Antipater's caricature.

Having Callimachus' stream 'in a cup', furthermore, would have resonances in the context of epigram collections. In the same way that the allusion to Callimachus' *Hymn to Apollo* might rework a programmatic end into a programmatic opening, sympotic imagery could also be exploited programmatically in Hellenistic poetry collections. When it comes to epigram collections, consider a poem by Posidippus from the *Palatine Anthology* which opens Κεκροπί, ῥαῖνε, λάγυνε, πολύδροσον ἰκμάδα Βάκχου ('Sprinkle, Cecropian jug, the dewy moisture of Bacchus', 1.1 *HE* = *AP* 5.134.1 = 123.1 AB). Posidippus goes on in the following lines to reject the Stoic drinking practices of Zeno and Cleanthes and

[55] Harder (2002) 212–17, with more in-depth discussion in Hunter (1996) and Harder (2012) II, 971–2.

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takes γλυκύπικρος Ἔρως ('bittersweet Eros', 4) as his topic. It thus has a programmatic function. In her study of this epigram, Kathryn Gutzwiller suggests that Posidippus may be the first to compose 'a hymnlike poem addressed to a wine jar'.[56] Hymns often introduced ancient collections of poems (e.g. Theognis 1–18, Sappho fr. 1), so it is possible that the hymnic aspect marks it as programmatic. Equally, though, Theognis' collection is strongly sympotic in its themes, and hymns were sung at the beginning of symposia: an opening hymn could itself be *sympotically* programmatic.[57] With the publication of the Milan Posidippus, this proposal can be extended.[58] The first two (readable) epigrams in the collection's programmatic opening section, restored as Λιθικά (*On Stones*), take as their subject drinking vessels. Epigram 2 AB envisions a κέρας ('drinking horn', 1) used for pouring libations.[59] Epigram 3 AB instead considers a ruby engraved with the image of a cup encircled with tendrils. These ekphrastic epigrams' reflection on the preciousness of the materials and the drinking-ware, it has been convincingly proposed, articulate an aesthetic program which runs through the whole collection.[60] Posidippus introduces the sympotic motif symbolised by a drinking vessel to set out his aesthetic principles in a convivial mode.[61]

Leonides' 'cup' continues this strategy of indicating a particular aesthetic approach through a sympotic motif and is equally as programmatic as the allusion to Callimachus' spring. There is a further reason why the cup is an apt image for Leonides to introduce. Leonides elsewhere represents his works as crafted gifts for friends in a dining setting.

[56] Gutzwiller (1998) 157–8.
[57] Cf. e.g. Alcman 98 *PMG*; Xenophanes 1.1–17 *IEG*; Aesch. *Ag*. 247; Xen. *Symp*. 2.1; Pl. *Symp*. 176a; Ath. 149c. Meleager acknowledged the programmatic significance of Posidippus 123 AB and placed it at the beginning of his own erotic-sympotic collection. Of course, whether because of its hymnic or sympotic aspects, one cannot say.
[58] For wide-ranging studies on the new collection see Acosta-Hughes et al. (2004); Gutzwiller (2005); Seidensticker et al. (2015).
[59] See Kuttner (2005) 147–8.
[60] Kuttner (2005); Bing (2005).
[61] For the poetics of gems in the *Lithika* see now Elsner (2014), and for the importance of the sympotic resonances see Belloni (2015).

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τήνδε Λεωνίδεω θαλερὴν πάλι δέρκεο Μοῦσαν,
δίστιχον εὐθίκτου παίγνιον εὐεπίης.
ἔσται δ' ἐν Κρονίοις Μάρκωι περικαλλὲς ἄθυρμα
τοῦτο καὶ ἐν δείπνοις καὶ παρὰ μουσοπόλοις.

(Leonides 2 *FGE* = *AP* 6.322)
(Line 1 = 3,360; 2 = 3,440; 3 = 3,108; 4 = 3,108)[62]

Look again at this sturdy Muse of Leonides, a two-line plaything of clever eloquence. This will be a very fine toy for Marcus at the Saturnalia, both at dinners and among the servants of the Muses.

Pastimes such as isopsephy have a long and apparently distinguished history. They are in some sense a descendent of the games mentioned by Larensius in Athenaeus' *Dinner Sophists*, who on the authority of Clearchus of Soli (fourth century BCE) describes how οἱ παλαιοί ('the ancients'), in contrast to Clearchus' degenerate contemporaries, challenged each other with sympotic games: to recite a verse with a specific number of syllables or letters, or to recall in turn cities in Asia and Europe which began with certain letters (Ath. 10.457c–f = Clearchus fr. 63 Wehrli). While Clearchus describes letter-play as more noble than contemporary habits, for Plutarch the 'putting of names into number symbols' (θέσεις ὀνομάτων ἐν ἀριθμοῖς ὑποσυμβόλοις, *Qaest. conv.* 5.673b) was a game playable even by the 'unlearned' (ἀφιλόλογοι, 673a) after dinner. Setting both Clearchus' and Plutarch's rhetoric of the high-brow and low-brow to one side, it is clear that Leonides specifically invites the reader into the text's games ('look again'), while the image of the cup in the opening line of the epigram which probably inaugurated one of Leonides' collections sets out a context for them as post-prandial play.

2.3 Pebbles in the Stream

The opening words of the second couplet of 33 *FGE* explain (γάρ) what is new about Leonides' epigram, while the subsequent adversative address to Blame – ἀλλὰ σύ, Μῶμε – looks to defend what has immediately preceded. What Leonides must defend in his claim that δίστιχα γὰρ ψήφοισιν ἰσάζεται is that his opening

[62] Page (1981) 516: 'The problem remains unsolved.' I intend to advance my own solution elsewhere.

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Callimachean introduction swiftly turns to a concern for numbers. In this section I explore further how Leonides' imagery and engagement with the *Hymn to Apollo* seek to bridge the perceived gap between refined poetry and numerical accounts: the presence of ψῆφοι in his poems is a rebuttal against a very particular form of biting criticism.

At a critical point for concepts of number and measurement in the Reply to the Telchines, Callimachus addresses the Telchines and attempts another banishing.

ἔλλετε Βασκανίης ὀλοὸν γένος· αὖθι δὲ τέχνηι
κρίνετε,] μὴ σχοίνωι Περσίδι τὴν σοφίην·

(Callimachus *Aetia* fr. 1.17–18 Harder)

Be off, destructive breed of Bascania, and hereafter judge cleverness by craft, not by the Persian *schoinos*.

Callimachus' injunction addresses two related but distinct aesthetic concepts: the act of measurement and the criterion of measurement. The prohibition against judging by the σχοῖνος Περσίς implies on the one hand that one ought not to approach artworks with the criterion of length in mind. On the other hand, the σχοῖνος Περσίς as the criterion, a land-measurement of many *stadia* in length, could be understood as a rejection of producing and valuing works of *excessive* length: 'do not judge poetry by the kilometre'. In what looks like a purposeful (mis)reading of this latter sense in Callimachus, Leonides announces that what is unique about his poem is its being equal in ψῆφοι, which refers in the first instance to the small stones used for numerical manipulations (LSJ *s.v.* ψῆφος II.1). That is, Leonides still numerically 'measures' his epigrams, but replaces an excessive criterion with a smaller one, a size more apt for the refined aesthetics of Callimachus and the Hellenistic age and which might be thought of as particularly apt for the small, originally stone-bound genre of epigram.

Leonides' epigram also *thematically* reconciles his potentially un-Callimachean enumerating epigrams by invoking the aesthetics of scale observed in Section 1. In Callimachus' *Hymn to Apollo*, a contrast is made between the great torrent of the Euphrates and an undefiled stream: a contrastive aesthetic underscored by Phthonos' preference for large poems which takes up

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a single line and Apollo's favouring of smaller works which extends to five. The key feature of the Assyrian river, the symbol of its large size, is that it carries filth (λύματα) and refuse (συρφετός) with it. Leonides, however, appears to respond to a literal parallel between water source and poetry: large rivers carry debris, while streams are clean; large poems carry literary 'rubbish', while small poems are pure. His use of the term ψῆφος ('pebble') to indicate the letters counted as numbers of course has as its common meaning a small pebble or stone (LSJ *s.v.* ψῆφος). On first reading, the epigram upsets the imagery of Callimachus' aesthetics at the end of the *Hymn to Apollo*. The Callimachean 'source' which flows into Leonides' collection has been modified; for (γάρ) his couplets 'are equal in pebbles' or, even, 'these couplets are equal *to* pebbles'. Either way, Leonides provocatively reworks Callimachus' hydrological metapoetics by taking his cue from Callimachus' source, while quite literally filling his own lines with ψῆφοι, making it a Callimachean spring of a rather different kind: ἐξ ἑτέρης . . . πίδακος. This plays out on the textual level too. Just as it is Leonides who adds pebbles into Callimachus' undefiled spring, it is the announcement of Leonides, his new epigram and its innovation in lines 2–3 which disturbs the flow of Callimachean allusions in lines 1 and 3–4, which appear in the hymn in consecutive lines (112–13).

The water metaphor of Hellenistic – and particularly Callimachean – poetics is well known, but stones too have their place among the aesthetic imagery of the poets and even beside water. In Theocritus' *Idyll* 22, for example, the Dioscuri wander from the rest of the Argonauts and encounter 'a perennial spring, brimming with undefiled water and the pebbles seeming like crystal or like silver' (ἀέναον κρήνην ὑπὸ λισσάδι πέτρῃ | ὕδατι πεπληθυῖαν ἀκηράτῳ· αἱ δ' ὑπένερθε | λάλλαι κρυστάλλῳ ἠδ' ἀργύρῳ ἰνδάλλοντο, 37–9).[63] The description of the stream is similar to Callimachus' in that it is pure, and the implication is that this allowed for the λάλλαι ('pebbles'), if that is the correct reading, to be viewed with clarity.[64] Immediately after this scene

[63] The text and translation follow Gow (1952) I, 160–1.

[64] This is the generally accepted emendation of ἀλλαί. See Gow (1952) II, 389 and Sens (1997) 107.

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the Dioscuri meet the boxer Amycus. The description forms a notable contrast.

ἐν δὲ μύες στερεοῖσι βραχίοσιν ἄκρον ὑπ᾽ ὦμον
ἕστασαν ἠύτε πέτροι ὀλοίτροχοι οὔστε κυλίνδων
χειμάρρους ποταμὸς μεγάλαις περιέξεσε δίναις·

(Theocritus *Idylls* 22.48–50)

Beneath his shoulder points the muscles in his brawny arms stood out like rounded boulders which some winter torrent has rolled and polished in its mighty eddies.

The peaceful stream with its pebbles like crystal is replaced by Amycus, whom they will soon fight, whose monstrous mass is like a boulder polished by a torrent. Theocritus' description is a detailed reworking of Homer's simile of Hector's attack on the Achaean ships (*Il.* 13.137–43).[65] There Hector's onslaught is likened to a stone pulled loose by a winter storm and carried down to the plain. Similarities can be observed with Callimachus' torrent which carries refuse. Theocritus and Callimachus diverge, however, in that both Theocritus' streams – the one seen by the Dioscuri and the torrent employed in the simile – contain stones. In fact, the boulder smoothed down by the torrent is an equally Hellenistic image of fineness as the smoothed rock at the *locus amoenus* and the pebbles in the stream.[66]

The contrasting aesthetics of stone and water imagery can also be observed in Posidippus' programmatic opening section, the *Lithica*. It too contains in its sequence an arrangement that starts with fine, engraved stones (1–7, 13–15 AB) and even crystal (16 AB) which then moves on to larger rocks (18, 19 AB). Size, too, is a focus for the smaller work 'that measures three spans in circumference' (τρισ[πίθαμον περίμετρον, 8.7 AB) as well as for the 'fifty-foot rock' which concludes the section (ἡμι]πλεθραίην … πέτρην, 19.5 AB). In fact, this final stone of the section again alludes to Homer's 'rolling stone' from the *Iliad*'s Hector simile

[65] Sens (1997) 116–17.
[66] Emphasised by a reuse of λισσάς to mean 'smooth rock', which had indicated jagged rocks in earlier poetry, e.g. *Od.* 3.293, 5.412. See Sens (1997) 106.

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(ὁλοοίτροχος, *Il*. 13.137; cf. 19.9 AB).[67] In the case of both the small refined stones and the large fifty-foot rock their movement is connected with water, whether in a rushing river or washed up by the sea.[68]

My point is not that these are necessarily metapoetic images, but that the Hellenistic tradition already advanced a contrastive aesthetic by setting small stones beside larger rocks all in a waterborne context. What I am proposing, then, is that Leonides is drawing on this distinction between the differing aesthetics of stones in a river when alluding to Callimachus' *Hymn to Apollo*; placing small pebbles and not refuse in Callimachus' stream resembles the river content seen in Theocritus *Idyll* 22 and the earlier epigrams from Posidippus' collection. Leonides sets his unique form of poetic 'refinement' (pebbles) within Callimachus' pre-existing image of 'slimline' poetry (stream), and so his epigram doubly emphasises poetic fineness through two mutually reinforcing Hellenistic aesthetic images. Skimming pebbles into Callimachus' stream, Leonides underscores the value of isopsephy. He composes small, refined works which nevertheless contain ψῆφοι and not large stones: isopsephy is another source of refinement.

Leonides can be seen to draw on Hellenistic imagery of water and stones in characterising his poetry, but it is also important to highlight the contemporary reception and critical value of those images. Longinus' *On the Sublime*, a text perhaps contemporary with Leonides, also uses fluvial metaphors to characterise literary output and the nature of the sublime poet.[69] Significant for the current discussion is that he does so by drawing on the distinction found at the end of Callimachus' *Hymn to Apollo*.

[67] The Homeric *hapax* to which the stone used by Hector is compared is deployed at 19.9 AB in the form ὁλοίτροχος. A similar reworking of the simile, however, can be found at 7 AB; see Bing (2005) 125–6. On the poetological significance of measurements in the *Lithika* see Hunter (2004) 97–8 and Fuqua (2007) 281–3.

[68] Cf. e.g. 7, 9, 11, 12, 16, 19, 20 AB. For the import of this water imagery in terms of both the poetics of epigram collections and the geopoetics and geopolitics of Posidippus as a Ptolemaic writer, see Bing (2005) 126–32.

[69] The text is often placed in the first century CE; see Russell (1964) xxii–xxx and *contra*, Heath (2000).

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ἔνθεν φυσικῶς πως ἀγόμενοι μὰ Δί' οὐ τὰ μικρὰ ῥεῖθρα θαυμάζομεν, εἰ καὶ διαυγῆ καὶ χρήσιμα, ἀλλὰ τὸν Νεῖλον καὶ Ἴστρον ἢ Ῥῆνον, πολὺ δ' ἔτι μᾶλλον τὸν Ὠκεανόν.[70] (Longinus *On the Sublime* 35.4)

So it is that we are led in some natural way, by Zeus, not to wonder at the small streams, even though they are clear and useful, but at the Nile, the Istrus and the Rhine, and much more still, at the Ocean.

The image of Homer as the Ocean from which all poets draw inspiration is a commonplace which arises in the Hellenistic period and is not confined to Callimachus.[71] Longinus nevertheless inverts the contrastive aesthetic of the *Hymn to Apollo*; the great poets are like roaring torrents majestic and sublime, completely eclipsing fine, small rivulets. Nicholas Richardson and Richard Hunter, among others, see this discussion in Longinus as conspicuously avoiding mention of Callimachus.[72] The language of poetic purity or immaculacy, as has been noted, echoes Callimachus' 'pure' (καθαρή) stream. His rhetorical comparison of poets develops the allusion.

τί δέ; Ἐρατοσθένης ἐν τῇ Ἠριγόνῃ (διὰ πάντων γὰρ ἀμώμητον τὸ ποιημάτιον) Ἀρχιλόχου πολλὰ καὶ ἀνοικονόμητα παρασύροντος . . .; (Longinus *On the Sublime* 33.4)

What then? [Is] Eratosthenes [better] in his *Erigone* (in all respects a blameless little poem) than Archilochus surging greatly and disorderly?

Longinus will go on to compare Bacchylides and Pindar, and Ion of Chios and Sophocles. The contrast of Eratosthenes and Archilochus here may have something to do with Archilochus' connection to wine and the *Erigone*'s aetiology for the introduction of wine production into Attica.[73] It may also be that Callimachus was too great a figure to challenge and so Longinus

[70] Greek text following Russell (1964).

[71] See Williams (1978) 98–9 and the detailed discussion of Asper (1997) 109–28, esp. 125–8.

[72] 'It may be that with his great range of invention, variety of style, and constant ability to take us by surprise, [Callimachus] stands apart from and above the other poets of his period', Richardson (1985) 398. 'More than one modern reader . . . has been deafened by the silent absence of the name of Callimachus', Hunter (2011) 230. See also Russell (1989) 306–11.

[73] For a further outline of the comparison of Eratosthenes and Archilochus see Hunter (2011) 230–5.

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takes on his 'pupil', his 'second in command' (Eratosthenes, as a polymath, was famously named τὸ Βῆτα, 'Mr Beta').[74] While it has been observed that Archilochus' surging here aligns him with the large torrents (of great poets) as found in Callimachus' *Hymn to Apollo* and later on in Longinus, it should also be noted that Eratosthenes' poem provides the second term of comparison in the hymn. Just as Apollo in the hymn champions refined compositions and banishes 'Blame' (Μῶμος), Eratosthenes' poem is small (cf. τὸ ποιημάτιον) and 'blameless' or literally 'does not attract μῶμος/Μῶμος'.

Longinus, then, goes to great lengths to cleave sublime poetry and Homeric verse apart from poetry concerned with minutiae, and he does so by using Callimachus' fluvial imagery against him. Underlying this contrast is the question of how 'accuracy' (ἀκρίβεια) relates to good poetry. He opens his digression on the difference between genius and faultlessness (of which the fluvial comparison forms a part) with a question: is a great poet made by the largest number of virtues, or the greatness of the virtues themselves (33.1)? He proposes in response that 'the greatest natures [of poets] are the least immaculate; for accuracy in everything runs the risk of smallness' (αἱ ὑπερμεγέθεις φύσεις ἥκιστα καθαραί· τὸ γὰρ ἐν παντὶ ἀκριβὲς κίνδυνος μικρότητος, 33.2). He sets sublime poets apart from concerns about accuracy by looking to the Aristotelian conception of it as social pettiness: ἡ ἀκριβολογία μικροπρεπές (*Eth. Nic.* 1122b8). The greatest poets, those who achieve sublimity, are not petty or mean but ignore small faults in the grip of genius. In his later comparison of Demosthenes and Hyperides (34), too, distinguishing between the precise and flawless poet and the sublime poet is the difference

[74] There is, however, a good contextual argument for choosing Eratosthenes as a term of comparison. Eratosthenes, as well as being known as τὸ Βῆτα ('Runner-up') was also known as Πένταθλος ('Jack of all trades, master of none', *Suda s.v.* Ἐρατοσθένης 2898). In the chapter that intervenes between the comparison of sublime and technically accomplished but mediocre poets, Longinus contrasts the sublime Demosthenes and the accomplished Hyperides: 'he is almost nearly the best in everything like a pentathlete, so that in all contests he loses out to the first-place professionals, but wins among the amateurs' (σχεδὸν ὕπακρος ἐν πᾶσιν ὡς ὁ πένταθλος, ὥστε τῶν μὲν πρωτείων ἐν ἅπασι τῶν ἄλλων ἀγωνιστῶν λείπεσθαι, πρωτεύειν δὲ τῶν ἰδιωτῶν, 34.1). Eratosthenes serves to introduce a longer criticism of the accomplished, 'pentathletic' orator in light of the sublime orator.

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between judging based on 'counting' (ἀριθμῷ) and on 'greatness' (μεγέθει).[75] It is not only the water imagery that Longinus inverts: the counting up of poetry at which Callimachus so inveighed is turned against him here. For Longinus, the flawless Hellenistic poet wins only when the counting Telchines are the critics.

Given Leonides' combining of isopsephy with Callimachus' poetics, it would be hard to imagine him agreeing with Longinus' assessment that accuracy is only for second-rate, non-sublime poets, especially when that argument is cloaked in Callimachean imagery. Equally, Leonides does 'make Callimachus count', as it were, and sets his themes in compositions that have manifestly focused on numerical accuracy. However, I would tentatively argue that the intertextual advertisement that his 'Callimachean' stream contains pebbles proposes a rather different critical judgement regarding his enumerating epigrams. The precedent of pebbles in a stream reaches back further even than Callimachus, to Homer's simile describing Scamander's onslaught on Achilles in *Iliad* 21.

ὡς δ᾽ ὅτ᾽ ἀνὴρ ὀχετηγὸς ἀπὸ κρήνης μελανύδρου
ἄμ φυτὰ καὶ κήπους ὕδατι ῥόον ἡγεμονεύῃ
χερσὶ μάκελλαν ἔχων, ἀμάρης ἐξ ἔχματα βάλλων·
τοῦ μέν τε προρέοντος ὑπὸ ψηφῖδες ἅπασαι
ὀχλεῦνται· τὸ δέ τ᾽ ὦκα κατειβόμενον κελαρύζει
χώρῳ ἔνι προαλεῖ, φθάνει δέ τε καὶ τὸν ἄγοντα·

(Homer *Iliad* 21.257–62)

Just as when a man drawing from a dark water source guides the water in a channel along his plants and orchard, holding in his hand a spade and chucking out from the ditch obstructions. The pebbles are all jostled by the water as it flows forth, and as it quickly flows down, it murmurs in the sloping plot and outruns the man guiding it.

It has often been noted in passing – although, as far as I have been able to investigate, nowhere in print – that Callimachus' image of the Assyrian river full of refuse is modelled, at a certain remove, on this passage. Immediately before Scamander and Achilles meet

[75] Russell (1964) *ad loc.* prints τῷ ἀληθεῖ for τῷ μεγέθει, although he knows no parallel and acknowledges that many other editors print τῷ μεγέθει, 159. The emphasis on τὸ μεγέθος in chapters 33 and 35 supports τῷ μεγέθει, as does the lack of the language of truth in the preceding ten chapters.

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in battle, Scamander turns to Apollo and warns him to keep out of the fight as he had agreed (*Il.* 21.227–32): a scene reworked in Callimachus with Phthonos' championing those who sing as much as the sea being thoroughly rebutted by Apollo's rejection of big rivers. Here, Leonides' ψῆφος ('pebble') in the stream becomes important. The term λίθος ('stone') appears numerous times in Homer, but this passage is the only use of ψηφίς (ψῆφος is not attested at all). It may be that Leonides saw the image in this passage behind Callimachus' stream and so created a window allusion to Homer, a strategy recognisable in Hellenistic and Roman poetry, where an author alludes to another text as well as a third that was a source for that other text.[76] The Homeric *hapax* ψηφίς, at any rate, together with the importance of ψῆφοι for Leonides' poetics more generally, makes it possible that Leonides has the Homeric passage in his sights.

Reading this further intertext into the epigram has an important bearing for understanding Leonides' argument in 33 *FGE*. The *scholia* to the Homeric passage preserve a range of critical responses to Homer's simile. For the late Classical writer Duris of Samos, the evocation of irrigation is too exact and takes the reader away from a sense of the din of battle (Ge-*scholia* on *Il.* 21.257–62 = Duris *FGrH* 76 F 89). An anonymous scholiast replies to Duris with a more charitable reading: 'but he has composed it in this way, since he is good at introducing a new thought into the poem' (ἀλλὰ τοῦτο συνέθηκεν οὕτως, ἀγαθὸς ὢν καινοτομῆσαι τὴν ἐν τοῖς ποιήμασι διάνοιαν, Ge-*schol. Il.* 21.257–62). In *On Style*, a rhetorical treatise attributed to one Demetrius and usually dated to the second or first century BCE,[77] the author identifies Homer's simile as a prime example of vividness (ἐναργεία). Vividness comes about, he says, 'first from exactness of speech and from omitting and excluding nothing' (πρῶτα μὲν ἐξ ἀκριβολογίας καὶ τοῦ παραλείπειν μηδὲν μηδ' ἐκτέμειν, *On Style* 209). Here, Demetrius makes positive Duris' criticism that it is 'the complete evocation of the water irrigation through the orchard' (<τὸ> τὴν ἐν τοῖς κήποις ὑδραγωγίαν ἐκμιεῖσθαι, Duris

[76] 'Window reference' after Thomas (1986) 188, or a 'two-tier allusion', Hinds (1987) 56 n.16.
[77] See Doreen Innes in Halliwell et al. (1995) 312–21.

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FGrH 76 F 89) which takes the reader away from the greatness of the battle scene. He quotes Homer's passage as an example of how vividness can be achieved through the plain style and its focus on the small things: 'We should perhaps keep to subjects which are small . . . the more familiar is always simpler . . . and employ no words which create grandeur' (ἔχοιμεν ἂν καὶ πράγματα ἴσως τινὰ μικρὰ . . . μικρότερον γὰρ τὸ συνηθέστερον πᾶν . . . μηδ' ὅσα ἄλλα μεγαλοπρέπειαν ποιεῖ, *On Style* 190–1). Demetrius sees in this Homeric stream an example of how the greatest of poets can nevertheless excel in the arena of poetic 'accuracy' (ἀκρίβεια): in contradistinction to Longinus' later pronouncement, it demonstrates an ἀκριβολογία ('exactness of speech') appropriate to Homer.

Homer's simile could be seen to enshrine – though not uncontroversially – poetic innovation in accurate descriptions of small subjects and thus also to provide authority for Leonides for placing pebbles in the stream (and read: for combining Callimachus and enumeration). This innovation in poetic accuracy is an important claim that Leonides also makes for his ξεῖνον . . . γράμμα ('novel epigram'). By muddying the waters and placing ψῆφοι in Callimachus' stream, 33 *FGE* justifies Leonides' enumerating epigrams. If one reads the presence of ψῆφοι between the allusions to Callimachus' stream as a reference to the Homeric passage, then Leonides can be observed to collapse the dichotomy of the great river and its rubble in contrast to the pure clean source, an image that Callimachus himself had constructed and which Longinus inherited and inverted in attacking Hellenistic ἀκρίβεια. Leonides positions his playful isopsephic epigrams as filled from a Calimachean stream *and* as drawing on a Homeric source. The allusive nature of the ψῆφοι in the epigram notwithstanding, I think it is clear that Leonides is seeking to intervene in a debate about poetic accuracy by mobilising the metapoetic image of the stream so tied to Callimachus. For Longinus accuracy may lead to triviality (μικρότης), but Leonides makes a virtue of it.

* * *

It is evident that Leonides has suffered for not having been included in Philip's *Garland* and for the novelty he sought to

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introduce into epigram.[78] Yet, as I hope to have demonstrated, isopsephy is not treated by Leonides as simply a novel addition to the epigrammatic art but as a practice which must be justified on poetic grounds and defended against criticism. And he legitimises isopsephic epigrams by drawing on the language and themes of his Alexandrian forerunner Callimachus – not to mention responding to earlier epigrammatic receptions of Callimachus – in order to lay out what he sees to be the correspondences between Callimachean poetics and his own counting compositions. He also deftly balances the poetic and the political by addressing poems and introducing their novelty to the Roman imperial family.[79] Here again Callimachus provides a model.

Crucially, unlike the mainstream of Callimachean reception at Rome which constructed an Alexandrian poet of programmatic refinement and thinness, but quite similar to Catullus and Martial in the previous chapter, Leonides has identified a tension between counting and criticism foregrounded in the Reply to the Telchines. Which is to say, after Callimachus had made explicit the role that counting could – but should not – play in poetic criticism, the issue remained present and alive enough for poets to repeatedly return to the Reply and explicitly develop Callimachus' examination of how poetic content and extent interrelate. Moreover, the poems I have discussed – but especially Catullus' kiss count and Leonides' epigrams – show in different ways just how influential this concern could be for the form of new poems. In seeking to respond to an ongoing debate about counting in relation to criticism, these poets produced works that purposefully and patently straddle the boundary of poetry and counting. Across the centuries following Callimachus' Reply, in short, counting can be seen to influence poetic composition. This poetic world was shaped in part by the world of number.

[78] Philip had read Leonides, it appears: Gow and Page (1968) II, 328. It looks, though, as if Leonides' epigrams were lifted directly from his own book into a later anthology, but perhaps before Cephalas, see Page (1981) 506.

[79] Perhaps even as a response to the isopsephic calculation that circulated calling Nero a matricide (Suet. *Nero* 39.2, see above)?

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PART II

ARITHMETIC AND AESTHETICS

Part I addressed counting as a means of interrogating the relationship between poetic content (the 'stuff' that a poem contains) and the space that is needed to express it. There I demonstrated that counting had an important role to play in poetic criticism of the Hellenistic period and that later poets were aware of this, incorporating and developing counting criticism in their own programmatic poetic statements. In early mathematical education, after counting there came more complex operations: multiplication, but also calculations that in modern mathematical notation would be written as equations and solved algebraically. These mathematical procedures today form part of arithmetic. The focus of Part II is thus on how the 'stuff' of poetry is expressed and arranged so as to require an arithmetical interpretation and solution.

In antiquity, the domain of modern arithmetic was divided into the λογιστικὴ τέχνη ('the art of calculating') and the ἀριθμητικὴ τέχνη ('the art of number').[1] The former dealt with tangible objects and their manipulation; the latter dealt with the theory of numbers per se. The clearest source for the nature of 'logistic' is a *scholium* to Plato's *Charmides* (165e), which is worth quoting at length.[2]

λογιστική ἐστι θεωρία τῶν ἀριθμητῶν, οὐχὶ δὲ τῶν ἀριθμῶν, μεταχειριστική, οὐ τὸν ὄντως ἀριθμὸν λαμβάνουσα, ὑποτιθεμένη τὸ μὲν ἓν ὡς μονάδα, τὸ δὲ ἀριθμητὸν ὡς ἀριθμόν, οἷον τὰ τρία τριάδα εἶναι καὶ τὰ δέκα δεκάδα· ἐφ' ὧν ἐπάγει τὰ κατὰ ἀριθμητικὴν θεωρήματα. θεωρεῖ οὖν τοῦ<το> μὲν τὸ κληθὲν ὑπ' Ἀρχιμήδους βοϊκὸν πρόβλημα, τοῦτο δὲ μηλίτας καὶ φιαλίτας ἀριθμούς, τοὺς μὲν ἐπὶ φιαλῶν, τοὺς δ' ἐπὶ ποίμνης, καὶ ἐπ' ἄλλων δὲ γενῶν τὰ πλήθη τῶν αἰσθητῶν σωμάτων σκοποῦσα, ὡς περὶ τελείων ἀποφαίνεται. ὕλη δὲ αὐτῆς πάντα τὰ ἀριθμητά· (*Scholium* on *Charm.* 165e Cufalo)

[1] For further on logistic, see Heath (1921) I, 14–15; Klein (1968) 6–8; Taub (2017) 44–5.

[2] The *scholium* is late, but it evidently draws from Hero's first-century CE *Definitions* (135.5); see Heath (1921) II, 13–15 and Cufalo (2007) 173. However, Plato in the *Laws* (819b) provides further evidence for arithmetical handling and manipulation of objects (see the introduction to Chapter 4). He says this goes back to the Egyptians (cf. 819a), as does the *scholium* in the remainder of the passage, not quoted.

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Logistic is the science which deals with numbered things, not numbers. It does not take number in its essence, but it presupposes 1 as a unit and the numbered object as a number, so that 3 is taken to be a triad and 10 to be a decad. To these it applies the theorems of arithmetic. It investigates on the one hand what is called by Archimedes the cattle problem and on the other hand *mêlites* and *phialites* numbers, the latter concerning bowls, the former concerning flocks of sheep.[3] It investigates the number of sensible bodies in other kinds of things too and treats them as absolutes. Its subject is everything that is numbered.[4]

The priority of λογιστική is to treat real world objects in a numerical manner, rather than to think abstractly about numbers. Numbered bowls and sheep, that is, are treated *as* these objects and are thus indivisible units: one is not allowed to chop up the sheep.[5] Part II tackles poetry that incorporates such arithmetical challenges where the configuration of the poetic content would have been solved by logistic and treated as such rather than simply a series of abstract numbers.

A prime example of setting arithmetic in poetry is a scene from the *Contest of Homer and Hesiod* that I briefly discussed in the Introduction, which can be traced back to the fifth century BCE.[6] Homer and Hesiod meet and compete at the funeral games held for Amphidamas, the king of Euboea. There, they competitively exchange verses from both of their poems, as well as verses not otherwise known to have been composed by either poet, but certainly based on them. They alternate between posing challenges of wisdom to each other (e.g. 'what is the best thing for mortals?')

[3] Heath (1921) 1, 14 wants to correct 'flock of sheep' to 'apples'. As I suggest below (Chapter 4, Section 4), however, there is good reason to think that there was no consensus regarding the interpretation of μηλίτες ἀριθμοί and that indeed later poets will be seen to play with the ambiguity.

[4] Translation adapted from Heath (1921) 1, 14.

[5] For another clear distinction between arithmetic and logistic, in similar language, see Proclus *In Euc*. 39.7–40.9.

[6] The text in the manuscript tradition is a Hadrianic recension, but the tradition and even large portions of the text date back to the Hellenistic period and quite probably to the *Musaion* of Alcidamas, active in the second half of the fifth century. For a clear study of the tradition see Bassino (2019) 1–82. Alcidamas' influence on the tradition of the contest is undoubtedly strong, but it does predate him. See Richardson (1981), *pace* West (1967). For the likelihood that Aristophanes' *Frogs* knows the *Contest*, see Rosen (2004). Thanks to the papyrus *PPetrie* I 25, a fair proportion of Alcidamas' work prior to the Hadrianic recension can be securely reconstructed. This passage is not definitively connected to Alcidamas, but since it follows only a few lines after the previous exchange that *is* preserved in the papyrus and seems to be part of a wider run of questions which challenge Homer's ability from a range of angles, I think it is probable.

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and responding to each other's individual sentences. Following on from Hesiod's presenting of 'ambiguous propositions' (τὰς ἀμφιβόλους γνώμας, *Contest* 102–3 Bassino) to Homer, Hesiod presents him with a mathematical challenge.

πρὸς πάντα δὲ τοῦ Ὁμήρου καλῶς ἀπαντήσαντος πάλιν φησὶν ὁ Ἡσίοδος·

> τοῦτό τι δή μοι μοῦνον ἐειρομένῳ κατάλεξον,
> πόσσοι ἅμ' Ἀτρείδῃσιν ἐς Ἴλιον ἦλθον Ἀχαιοί;

ὁ δὲ διὰ λογιστικοῦ προβλήματος ἀποκρίνεται οὕτως·

> πεντήκοντ' ἦσαν πυρὸς ἐσχάραι, ἐν δὲ ἑκάστῃ
> πεντήκοντ' ὀβελοί, περὶ δὲ κρέα πεντήκοντα·
> τρὶς δὲ τριηκόσιοι περὶ ἓν κρέας ἦσαν Ἀχαιοί.

τοῦτο δὲ εὑρίσκεται πλῆθος ἄπιστον· τῶν γὰρ ἐσχαρῶν οὐσῶν πεντήκοντα ὀβελίσκοι γίνονται πεντακόσιοι καὶ χιλιάδες β΄, κρεῶν δὲ δεκαδύο μυριάδες ,ε †ϋν†[7]

(*Contest of Homer and Hesiod* 138–48 Bassino)
(50 × 50 × 900 = 2,250,000)[8]

Since Homer had replied well to all these things [*sc*. challenges], Hesiod said again:

'Detail to me only this which I ask: how many Achaeans went to Ilium with the Atreids?'

He answered with a logistic problem as follows:

'There were fifty hearths of fire, in each were fifty spits and around each were fifty pieces of meat: three times three hundred Achaeans were around one piece of meat.'

But this results in an unbelievable number; for if there are fifty hearths then there are 2,500 spits and 125,000 pieces of meat. †

Homer's outline of the spits in each fire and the men around each piece of meat is specifically designated by its author as a response

[7] Kwapisz (2020b) proposes, in contrast to the recent edition of Bassino (2019), that the original form of Homer's reply is probably that preserved in *AP* 14.147; see Chapter 4, Section 4. It is a convincing suggestion that deserves serious consideration. Since I am quoting more than Homer's reply here, I have chosen to keep to Bassino's edition for consistency. In any case, the difference between the two versions does not affect the present discussion.

[8] I follow Kwapisz (2020b) 193 in understanding the verse to mean, though not unambiguously, that each hearth has 50 spits and so 50 pieces of meat, rather than 50 pieces of meat on each spit.

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to Hesiod in the form of a 'logistic problem' (λογιστικοῦ προβλήματος, *Contest* 142 Bassino).[9] Homer is effectively made to treat the Greek soldiers as those units which can be manipulated and arranged in a number of ways, but must stay as – and fundamentally are – indivisible bodies. From an early point in time poets were well able to adapt their abilities to versifying logistic challenges.

But there is also literary sophistication to this exchange of verses. Hesiod asks a question which cannot but recall Homer's Invocation prior to the Catalogue of Ships. The first line is formulaic, and the verb κατάλεξον functions as something of a technical term for recalling and cataloguing information.[10] The second line is calqued from verses in which Homer is appealing directly to the Muses for knowledge. The first phrase (πόσσοι ἅμ' Ἀτρείδῃσιν) reworks the relatively rare ἅμ' Ἀτρείδῃσιν used by Homer during the Catalogue when requesting to know in addition who were the best of the Achaeans 'who followed the Atreids' (οἳ ἅμ' Ἀτρεΐδῃσιν ἕποντο, *Il.* 2.762), and the final words echo the conclusion of Homer's Invocation (ὅσοι ὑπὸ Ἴλιον ἦλθον, *Il.* 2.492), where he signalled his dependence on the Muses in handling the mass of tradition (488–92).[11] Hesiod uses Homer's own poetry to question the extent to which his claim to be supported by the Muses is true when it comes to numerical information.

Homer's reply, however, differs from the Iliadic Invocation. These lines of the *Contest* appear to have been borrowed from the conclusion to *Iliad* 8 where, in a similar fashion to the Invocation in *Iliad* 2, the poet juxtaposes a simile with a numerical approach to the mass of warriors, this time the mass of Trojans. He first describes the Trojan camp's many fires

[9] While without parallel – Bassino (2019) 157 – it is a perfectly understandable phrase, especially in light of the later prose discussions of logistic.

[10] LSJ *s.v.* A.I.3. It also seems to have an affiliation with counting, cf. e.g. *Od.* 16.235, where Odysseus commands Telemachus: ἀλλ' ἄγε μοι μνηστῆρας ἀριθμήσας κατάλεξον ('but come recount and number for me the Suitors').

[11] ἅμ' Ἀτρείδῃσιν appears at *Od.* 17.103 and 19.182 in the same *sedes* in Hesiod's verse, whereas at *Il.* 2.762 it occurs in a different *sedes*. However, Hesiod's second verse also resembles Odysseus' words to Thersites earlier in *Iliad* 2, that there is no man worse than him 'among as many as those who went with the Atreids to Ilium' (ὅσσοι ἅμ' Ἀτρεΐδῃς ὑπὸ Ἴλιον ἦλθον, *Il.* 2.248). I therefore see this a deliberate connection to *Iliad* 2.

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'[as when] the infinite air is broken open in the heavens and all the stars are seen' (*Il*. 8.558–9) and then adds further qualification, 'a thousand fires burned on the plain and beside each sat fifty in the brightness of the burning fire' (*Il*. 8.562–3). The *Contest* therefore does not echo a Homeric catalogue here, but a Homeric calculation.[12] The Homer of the *Contest* in this sense is even more calculating than the poet of the *Iliad.* He does not allow room for addition at all, whereas in the Catalogue it is necessary to add together the troops under each leader in order to reach a sum for the entire Achaean contingent, in the manner that Thucydides had theorised. If Hesiod's echoing of invocatory language intends to test the Muses' support of Homer, then Homer's reply is strategic. He does not offer a catalogue, which might display the extent of the Muses' knowledge through the poet, but rather offers a multiplication which explains the number of the host in only a few lines. This Homer responds to with a display of his own – and not the Muses' – calculating capacity.

Important to observe here is that the poet of these new verses has not adapted any old Homeric verses or provided a calculation with any chance objects, but instead has excavated the *Iliad* itself for a scene and for a set of objects which might easily be adapted to arithmetic and form an equally knotty challenge for Hesiod in turn. What is more, the coincidence of the subject matter and the arithmetic is turned to reflect again on Homer's capacity as a poet but also – since it is a 'logistic problem' left unsolved and addressed to Hesiod in response – to challenge the literary and arithmetic capacities of the reader. It is this practice of seeking for ways to integrate arithmetic into poetry, and the particular configuration of the poet and the reader which results, that is my focus in the second half of the book. My overarching claim in Part II is that the objects – the 'stuff' – that are arranged into ratios in other arithmetical poems are not arbitrary either, nor are the language and imagery used to describe them. That is to say, the way poets chose to verbally encode arithmetical challenges demonstrates an awareness that they are composing poems as much as calculations,

[12] See also Agamemnon's calculation of the opposing forces at *Il*. 2.119–28, discussed in the Introduction p. 3.

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but also attests to their interrogation of how that very arithmetic shapes the poetic form. Whether consciously or not, these poets articulate a literary aesthetic appropriate to arithmetic.

Beyond the versified logistic problem spoken by Homer in the *Contest*, there survive from antiquity two further cases of calculations in poetry, and the following chapters will be devoted to understanding the particular aesthetics in which the poets wrapped their arithmetic. They are represented in the *scholium* to *Charmides*, which distinguishes between 'what is called by Archimedes the cattle problem' and '*mêlites* and *phialites* numbers'. Part II dedicates a chapter to each of these types in poetry. Quite what the difference is between the two kinds of logistic is unclear; the syntax of the *scholium* (μέν ... δέ) could be either conjunctive or disjunctive. The only observable distinction in the arithmetic over the course of my discussion will be the difficulty or solvability of the problems, though this is not to make a claim about what the differences (or indeed similarities) were thought to be in antiquity.

In Chapter 3 I address the elegiac poem called the *Cattle Problem* attributed to Archimedes, which I take to be synonymous with the problem referred to in the *Charmides scholium*. The poem outlines the ratios of the Cattle of the Sun that reside on Sicily, producing a logistic problem the solution to which was only recently resolved and was most probably irresolvable in antiquity. It was supposedly addressed to Eratosthenes, the head of the Alexandrian Library. Whereas it has long been of interest to historians of mathematics, my aim in the chapter is to analyse it as a poetic work. What will emerge is a composition that knowingly intertwines poetry and arithmetic: the language and sophisticated allusions to earlier poetry set Archimedes on a par with more well-known Hellenistic poets. Particularly significant will be Archimedes' positioning of the *Cattle Problem* within literary and generic traditions both through extended reference to Homer's Catalogue of Ships and counting of the troops in *Iliad* 2 and also by modelling his count on the oracular practice of claiming possession of land through calculating the amount of agricultural produce or livestock in a given location. These two aspects will prove to be especially pointed given that it was sent to

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Eratosthenes, who was a geographer as well as a mathematician and poet, and who in his geographical treatise had stripped Sicily of its Homeric past. Ultimately, the aesthetics of the *Cattle Problem* will be seen to be as much about testing the notion that one can combine mathematics and poetry as they are about challenging the idea that mathematics is a sophisticated means of gaining geographical knowledge.

In the case of the *Cattle Problem*, sufficient information exists about its context to develop a historically informed reading of its aesthetics. Yet over forty further poems survive that versify logistic problems, which are much shorter and lack such a specific context. These are the so-called arithmetic epigrams preserved in Book 14 of the *Palatine Anthology*, which I will be calling arithmetical poems since they are not all epigrammatic in either metrical or generic form. They seem to reflect in their arithmetic as well as subject matter the '*mêlites* and *phialites* numbers' mentioned in the *Charmides scholium*.[13] My intention in Chapter 4 is to develop a deeper understanding of the genesis of these poems and their aesthetic, both on the level of individual poems and as a collection. I detail the various generic affiliations of the poems and their strategies of expanding on numerical aspects in pre-existing genres. I go on to propose that the fact these poems demand input on the part of the reader in order to become interpretable, as well as the striking continuity of generic forms, locates these poems as a product of Late Antiquity. Drawing on a range of comparative works, I outline how these arithmetical poems match the period's balancing act of literary conservatism and formal experimentation. I then consider the organisation of the arithmetical poems as they were collected by a certain Metrodorus at some point in Late Antiquity and then as they were incorporated into the *Palatine Anthology*. It will become clear that in both cases the editors are alive to the particular nature of the compositions as arithmetical poetry and that this affects the orderings and

[13] Taub (2017) 40–1 connects the logistic described in the *scholium* with the passage from Plato's *Laws* (819a–c) that describes mathematical education through playing with apples, crowns or bowls. Kwapisz (2020a) 459–60 makes the connection stronger, I think, with his observation that at *AP* 14.48–50 three arithmetical poems offer problems with the same objects, in the same order.

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juxtapositions of the poems and the themes that they subsequently draw out. Part II demonstrates, in other words, that over the course of more than a millennium audiences and authors alike were attuned to a whole range of images and strategies for aestheticising arithmetic.

I must here also offer a caveat regarding notation. I have presented the accompanying solutions to the poems algebraically. This is a guide for the modern reader (just as I provided the isopsephic counts in the case of Leonides' epigrams) and should not be understood to be a reconstruction of how the problems were solved in antiquity. The algebraic method does not align with ancient arithmetic practice. Moreover, in the case of the *Cattle Problem* and some of the arithmetical poems I have provided more than one unknown where necessary, so that the reader may solve the problem as a series of simultaneous equations. Based on the evidence of Diophantus' *Arithmetica*, it would seem that only one unknown symbol was used for solving arithmetical problems.[14]

[14] See Heath (1910) 39.

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3

ARCHIMEDES' *CATTLE PROBLEM*

Below is the Greek text of Archimedes' *Cattle Problem* (henceforth *CP*) and the anonymous prose introduction which provides the context of its composition, a translation and a delineation of the equations represented algebraically.[15]

πρόβλημα ὅπερ Ἀρχιμήδης ἐν ἐπιγράμμασιν εὑρὼν τοῖς ἐν Ἀλεξανδρείαι περὶ ταῦτα πραγματευομένοις ζητεῖν ἀπέστειλεν ἐν τῇι πρὸς Ἐρατοσθένην τὸν Κυρηναῖον ἐπιστολῆι.

πληθὺν Ἠελίοιο βοῶν, ὦ ξεῖνε, μέτρησον
  φροντίδ' ἐπιστήσας, εἰ μετέχεις σοφίης,
πόσση ἄρ' ἐν πεδίοις Σικελῆς ποτε βόσκετο νήσου
  Θρινακίης τετραχῇ στίφεα δασσαμένη
χροιὴν ἀλλάσσοντα· τὸ μὲν λευκοῖο γάλακτος,
  κυανέῳ δ' ἕτερον χρώματι λαμπόμενον,
ἄλλο γε μὲν ξανθόν, τὸ δὲ ποικίλον· ἐν δὲ ἑκάστῳ
  στίφει ἔσαν ταῦροι πλήθεσι βριθόμενοι
συμμετρίης τοιῆσδε τετευχότες· ἀργότριχας μὲν
  κυανέων ταύρων ἡμίσει ἠδὲ τρίτῳ
καὶ ξανθοῖς σύμπασιν ἴσους, ὦ ξεινε, νόησον,
  αὐτὰρ κυανέους τῷ τετράτῳ τε μέρει
μικτοχρόων καὶ πέμπτῳ, ἔτι ξανθοῖσί τε πᾶσιν.
  τοὺς δ' ὑπολειπομένους ποικιλόχρωτας ἄθρει
ἀργεννῶν ταύρων ἕκτῳ μέρει ἑβδομάτῳ τε
  καὶ ξανθοῖς αὐτοὺς πᾶσιν ἰσαζομένους.
θηλείαισι δὲ βουσὶ τάδ' ἔπλετο· λευκότριχες μὲν
  ἦσαν συμπάσης κυανέης ἀγέλης
τῷ τριτάτῳ τε μέρει καὶ τετράτῳ ἀτρεκὲς ἶσαι·
  αὐτὰρ κυάνεαι τῷ τετράτῳ τε πάλιν
μικτοχρόων καὶ πέμπτῳ ὁμοῦ μέρει ἰσάζοντο
  σὺν ταύροις πάσαις εἰς νομὸν ἐρχομέναις.
ξανθοτρίχων δ' ἀγέλης πέμπτῳ μέρει ἠδὲ καὶ ἕκτῳ
  ποικίλαι ἰσάριθμον πλῆθος ἔχον τετραχῇ.

[15] This chapter develops and substantially expands arguments first put forth in Leventhal (2015).

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ξανθαὶ δ' ἠριθμεῦντο μέρους τρίτου ἡμίσει ἶσαι
ἀργεννῆς ἀγέλης ἑβδομάτῳ τε μέρει.
ξεῖνε, σὺ δ' Ἠελίοιο βόες πόσαι ἀτρεκὲς εἰπών,
χωρὶς μὲν ταύρων ζατρεφέων ἀριθμόν,
χωρὶς δ' αὖ θήλειαι ὅσαι κατὰ †χροιὰν ἔκασται,
οὐκ ἄϊδρίς κε λέγοι' οὐδ' ἀριθμῶν ἀδαής,
οὐ μήν πώ γε σοφοῖς ἐναρίθμιος. ἀλλ' ἴθι φράζευ
καὶ τάδε πάντα βοῶν Ἠελίοιο πάθη.
ἀργότριχες ταῦροι μὲν ἐπεὶ μιξαίατο πληθὺν
κυανέοις, ἵσταντ' ἔμπεδον ἰσόμετροι
εἰς βάθος εἰς εὖρός τε, τὰ δ' αὖ περιμήκεα πάντη
πίμπλαντο πλίνθου Θρινακίης πεδία.
ξανθοὶ δ' αὖτ' εἰς ἓν καὶ ποικίλοι ἀθροισθέντες
ἵσταντ' ἀμβολάδην ἐξ ἑνὸς ἀρχόμενοι
σχῆμα τελειοῦντες τὸ τρικράσπεδον οὔτε προσόντων
ἀλλοχρόων ταύρων οὔτ' ἐπιλειπομένων.
ταῦτα συνεξευρὼν καὶ ἐνὶ πραπίδεσσιν ἀθροίσας
καὶ πληθέων ἀποδούς, ξεῖνε, τὰ πάντα μέτρα
ἔρχεο κυδιόων νικηφόρος ἴσθι τε πάντως
κεκριμένος ταύτῃ γ' ὄμπνιος ἐν σοφίῃ.[16]

(Archimedes *Cattle Problem SH* 201)

A problem Archimedes devised in epigrams that he sent in a letter to Eratosthenes of Cyrene, to those in Alexandria attempting to work out such things.

The multitude of the Cattle of the Sun calculate, O stranger, and set your mind to it, if you have a share in wisdom, as many as once grazed the plains of Sicilian Thrinakia's island, divided four-ways into groups of differing colours: one milky white, another shining with black hue, while yet another brown, the last dappled. In each herd were bulls strong in number formed in the following proportions. Consider, O stranger, that the white-haired equal a half and third of the black bulls together with the brown bulls, but that the black equals a quarter share and fifth of the dappled and the whole of the brown besides. Observe how the remaining dappled bulls equal a sixth and a seventh share of the white bulls and the whole of the brown. With the cows, it was the following: the white-haired were exactly equal to a third and a quarter share of the whole of the black herd: but the black cows again equalled a quarter of the dappled and a fifth share together, when with all the bulls they went to pasture. The dappled quartered have an equal number to a fifth and sixth of the brown-haired herd. The brown cows numbered equal to a half of a third share of the white herd and a seventh share.

If, O stranger, you accurately tell how many Cattle of the Sun there are, telling separately the number of well-fed bulls and separately again the number of each

[16] This text follows Lloyd-Jones and Parsons (1983) 77–8.

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herd of cows according to colour, you would not be called unskilled or ignorant of numbers; nor yet, though, would you be numbered among the wise.

But come, consider all these conditions of the Cattle of the Sun. When the white-haired bulls mix their multitude with the black they stand firmly together, their length and breadth of equal measure, stretching far and wide the plains of Thrinakia were filled with their masses. Again, when the brown and dappled bulls were herded together they stood, beginning with one, increasing in number resulting in a three-bordered shape, neither any other coloured bulls among them, nor with any left out.

If, O stranger, having completely worked out in your mind these things, collating and giving an account of every dimension you may go, a victor, and carry yourself proud, knowing that wholly you have been judged *opmnios* (perhaps 'well-fed') in this species of wisdom.[17]

White Bulls = $\frac{5}{6}$ Black Bulls + Brown Bulls
Black Bulls = $\frac{9}{20}$ Dappled Bulls + Brown Bulls
Dappled Bulls = $\frac{13}{42}$ White Bulls + Brown Bulls
White Cows = $\frac{7}{12}$ (Black Bulls + Black Cows)
Black Cows = $\frac{9}{10}$ (Dappled Bulls + Dappled Cows)
Dappled Cows = $\frac{11}{30}$ (Brown Bulls + Brown Cows)
Brown Cows = $\frac{13}{42}$ (White Bulls + White Cows)
White Bulls + Black Bulls = A square number
Brown Bulls + Dappled Bulls = A triangular number

These twenty-two couplets capitalise on Homer's depiction of the Cattle of the Sun in *Odyssey* 12 and its numerical aspect, where Circe explains to Odysseus that on Thrinakia, 'there many cows and stout sheep of Helios graze, seven herds of cows and just as many fine flocks of sheep and fifty in each' (*Od.* 12.127–30). The description in the *CP* of the related proportions of black, white, brown and dappled herds of cattle, which are then configured geometrically on Sicily, creates a strikingly colourful image. Just as striking is the author's decision to respond to Homer's scene with a poem that fills the verses almost exclusively with the ratios of cattle. Reading through the work it becomes clear that the mathematics is more complex than that of Homer's *Odyssey*.

Since the work's discovery, scholars have essayed solutions to Archimedes' mathematical complexity.[18] It was only in 1965 that

[17] The translation is adapted from Thomas (1941) 202–5.
[18] According to Hermann (1831) 230, C. F. Gauss was reported to have worked on the problem, although Krumbiegel (1880) 123 doubts Gauss' involvement. The key advance towards a solution is found in Wurm (1830), later developed in Nesselmann

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the smallest solution was able to be written out in full (a number whose digits filled forty-two sheets of paper).[19] What makes the problem particularly fiendish is the addition of the further parameters. The poem first outlines a series of ratios which in modern notation can be written as a series of simultaneous equations. The problem is interesting in that, since there are seven equations and eight unknowns (again this is a modern way of phrasing the problem), one cannot find a single solution, but instead infinitely many solutions.[20] It is the subsequent stipulation that the white bulls and black bulls together form a square number and that the brown bulls and dappled bulls form a triangular number that makes the (infinitely many) solutions to the problem become truly astronomical in size. Unsurprisingly, attention has largely been paid to the mathematics, with historians of mathematics keen to highlight how the *CP* attests to an ancient awareness of complex arithmetic and of its limitations.[21] Approaches that have eschewed the mathematics inevitably do so only to discuss authenticity, a thorny riddle as unsolvable as the equations.[22]

The obsession with solving the mathematics and the question of authenticity has meant that the importance of the *CP*'s medium has been understudied and undervalued. Discussions of the text have failed to appreciate the *CP* as a poem and to understand the cultural and literary context which engendered it. Most, if not all, readers have been left bewildered by the mathematical

(1842) 484 and finalised in the form given by Amthor (1880). It was he who found a method for calculating the solution's large size, expressing only the first four significant digits of a number containing hundreds of thousands of digits.

[19] That is to say, the number was fully expressed. See Williams et al. (1965) and, in a more manageable form, Nelson (1981).

[20] Solutions are of the following form, with n as any arbitrary positive integer: White Bulls = 10,366,482n; Black Bulls = 7,460,514n; Brown Bulls = 4,149,387n; Dappled Bulls = 7,358,060n; White Cows = 7,206,360n; Black Cows = 4,893,246n; Brown Cows = 5,439,213n; Dappled Cows = 3,515,820n.

[21] See e.g. Heath (1921) II, 14.

[22] The poem is mentioned in Hero's *Definitions* – on which it is clear that the *scholium* to *Charmides* (see above) depends – and Cicero mentions a πρόβλημα Ἀρχιμήδειον (*Att.* 12.4, 13.28). I take Cicero to refer to the *CP* since no other work of Archimedes', as far as I know, is called a problem and although he does talk of problems in his treatises, this is too unmarked a use to develop into something as marked as a title for a poem. I think the most likely explanation is that this is the text to which the ancient sources refer. For further discussions see Struve and Struve (1821); Nesselmann (1842) 481–2; Krumbiegel (1880) 125. A balanced approach can be found in Fraser (1972) I, 407.

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demands of Archimedes' prescribed proportions and configurations and read no deeper. Certainly, the confrontation of Homeric epic and mathematics is central to the work, yet its importance lies not in the complex calculations alone, but in how the mathematics is co-opted to manipulate a readership. It seems clear, given the time and effort modern scholars have put into solving Archimedes' ratios, that his recipient, Eratosthenes, would have been unable to solve the arithmetical challenge.[23] A more productive approach is to accept that the problem would have been arithmetically unsolvable and then to analyse Archimedes' unique intersection of arithmetic and Homeric reception.

In that respect, it is important to observe that in other surviving treatises Archimedes shows himself to be a versatile and erudite author in his writing up of mathematics. In the *Sand Reckoner*, he engages with that most poetic trope, counting the number of the sands (e.g. *Il*. 2.800, 9.385; Pind. *Ol*. 2.98–100), and attempts to calculate the number of grains of sand that would be required to fill the universe. The treatise is dedicated to Gelon II, the ruler of Syracuse, and localised in relation to Sicily: Archimedes specifies that some people think the number of sands is infinite, the number 'not only around Syracuse and the rest of Sicily, but in every region, both inhabited and uninhabited' (2.134.1–6 Mugler). It stands apart from other, more typical mathematical texts in that it is not characterised by a pared-down, impersonal style focused on geometric proof, but 'is ruled throughout by Archimedes speaking in his own voice, occasionally breaking his speech so as to give room for mathematical proof'.[24] Similarly, in his *Stomachion* – which will be treated in more detail in the next

[23] It is still unclear how ancient mathematicians would begin to think about solving the problem, nor is it known if the creator of the mathematical problem knew the quantities beforehand, although Archimedes' *Sand Reckoner* does develop a system for coping with large numbers; see Vardi (1998) 318. The Press' anonymous reader further notes that the Greek is unclear in places. At verse 14 τοὺς ὑπολειπομένους should mean not the dappled bulls in their entirety but the dappled bulls not mentioned in the previous ratio delineation. The third equation above should thus perhaps be $^{11}/_{20}$ Dappled Bulls = $^{13}/_{42}$ White Bulls + Brown Bulls. There are similar problems with the interpretation of line 24, which raises the possibility that the sixth equation may not be correct either. These might be further reasons for thinking that the problem was indecipherable.

[24] Netz (2009) 105.

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chapter – he discusses the Greek game called στομάχιον ('Belly-teaser'), in which a square cut into fourteen shapes can be rearranged into many other figures. From what survives of the text, his first aim was to compute the total number of different ways that the pieces could be combined to produce a square, the answer being 17,152. How the treatise then proceeded is unclear, but it is probable that it introduced further parameters which result in a solution for the number of different combinations being so large that it can only be approximated.[25] In a not dissimilar vein to the *Sand Reckoner*, Archimedes takes an idea within Greek culture as a springboard for mathematical demonstration and as an opportunity for creating what Reviel Netz has called a 'carnival of calculation'.[26] In addition to this showmanship, there is the far more personal work of Archimedes' *Method*, also addressed to Eratosthenes, which describes a mechanical method for calculating the volume of certain solids.[27] He reminds Eratosthenes of geometrical problems he had sent him previously (4.82.1–8 Mugler) and praises his pedagogical commitment and mathematical enquiries (4.83.18–24 Mugler), before launching into an account of his discovery of the method which is strikingly biographical (4.84.10–25). My intention here is thus to situate the *CP* within the Archimedean corpus as equally sophisticated and literary, both capable of dazzling the reader with mathematical display and forged by his long-standing dialogue with Eratosthenes.

In what follows, then, I make three interrelated arguments. First, I show that the poem is a refined composition which resembles in form and content many other works produced in the Hellenistic era. In terms of the poet's allusiveness, I suggest that the narrative of the *Odyssey* is not just a useful image with which to encode the mathematics, but that it is at the heart of the poem, and in particular, that epic's concern with the location and name of Sicily. These aspects gain further significance when it is appreciated that the *CP*

[25] Netz (2009) 36. [26] Netz (2009) 17–21.

[27] The *Method* allows for the calculation of volumes of 'solids of revolution', those solids that are formed by the rotation of a two-dimensional figure about an axis to create a three-dimensional volume. For example, a rectangle set upon the axis and rotated about it will form a cylinder.

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is sent between two scholar-poets in different Hellenistic kingdoms. In the following section, I show in detail that a further key intertext of the *CP* is the Catalogue of Ships in *Iliad* 2 and the surrounding scenes, including the Invocation to the Muses. Appreciating this intertext allows one to observe how Archimedes conceives of, and presents to the reader, the very project of providing calculations in verse. By appealing to this foundational context in which the Homeric poet deals with numbers and must call on the help of the Muses, he addresses the issue of mathematical knowledge and its limits. In Section 3, I combine the geopolitical reading of the *CP* proposed in the first section with the focus on poetic catalogues developed in the second section. I draw on a range of catalogic scenes from Archaic and Hellenistic poetry in order to demonstrate that an abiding association in these passages is enumeration as geographical possession: whoever is able to make a symbolic census – be it of cities, crops or livestock – has a claim to the control and ownership of the land. In offering the reader the opportunity to calculate the Cattle of the Sun, I argue, Archimedes makes a political point about the (im)possibility of possessing Sicily by means of arithmetic. This arithmetical poem, in short, advances a very particular aesthetic which not only characterises the competitive context of the challenge posed, but also probes precisely what it means to simultaneously compose poetry and produce arithmetic.

3.1 Archimedes' Art

Archimedes was a great mathematician, but how good was his poetry? In this section I examine the literary aspects of the *CP*, its generic positioning and its allusions to earlier poetry. Whereas the focus has traditionally been on the complex enumeration encoded in the *CP*, here I provide a description of Archimedes the poet, a figure as erudite with words as he is sophisticated with mathematics. What will emerge, importantly, is not simply a scientific writer who draws on a Hellenistic education in order to 'versify' a series of equations, but a scientific writer able to handle a range of genres and generic expectations as well as to produce a poem full of intertexts and playful allusions to earlier works. Just like his

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correspondent Eratosthenes, Archimedes deserves to be ranked alongside the great Hellenistic poets as well as the greatest mathematicians.

To begin: the *CP* offers a number of different reading frameworks in its opening. The epistolary prose introduction frames the recipient as Eratosthenes and Archimedes as the sender. But is this Archimedes' voice in the poem? The phrase ἐν ἐπιγράμμασιν εὑρών is ambiguous: it could mean he discovered the poem 'among some epigrams' or that he devised it 'in elegiac couplets'.[28] It is not inconceivable that he would have found the poem in a pre-existing collection, but given the complexity of the mathematics I think it is more likely that Archimedes himself composed the poem. In any case, it is an intentional communicative gesture to Eratosthenes on his part. If the poem were read without assuming the context of the prose introduction, a reader would probably consider themselves to be the addressee and the speaker to be the author of the poem. In characterising the relationship between the speaker and the addressee, one can also look towards the generic history of epigram. For public inscriptions and literary epigrams, the address to a παροδίτης ('passer-by', 'traveller'), ὁδοιπόρος ('wayfarer', 'traveller') or ξένος/ξεῖνος ('stranger', 'wanderer') is a competitive manoeuvre intended to catch the reader's eye, on busy public thoroughfares or on the scroll.[29] φροντίδ' ἐπιστήσας (2) could be taken not only as 'set one's mind to' but also 'halt one's mind', converting the traditional call to a passer-by to physically stop into a request for one to halt mentally. This aspect, as is often noted, is fruitfully exploited by epigrammatists of the Classical and Hellenistic period.[30] As

[28] ἐν ἐπιγράμμασιν in some cases appears to designate a generic form, as at Antig. *Mir.* 19.24, but it is a matter of interpretation. For example, in the case of references to Callimachus' epigrams, ἐπιγράμμασιν is found both with the definite article (Diog. Laert. 2.111, Ath. 7.284c) and without (Ath. 7.327a), and so it is unclear whether a collection of his is meant or the verse form is being defined. Athenaeus (3.125c) has Myrtilus call a poem by Simonides an epigram although modern commentators take it to be a fragment of an elegy; see Sider (2020) 315–16. The line is thus seemingly blurred also in antiquity.

[29] This appears to be the default position, although, as Sourvinou-Inwood (1996) 279–80 admits, it is often unstated. See also Tueller (2008) 59–60.

[30] The ideas of playfulness, generic awareness and supplementation have been a fruitful area of research in recent years. See Bing (1995); Bing (1998); Selden (1998) 307–19;

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Michael Tueller has shown, depending on whether the epigram is sepulchral, dedicatory or amatory, the relationship between speaker and addressee differs.[31] Archimedes' ξεῖνε hints towards the genre, though it is unclear into which subgenre the *CP* fits. In the present case, a subsequent, probably purposeful, ambiguity arises as to whether Eratosthenes is a 'foreigner' (ξεῖνος) or a 'guest-friend' (ξεῖνος).

The *CP* is also indebted to the language in the *Odyssey* where Circe addresses Odysseus.

Θρινακίαν δ' ἐς νῆσον ἀφίξεαι· ἔνθα δὲ πολλαὶ
βόσκοντ' Ἠελίοιο βόες καὶ ἴφια μῆλα,
ἑπτὰ βοῶν ἀγέλαι, τόσα δ' οἰῶν πώεα καλά,
πεντήκοντα δ' ἕκαστα.

(Homer *Odyssey* 12.127–30)

Then you will come to the Thrinakian island: there many cows and stout sheep of Helios graze, seven herds of cows and just as many fine flocks of sheep and fifty in each.

An alert reader may infer a similar dynamic in the *CP*: Odysseus as the addressee and Circe the speaker. Indeed, Odysseus as a ξεῖνος is a key theme in the *Odyssey*, and its use in the epigram is a possible exegetical signpost.[32] Is this Odysseus quite literally (or textually?) in disguise? Without any clear indication to whom these Circean words are directed, the reader may well place themselves as the Odyssean addressee. If the reader has before them the prose introduction, they could also imagine that Archimedes has taken on the role of Circe and therefore that Eratosthenes has been made to play the role of Odysseus. In either case, the addressee's characterisation as Odysseus presents them as the cunning, wily figure who is skilled in speech, according to Calypso (*Od*. 5.182–3) and Alcinous (*Od*. 11.367–8). The challenge as the poem proceeds is whether they can match up to that archetypal figure of intelligence and solve the mathematical puzzle.

Gutzwiller (2002); Fantuzzi and Hunter (2004) 291–306. For more on supplementation in the context of arithmetical poetry see Chapter 4, Section 2.

[31] Tueller (2008) 66–94.

[32] Stewart (1976) chapter 2 and Murnaghan (1987) chapter 3 still offer the best discussions of disguise, recognition and guest-friendship in the *Odyssey*.

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Moreover, the opening line and address taken together point towards a further generic form:

πληθὺν Ἠελίοιο βοῶν, ὦ ξεῖνε, μέτρησον
φροντίδ' ἐπιστήσας, εἰ μετέχεις σοφίης

(*Cattle Problem* 1–2)

The multitude of the Cattle of the Sun calculate, O stranger, and set your mind to it, if you have a share in wisdom.

In the initial hexameter line there is an invocation (ὦ ξεῖνε), a command (μέτρησον) and a topic (πληθύν) modified by an extended description (Ἠελίοιο βοῶν). It structurally recalls the opening lines of many hexameter poems, including the *Iliad* and the *Odyssey*.[33]

ἄνδρα μοι ἔννεπε, Μοῦσα, πολύτροπον, ὃς . . .

(Homer *Odyssey* 1.1)

Tell me, o Muse, of the man of many ways, who . . .

μῆνιν ἄειδε, θεά, Πηληϊάδεω Ἀχιλῆος

(Homer *Iliad* 1.1)

Sing, o Goddess, of the anger of Achilles, son of Peleus

They too open with their subject, an invocation, a command and often a polysyllabic adjective. Epic invocations are employed to request information from the poet's goddess or Muse: they, and not the poet, have true knowledge and information.[34]

The verse-initial use of πληθύν ('multitude') is uncommon in Homer (cf. *Il.* 9.641, 11.305, 11.405 and 15.295), and by far the most well-known usage is in the Invocation to the Muses in *Iliad* 2. This word, I argue in Section 2, provides a connection to the Invocation prior to the Catalogue of Ships and its positioning of the poet's knowledge in relation to the Muses'. What can be said here is that the *CP*'s epic invocation is instead addressed to the reader and solver; will you be as successful as the omniscient Muses of epic in solving the problem? In one sense, the idea of knowing the number of the Cattle of the Sun parallels the knowledge of the Muses. Teiresias' underworld explanation of Odysseus' future stop on Thrinakia and encounter with the livestock represents the Sun in

[33] See also, for example, *Thebaid* fr. 1.
[34] The clearest discussion of this is still Lenz (1980) 21–41.

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terms similar to the Muses. The description of the Sun who 'looks over everything and hears everything' (πάντ' ἐφορᾷ καὶ πάντ' ἐπακούει, *Od.* 11.109) is reminiscent of the Muses as described in the Invocation, who 'are gods and are present and know everything' (θεαί ἐστε πάρεστέ τε ἴστέ τε πάντα, *Il.* 2.485). The Cattle of the Sun are not a subject that the Muses dealt with directly, but the purview of the Sun allows for the possibility of their number being a matter of divine, superhuman and Muse-like knowledge nevertheless: an epic invocation in a Sicilian mode.

Equally, there is the influence of archaic elegy. Geoffrey Benson has argued that the stanzaic structure, the key terms of wisdom (σοφία) and measure or proportion (μέτρον) and the address to a ξεῖνε mean that 'the main motifs imitate archaic elegy'.[35] Wisdom and a sense of proportion appear in both archaic elegy and the *CP*, although the use of those terms in an emphatically mathematical context complicates the association; Archimedes enters into a dialogue with, but does not necessarily imitate, elegy. As Benson further notes, moreover, elegy continued to be composed in the Hellenistic period, and in particular it is the form used for some longer catalogue poems.[36] So while the prose introduction suggests that the poem ought to be read as a long epigram, the *CP*'s metrical form together with its listing of ratios rather places it in the tradition of Hellenistic catalogues. Generically speaking, then, the *CP* positions itself at the intersection of a number of poetic forms; both epigram and elegy are in play, and the period attests amply to how both genres reinterpret and rework Homeric material. Echoing archaic elegy, for example, no doubt lent an air of intellectual superiority and didactic wisdom to the imagined speaker. The disjunction between a lengthy catalogue and the short, compact works of epigram will return more pointedly in the following section.

[35] Benson (2014) 180–2, with the quotation from 182.

[36] His analysis of the structural similarities is strong. Antimachus, Hermesianax and Callimachus all employ elegy in catalogue form, and this may well have influenced Archimedes. His argument – Benson (2014) 183–6 – that something like the tradition of the Seven Sages is meant at line 31 does not persuade. I present my own interpretation of lines 30–1 below.

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Besides generic dexterity, Archimedes shows himself to be in touch with contemporary literary scholarship, and the prose introduction suggests some sort of dialogue with those working in Alexandria specifically.

πρόβλημα ὅπερ Ἀρχιμήδης ἐν ἐπιγράμμασιν εὑρὼν τοῖς ἐν Ἀλεξανδρείαι περὶ ταῦτα πραγματευομένοις ζητεῖν (*Cattle Problem*, Introduction)

A problem which Archimedes devised in epigrams for those in Alexandria attempting to work out such things: . . .[37]

As the *scholia* to the *Odyssey* suggest, the number of the Cattle of the Sun was a subject of enquiry; ζητεῖν picks up the common term in the *scholia* for describing scholarly research.[38] The *scholia* present the seven herds of fifty cows and seven of fifty sheep as representing the days and nights of the year, and the sun the whole year. According to one *scholium*, it is a claim made by anonymous thinkers: ἥλιον ἐνταῦθα τὸν χρόνον λέγουσιν εἶναι, βόας καὶ μῆλα τὰς ἡμέρας ('they say that here the sun is time and the cows and sheep the days', B-*scholia* on *Odyssey* 12.128). A further *scholium* specifies that Aristotle had considered the meaning of the Cattle of the Sun: Ἀριστοτέλης φυσικῶς τὰς κατὰ σελήνην ἡμέρας αὐτὸν λέγειν φησὶ τν΄ οὔσας ('Aristotle explains in the manner of natural enquiry that he [Homer] says that the days under the moon are 350', B-*scholia* on *Odyssey* 12.129). It thus appears that this passage created a 'Homeric problem' as early as the fourth century.[39] Reincorporating scholarly cruces into new compositions is a hallmark of the early Hellenistic poets. Here Archimedes goes one step further and makes a Homeric *zêtêma* the subject of an entire poem.

Archimedes is no less scholarly in his vocabulary; his lexical choices suggest a keen awareness of Homeric language. As the reader proceeds through the poem, Archimedes plays with the idea of the reader as being Odysseus-like in their progress. After a gap

[37] The referent of ταῦτα is probably the number of cattle; verse 41 of the poem refers to the cattle in this way.
[38] Nünlist (2009) 11.
[39] See now Mayhew (2019) 188–90, who persuasively argues that this is not Aristotle's reading, but Aristotle's attempt to describe what gave rise to the myth.

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of twenty-two lines, in which Archimedes elucidates the ratios of the herds of the Cattle of the Sun, he addresses the reader.

ξεῖνε, σὺ δ', Ἠελίοιο βόες πόσαι ἀτρεκὲς εἰπών,
χωρὶς μὲν ταύρων ζατρεφέων ἀριθμόν,
χωρὶς δ' αὖ θήλειαι ὅσαι κατὰ †χροιὰν ἔκασται,
οὐκ ἄϊδρίς κε λέγοι' οὐδ' ἀριθμῶν ἀδαής,
οὐ μήν πώ γε σοφοῖς ἐναρίθμιος.

(*Cattle Problem* 27–31)

If, O stranger, you accurately tell how many Cattle of the Sun there are, telling separately the number of well-fed bulls and separately again the number of each herd of cows according to colour, you would not be called unskilled or ignorant of numbers; nor yet, though, would you be numbered among the wise.

This signpost is not for the unlettered. It is an allusive reference underscoring the work's scholarly nature and its ludic application of Homeric philology. The adjective describing the addressee, ἄϊδρις ('unskilled'), occurs twice in Homer, once in the *Iliad* and once in the *Odyssey*. In the *Iliad*, Antenor describes Odysseus feigning foolishness while on an embassy to Troy as ἄϊδρις (*Il.* 3.219). In the *Odyssey*, after he has arrived on Aeaea and his crew have been transfigured into pigs, Hermes halts Odysseus and provides him with the protective moly before confronting Circe.

πῇ δὴ αὖτ', ὦ δύστηνε, δι' ἄκριας ἔρχεαι οἶος
χώρου ἄϊδρις ἐών;

(Homer *Odyssey* 10.281–2)

To where are you heading this time, poor man, along the hilltops, knowing nothing of the country?

This is not the sly Odysseus of the *Iliad*, but of the *Odyssey*, constantly wandering and wondering to which land he has been blown, guided by the divine assistance of Athena.[40] Similarly, the related noun ἀϊδρείη ('ignorance') is twice applied to Odysseus' men who 'with ignorance' entered Circe's palace: οἱ δ' ἅμα πάντες ἀϊδρείῃσιν ἔποντο ('they all at the same time entered with ignorance', *Od.* 10.231 = 10.257). Superficially, this adjective seems to be a congratulatory compliment to the reader and hopeful solver. What might the attentive reader infer about Archimedes' allusive

[40] E.g. *Odyssey* 6.191, 7.193, 8.301.

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description of them and another possible reference to Odysseus literally and textually disguised before them?

The Odyssean passage is emphatically geographical: Odysseus has no knowledge of *where* he is. How does this square with the *CP*? Broadly, the reader's halted progress parallels Odysseus' movement along the hilltops – δι' ἄκριας ἔρχεαι – intercepted by Hermes.[41] A problem that arises, however, is the transposition from Aeaea in the *Odyssey*, to Thrinakia in the *CP*. A claim of oversight on Archimedes' part is a possibility, but this does not really explain why such a specific textual allusion would lead to a readerly 'dead end'. Rather, I suggest, for the reader recognising both their adopted Odyssean role and the incongruity of the Homeric intertext, they best Odysseus by orienting themselves in line with Homeric geography, textually and figuratively. Thus, Archimedes' line could be reread as 'you will not be called unskilled (as Odysseus was, *geographically speaking*)'. In geographic terms, the allusion asks the reader if they can locate Odysseus. For Eratosthenes, questions of Odyssean geography are highly contentious. Broadly speaking, Homeric scholars had two positions on Odysseus' wanderings. Some located the wanderings within the Mediterranean, so Strabo records, such as himself and Callimachus (Strabo 1.2.37),[42] while others pinpointed them beyond the Pillars of Hercules, including Apollodorus of Athens and Eratosthenes (Strabo 7.3.6–7).[43] Sicily was identified as an especially likely candidate for the mythical island, and by the Hellenistic period the association was common. This was no doubt bolstered by Thucydides' folk etymology: Θρινακίη (Thrinakia), or as it was also known, Τρινακρία (Trinakria), a back-formation based on Sicily's three capes, τρεῖς-ἄκρας (lit. 'three points', Thuc. 6.2.2).[44] However, employing mythology to elucidate contemporary geography was found by some scholars to be methodologically dubious.

[41] On the literal and figurative movements of reading epigrams see Höschele (2007).
[42] For Strabo's positive view of Homer see most recently Kim (2010) chapter 3.
[43] The particular naming and concretisation of this theory as 'ἐξωκεανισμός', however, comes only later with Crates of Mallos; cf. Crates frr. 44 and 77 Broggiato with Walbank (1979) 586–7 and Roller (2010) 120–3.
[44] See Gomme et al. (1970) 211.

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Eratosthenes was a particularly vocal opponent. As a scientist and philosopher, as well as a literary critic and poet, he argued that although he was not against Homer's poetry per se, Homer's *Odyssey* had no place in the burgeoning discipline of geography.[45]

Yet prior to this proposed 'geographical' intertext, Archimedes had already signalled for the reader his intellectual allegiances.

πόσση ἄρ' ἐν πεδίοις Σικελῆς ποτε βόσκετο νήσου
Θρινακίης τετραχῇ στίφεα δασσαμένη

(*Cattle Problem* 3–4)

As many as once grazed the plains of Sicilian Thrinakia's island, divided four-ways . . .

Archimedes' account of Sicily as Thrinakia signals no debate: the suggested geographical equivalence becomes fact. The association would pose no problem for the average reader, used to the mythical heritage of the island: cultural terra firma. For Eratosthenes, however, the equation of Sicily as Thrinakia is an impossibility. From the beginning, Eratosthenes' acceptance of the mathematical challenge and the readerly journey would jar. The Odyssean allusion, then, advances Archimedes' strategy. To decode Archimedes' allusion, the reader must take on the Odyssean role, journeying through a text and a myth firmly located on Thrinakia, a Thrinakia that is in fact Sicily. The allusion sets the reader at the interstices of Homeric geography and Homeric philology. Yet Eratosthenes, whom one would expect to notice this allusion, interprets the *Odyssey* in a way which does not allow Archimedes' (playful) geography and philology to intersect. The characterisation of the reader as οὐκ ἄϊδρις in a geographical sense gains piquancy when it is imagined to be aimed at Eratosthenes. Praise about knowing *where* one is, is a pointed compliment for Eratosthenes the revolutionary geographer. But the setting of Archimedes' poem and the Odyssean allusion which would constitute this praising set such a compliment on the precipice of ridicule. Eratosthenes may know where he is in this poem through textual allusions, but as a geographer, does he *really* know Homeric

[45] Eratosthenes encapsulated this thinking, so Strabo reports, with the quip, 'one would find the location of Odysseus' wanderings when one finds the cobbler who sewed up the bag of winds' (ἂν εὑρεῖν τινα ποῦ Ὀδυσσεὺς πεπλάνηται, ὅταν εὕρῃ τὸν σκυτέα τὸν συρράψαντα τὸν τῶν ἀνέμων ἀσκόν, 1.2.15).

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geography? Archimedes displays a sophisticated literary strategy, not only testing the reader's educated status, but offering a view of the literary challenge he sets up for Eratosthenes.

The final lines of the *CP* express a conditional tone, and again the possibility of a solution seems to be undercut by the literary references. Archimedes employs language reminiscent of Greek epinician poetry.

ταῦτα συνεξευρὼν καὶ ἐνὶ πραπίδεσσιν ἀθροίσας
καὶ πληθέων ἀποδούς, ξεῖνε, τὰ πάντα μέτρα
ἔρχεο κυδιόων νικηφόρος ἴσθι τε πάντως
κεκριμένος ταύτῃ γ' ὄμπνιος ἐν σοφίῃ.

(*Cattle Problem* 41–4)

If, O stranger, having completely worked out in your mind these things, collating and giving an account of every dimension you may go, a victor, and carry yourself proud, knowing that wholly you have been judged *ompnios* in this species of wisdom.

Proceeding as one who is κυδιόων νικηφόρος, the reader proudly carries off their victory. In the context of this intellectual contest, ἔρχεο is as much a sphinx-like 'you may pass' – having solved the problem – as it is a secondary epigrammatic command to go forth, having contemplated an inscription. The initial conditionality of the challenge – εἰ μετέχεις σοφίης (2) – is here resolved in a neat ring composition. Having completed these calculations, you have been judged wise; not only is it no longer a case of 'if', but the successful solver is 'rich' in a species of wisdom. The νικηφόρος so reminiscent of Pindaric epinician should also make one read an agonistic context in κεκριμένος – 'having been judged *in contest*' (cf. Pind. *Isthm*. 1.22; *Nem*. 3.67; *Ol*. 2.5, 13.14). This novelty should not be overlooked. The challenge exchanged between the two scholars, a battle of learning and culture, offers a noticeably different view of competing individuals and *poleis* in the Greek world. Success is not gained through sporting prowess, but in giving an account of mathematical dimensions and aspects of Homeric poetry.

Through his use of allusion Archimedes points to both the geographical and intellectual stakes of his problem: it is concerned with Sicily and with the parameters of human knowledge and the limits of the wise. Before exploring how these two issues are dealt

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with on the scale of the poem as a whole and its catalogic form, I want to consider further the integration, confrontation and elision of various epigrammatic forms. The dense, allusive reworking of Homeric material positions the *CP* within the genre of epigrammatic riddles. The differing levels of assumed knowledge on the part of the reader have something to say about the *CP*'s context of production and reception.

To what extent is this allusion to Odyssean geography in the *CP* to be noticed by an astute reader? An epigram by Philetas of Cos underscores how Hellenistic riddle epigrams engage with Homeric material in intricate ways, employing both philology and a broader cultural knowledge.

οὐ μέ τις ἐξ ὀρέων ἀποφώλιος ἀγριώτης
αἰρήσει κλήθρην, αἰρόμενος μακέλην·
ἀλλ' ἐπέων εἰδὼς κόσμον καὶ πολλὰ μογήσας,
μύθων παντοίων οἶμον ἐπιστάμενος.

(Philetas fr. 8 Lightfoot)

No lumbering rustic from the mountains shall bear me, snatching up a hoe – me, an alder tree; but one who knows the marshalling of words, who toils, who knows the pathways of all sorts of speech.[46]

Peter Bing, rejecting variant views of the alder tree as a poet or a woman, suggested that it refers to a writing tablet.[47] More recently though, Jan Kwapisz highlights how the noun κλήθρη refers to the alder tree out of which Odysseus constructs his raft on Calypso's island.[48] The noun is a Homeric *dis legomenon*, only appearing in the scene where Odysseus builds the raft (*Od.* 5.64, 239), and it is the key for decipherment. If the pronoun μέ refers to the alder, then the 'alder-slayer' who knows 'the marshalling of words' and 'toils' is Odysseus, traits formulaically ascribed to him. Much as in the *CP*, the character of Odysseus is revealed to us through a philological signpost. How convincing is this reading? Philetas' epigram balances the reader's broad cultural exposure to Odyssean material with a textual allusion. Retrospectively, the reader might congratulate themselves for having noticed the unique κλήθρην. It is possible

[46] Translation adapted from Lightfoot (2009) 43.
[47] Bing (1986) 224.
[48] Kwapisz (2013b) 156, developing Cerri (2005).

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that an ancient reader would have deciphered the epigram simply from the references to a man who is good with speech, has struggled, but nevertheless knows many ways.[49] These are, after all, Odysseus' characteristic traits. This is crucial when considering literary riddles. Within a riddle, the information supplied is never itself erroneous; rather, it is obscurely expressed. With Philetas, as with Archimedes, their language describing Odysseus employs both philological specificities and ingrained cultural formularity. Not only does Archimedes repeatedly address the reader as a ξεῖνος ('stranger', 'guest') – Odysseus being the archetypal ξεῖνος – but the very situation is uniquely Odyssean. The novelty of this type of riddling epigram, it seems to me, lies in the ability to observe the author at work covering up the identity of a figure in Greek culture, mentioning but not mentioning the great Homeric hero. For the astute reader, a philological allusion is a further sign of the poet's skill in pointing to, but not explicating, the well-known subject.

The following riddle functions similarly, leaving its subject, a key Homeric figure, initially hidden from the reader.

ἄνδρ' ἐμὸν ἔκταν' ἑκυρός, ἑκυρὸν δ' ἔκτανεν ἀνήρ,
καὶ δαὴρ ἑκυρὸν καὶ ἑκυρὸς γενέτην.

(*AP* 14.9)

My father-in-law slew my husband, my husband slew my father-in-law, my brother-in-law slew my father-in-law, and my father-in-law my father.

The epigram's features are not outwardly Homeric, nor are there any philological pointers; rather, a certain level of knowledge of Homer's epics is required. To solve this riddle and identify the figure as Andromache, one must know that her first husband Hector was killed by Achilles, who became her father-in-law when she married Neoptolemus, who had killed her first father-in-law Priam, and that Andromache's brother-in-law Paris killed her father-in-law Achilles, who had killed her father Eetion. The epigram presents a set of propositions concerning certain members of an unknown person's family which are relatively straightforward. The repetitious language compounding the four interrelations,

[49] Bing (2009) chapter 8 considers insightfully the difference between general and specific allusions to Odysseus.

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however, spawns complexity. With Philetas the identity of Odysseus is a textual matter; this Homeric epigram weaves a knot of interconnection around Andromache out of the broader cultural currency of epic. Archimedes operates in like fashion. There is a certain superficial simplicity in offering up the ratios of herds of cattle. When considered thoroughly, though, it becomes obvious that things are more complicated. Both epigrams underscore how difficult it can be to untangle the mass of culture that is the Homeric tradition. The denouement of the epigram on Andromache is successful because it offers the reader resolution; there are simple answers to knotty cultural interrelations.

In these riddles, the workings of cultural capital can be seen at play. Hellenistic literate education and knowledge of Homer in particular could create a shared identity uniting the educated Greek elite, but it is also the means through which individuals could gain intellectual distinction by demonstrating the extent and depth of their learning.[50] The agonistic intellectualism of the Andromache epigram seems clear, for Philetas this is probable, and in the case of the *CP*, the epistolary header is highly suggestive. Clearly, a philological note demands deeper knowledge than heroic genealogies. Nonetheless, literary reference and popular knowledge are not mutually exclusive, and this is part of the craft of the riddle. In the *CP*, there is no enunciation of Odysseus. Yet his character and his narrative are never far from the reader's mind. A reader of the *CP*, picking up the Odyssean cues, could congratulate themselves. Those who notice the philological intertext of ἄϊδρις will feel 'intellectual' and may additionally reflect whether Eratosthenes too noticed the intertext. Archimedes' poem allows the reader to observe intellectual agonism 'in action', and the literary riddle is the ideal form through which to underscore this competitive interaction.

3.2 Cattle and Catalogues

Archimedes' allusive art in the *CP* sets his poetic skills on a par with Hellenistic poets more traditionally viewed as scholarly

[50] See Morgan (1998) 74–89 with Thompson (1994) 67–8 and Cribiore (2001) 225–30.

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and recondite. By redeploying key Homeric words, he alludes to the exclusive nature of being σοφός ('wise') and reconfigures Odyssean geography. This would have had a clear effect for a poem exchanged between himself and Eratosthenes, revolutionary geographer and curator of the largest Greek library ever seen. In addition to the allusive language, however, the catalogic form of the poem – its listing of the ratios of cattle – has a deep history in Homeric poetry. My interest in this section is the connection between the *CP* and Homer's Invocation prior to the Catalogue of Ships. I argue that Archimedes frames the possibility of solving the ratios through a series of allusions to that passage and to *Iliad* 2 more broadly. My focus in particular will be on what this intertext implies about handling large numbers in verse and the possibility of the reader solving the ratios. Subsequently, I ask how this perspective is modified by the appeal to elegiac traditions that occur in the first pentameter. If the Iliadic Catalogue is signalled as an intertext in the opening hexameter, how does this picture change when it becomes clear that this is an elegiac catalogue of cattle? I ultimately want to argue that Archimedes actively strains generic forms that might be ascribed to the *CP* in order to highlight the limits of human knowledge. The series of allusions to *Iliad* 2 together with the programmatic opening couplet, in other words, explores the similarities between mathematical and poetic knowledge and the difficult compromises which arise when they interact.

Before turning to the first word of the *CP*, it is worth pointing out that Archimedes' subject matter fits closely with the broader context of the Catalogue in *Iliad* 2. Immediately preceding the Invocation to the Muses for support in accounting for all the Achaeans at Troy, Homer describes the gathering host in a series of seven similes. They are likened first to a fire ravaging a forest (2.455–8), then to birds flocking on to a meadow (2.459–66), to the number of leaves in a meadow (2.467–8) and flies swarming round a milk pail (2.469–73). Following these four similes characterising the host, the poet turns to characterise their organisation.

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τοὺς δ', ὥς τ' αἰπόλια πλατέ' αἰγῶν αἰπόλοι ἄνδρες
ῥεῖα διακρίνωσιν, ἐπεί κε νομῷ μιγέωσιν,
ὣς τοὺς ἡγεμόνες διεκόσμεον ἔνθα καὶ ἔνθα
ὑσμίνηνδ' ἰέναι

(Homer *Iliad* 2.474–7)

Just as when goatherds easily divide up the broad herd of goats when they mix in the field, so did the leaders order them [the troops] here and there to go into battle.

The organisation of the troops is likened to goat-herding. The leaders who διεκόσμεον ('ordered') the troops recall Agamemnon's notable numerical language earlier in the book, where he imagines both the Trojans and Achaeans being 'counted up' (ἀριθμηθήμεναι, *Il.* 2.125) and the Achaeans being 'ordered into tens' (ἐς δεκάδας διακοσμηθεῖμεν, *Il.* 2.127), in order to highlight that the Trojans are outnumbered. The counting of troops in this later scene is now a pastoral activity. Archimedes' poem looks to a highly numerical passage regarding cattle in the *Odyssey* but, given its opening allusion to the Invocation prior to the Catalogue, also connects this with the herding imagery which immediately precedes the Invocation. In asking the reader to calculate the πληθύς ('multitude') of cattle, Archimedes realises the vehicle of the Homeric simile and transforms it into the actual subject of a calculation.

Now to the opening word itself: πληθύν. Primarily, it signifies a 'multitude'. It also recalls Homer's Invocation before the Catalogue. That passage's popularity as a stand-alone section of the *Iliad* in Greek society, evidenced by papyri, affords the opportunity to take πληθύν seriously as a salient intertext and ask how this might affect a reading of the *CP*.[51] Here is the passage again.

ἔσπετε νῦν μοι, Μοῦσαι Ὀλύμπια δώματ' ἔχουσαι –
ὑμεῖς γὰρ θεαί ἐστε πάρεστέ τε ἴστέ τε πάντα,
ἡμεῖς δὲ κλέος οἷον ἀκούομεν οὐδέ τι ἴδμεν –
οἵ τινες ἡγεμόνες Δαναῶν καὶ κοίρανοι ἦσαν.
πληθὺν δ' οὐκ ἂν ἐγὼ μυθήσομαι οὐδ' ὀνομήνω,
οὐδ' εἴ μοι δέκα μὲν γλῶσσαι, δέκα δὲ στόματ' εἶεν,
φωνὴ δ' ἄρρηκτος, χάλκεον δέ μοι ἦτορ ἐνείη,
εἰ μὴ Ὀλυμπιάδες Μοῦσαι, Διὸς αἰγιόχοιο
θυγατέρες, μνησαίαθ' ὅσοι ὑπὸ Ἴλιον ἦλθον·
ἀρχοὺς αὖ νηῶν ἐρέω νῆάς τε προπάσας.

(Homer *Iliad* 2.484–93)

[51] Cribiore (1994) 4–5; Cribiore (1996); Cribiore (2001) 194.

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Tell me now, you Muses who have dwellings on Olympus – for you are goddesses and are present and know all things, but we hear only a rumour and know nothing – who were the leaders and lords of the Danaans. But the multitude I could not tell or name, not even if ten tongues were mine and ten mouths and a voice unwearying, and the heart within me were of bronze, unless the Muses of Olympus, daughters of Zeus who bears the aegis, call to my mind all those who came beneath Ilion. Now I shall tell the leaders of the ships and all the ships.

With the prospect of (re)counting all the men at Troy the poet reaffirms his relationship to the Muses. The poet's inability to deal with a large number of people contrasts with the Muses' omniscience. This progression of thought raises interpretative issues. The poet's lack of knowledge in comparison to the Muses and the inability to recall the entire πληθύς given his human limitations and mortal frame are traditional elements of catalogues.[52] The further conditional, however, could be interpreted as implying that the Muses can help the poet overcome those mortal deficiencies which he had outlined.[53] I would follow Tilman Krischer and see this as being resolved by taking ὅσοι (*Il.* 2.492) to be an indirect interrogative and not a relative pronoun.[54] The Muses, that is, can support the poet to recall the number of the πληθύς and select narratives, but nothing more: recalling the narratives of the entire πληθύς would demand a superhuman ability.[55] His final resolution to speak about the leaders of the ships and the ships allows him to balance both demands.

How the passage in the *Iliad* might have been understood later in antiquity affects the sense that can be ascribed to the echo of πληθύς in the *CP*. On the broadest level, the opening use of πληθύς brings to mind the difficulty of dealing with large numbers that arose in *Iliad* 2 and raises the question whether the reader of the *CP* will be able to manage these large numbers too. In *Iliad* 2, the

[52] See Sammons (2010) 148–53, with further bibliography.
[53] See Brügger et al. (2003) 143–4.
[54] Krischer (1965) 4–5. Sammons (2010) 154–5 points to some problems with this interpretation, especially the fact that the indirect interrogative follows on from a clause which is more to do with naming than counting. However, I take counting here to be a prerequisite for recalling: one could not possibly recall the entire (narrative history of the) multitude without first establishing how many there are.
[55] This distinction between naming and counting finds support in one of the *scholia* to the Catalogue, which specifies that it is the act of recalling and naming which requires divine aid and so, it might be thought, divine *abilities* (bT-*schol. Il.* 2.488).

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Invocation could be interpreted as signalling that the poet has divine support in giving the audience an account of the gathered troops, or it could be understood that his account based only on the leaders and the ships instead constituted the poet recounting the troops without divine aid. If Homer were understood not to have the support of the Muses in giving his enumerative catalogue, this may make more tangible the reader's expectation that the catalogue of ratios is manageable and the πληθύς enumerable: Homer did this without the Muses, so might I. In my estimation, though, the condition of the Muses' support in recalling how many went to Ilion (492) is what enables the poet to account for (to say nothing of naming) the πληθύς in the form of a catalogue. With *Iliad* 2 in mind, the Muses' absence from Archimedes' poem suggests that, just like the poet on his own, the reader will be unable to give the total number of Cattle of the Sun. This picks up a further aspect of the Catalogue and its calculations, namely that Homer never gives a final answer nor explicitly puts a number to the πληθύς of the troops. Even with the Muses' help, the poet is only able to give a catalogue that counts the number of troops per ship and ships per leader, and fails to provide the numerical total. Since Archimedes' ratios would have been irresolvable, his poem too remains a catalogue of numbers that does not yield a final numerical answer for the πληθύς.

Computing the ratios of the Cattle of the Sun thus becomes akin to attempting to count up all the heroes who went to Troy, but this connection extends well beyond the allusive opening word. Archimedes further draws from the deliberative scenes in *Iliad* 2 in order to characterise the potential solver of the problem. Consider again Archimedes' apostrophe to the reader.

ξεῖνε, σὺ δ', Ἠελίοιο βόες πόσαι ἀτρεκὲς εἰπών,
χωρὶς μὲν ταύρων ζατρεφέων ἀριθμόν,
χωρὶς δ' αὖ θήλειαι ὅσαι κατὰ †χροιὰν ἔκασται,
οὐκ ἄϊδρίς κε λέγοι' οὐδ' ἀριθμῶν ἀδαής,
οὐ μήν πώ γε σοφοῖς ἐναρίθμιος.

(*Cattle Problem* 27–31)

If, O stranger, you accurately tell how many Cattle of the Sun there are, telling separately the number of well-fed bulls and separately again the number of each

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herd of cows according to colour, you would not be called unskilled or ignorant of numbers; nor yet, though, would you be numbered among the wise.

Verse 31 looks forward to the additional parameters which Archimedes will provide, but also continues to allude to Homer and to Odysseus. The *Iliad* and the *Odyssey* each contain a single occurrence of ἐναρίθμιος ('numbered among'). Most pertinent is the Iliadic context where Odysseus seeks to persuade the Achaeans not to flee following Agamemnon's test of the troops and false promise of return.[56]

δαιμόνι᾽ ἀτρέμας ἧσο καὶ ἄλλων μῦθον ἄκουε,
οἳ σέο φέρτεροί εἰσι, σὺ δ᾽ ἀπτόλεμος καὶ ἄναλκις,
οὔτέ ποτ᾽ ἐν πολέμῳ ἐναρίθμιος οὔτ᾽ ἐνὶ βουλῇ.

(Homer *Iliad* 2.200–2)

Good man, sit still and listen to the words of others, who are better than you, while you are weak and unwarlike, nor are you ever to be counted in war or in council.

Odysseus attempts to subtly talk over the other leaders among the Greeks, but he addresses those of the masses with harsher words. Here, being ἐναρίθμιος designates inclusion within a group, and a group that is marked out by its power and elite position within Homeric society. Odysseus' denigration of the masses as not being ἐναρίθμιος within this group is offset by the Catalogue of Ships. If Odysseus uses the language of counting to define the lower social position of the average soldier, Homer nevertheless ensures that they are given some renown by being meticulously counted among those who went to Troy. The adjective's Iliadic usage raises the possibility of the reader of the *CP* being counted among the wise in the same way that the leaders at Troy are promoted above the mere mass of soldiers.

Archimedes concludes his representation of the reader in the final lines of the *CP* and continues to draw on *Iliad* 2 in characterising the successful solver.

ταῦτα συνεξευρὼν καὶ ἐνὶ πραπίδεσσιν ἀθροίσας
καὶ πληθέων ἀποδούς, ξεῖνε, τὰ πάντα μέτρα

[56] Its use in the *Odyssey* scene (12.62–6) may also be pertinent for the *CP* given that the passage is spoken by Circe, who later in her speech will describe the Cattle of the Sun.

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ἔρχεο κυδιόων νικηφόρος ἴσθι τε πάντως
κεκριμένος ταύτῃ γ' ὄμπνιος ἐν σοφίῃ.

(*Cattle Problem* 41–4)

If, O stranger, having completely worked out in your mind these things, collating and giving an account of every dimension you may go, a victor, and carry yourself proud, knowing that wholly you have been judged *ompnios* in this species of wisdom.

Important for my purposes, first, is that the participle κυδιόων ('carrying oneself proudly') is used to describe Agamemnon in his entry within the Catalogue.[57]

ἐν δ' αὐτὸς ἐδύσετο νώροπα χαλκὸν
κυδιόων, πᾶσιν δὲ μετέπρεπεν ἡρώεσσιν,
οὕνεκ' ἄριστος ἦεν, πολὺ δὲ πλείστους ἄγε λαούς.

(Homer *Iliad* 2.578–80)

And among them he himself wearing flashing bronze, exulting, standing out among all the heroes, very much the best because of his many people.

Even in a catalogue of heroes and their troops, Agamemnon nevertheless stands above them all in his pre-eminence. Identifying the figure of Agamemnon behind Archimedes' representation of the reader in the final lines highlights the arithmetic progress being implied. The rhetorical movement in the *CP* from the solver as one who is ἐναρίθμιος to one who is like Agamemnon models Odysseus' address to the soldiers. Following his denigration of the soldiers as not even ἐναρίθμιος in war or council he then calls for them to unite under Agamemnon – εἷς κοίρανος ἔστω | εἷς βασιλεύς ('let there be one ruler, one king', *Il.* 2.204–5). Characterising the solver now not simply as one of those who is counted among the generals of the troops as opposed to the mass of soldiers, but as the leader of the whole contingent, figures them as unique in their abilities. Agamemnon had already displayed his ability to make calculations regarding the troops earlier in the book (*Il.* 2.123–33), and he stands even above the other leaders ordering their troops in the simile before the Invocation and Catalogue (474–5, see above), both of which suggest his ability to handle and order numbers on a greater scale than the other leaders. At the

[57] It is used in the nominative plural in reference to the gods at *Il.* 21.519.

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end of the *CP*, Archimedes' use of κυδιόων in a poem already recalling the Invocation and Catalogue raises the possibility that the reader will have full mastery over the number of cattle just as Agamemnon had control over the troops.

Equally, though, the conclusion can be read as hinting at the impossibility of the arithmetical task. The participle κυδιόων also appears in two almost identical similes comparing the heroes Paris and Hector to horses that have bolted the stable and enjoy their freedom glorying in their splendour (*Iliad* 6.506–11 = 15.263–8). With Paris, the image of a horse that delights too much in his appearance reflects Paris' underlying nature, whereas Apollo, rousing Hector from his feeling of defeat, brings out in him the exulting confident defender of Troy. It is this onslaught, this final rallying against the Achaeans with Apollo's aid, that leads to the death of Patroclus at Hector's hands, and thus seals his fate at Achilles' hands.[58] Moreover, in the Homeric *scholia* both Paris and Hector are taken as paradigms of 'boastfulness' (ἀλαζονεία).[59] To read echoes of either narrative is thus to hear a note of caution about believing in one's own abilities.[60] There may well be further irony, too. The adjective νικηφόρος plainly refers to the solver as a victor, but in Pindaric epinician poetry it can also be applied to horses (e.g. *Ol.* 2.5). Likewise, while the meaning of ὄμπνιος remains unclear, it seems that it was connected by a number of authors with nourishment, agricultural produce and grain.[61] The solver may well be 'victorious' and 'well-fed' or 'nourished', but like an overly proud horse; after all, Homer appeals to the Muses to

[58] On both similes see most recently Graziosi and Haubold (2010) 226–7.

[59] On Paris see bT-*schol. Il.* 3.439–40a and on Hector see bT-*schol. Il.* 7.29 and A-*schol. Il.* 17.201b.

[60] The account of Agamemnon as κυδιόων in the Catalogue also recalls his earlier description in the run of similes before the Invocation. There in the same metrical *sedes* he is likened to a bull 'standing out among the gathered herds' (βόεσσι μεταπρέπει ἀγρομένῃσι, 481) and the simile is made explicit two lines later when Homer describes how Zeus makes Agamemnon 'stand out from the many and pre-eminent among heroes' (ἐκπρεπέ' ἐν πολλοῖσι καὶ ἔξοχον ἡρώεσσιν, 483). If Agamemnon is seen as the leader of all the troops, it does not mean from a divine perspective that he is not still one of the herd.

[61] See LSJ *s.v.* ὄμπνιος with further discussion at Dettori (2000) 21 and 122–3, Lightfoot (2009) 79 and Leventhal (2015) 209. A *scholium* to Apollonius Rhodius offers the phrase στάχυν ὄμπνιον ('an *ompnios* ear of corn') and records that Philetas of Cos defined it as corn that is εὔχολον καὶ τρόφιμον ('succulent and nourishing'), *Schol.* on Ap. Rhod. 4.989i Wendel = fr. 46 Lightfoot.

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account for horses, as well as for men, in his Catalogue (cf. *Il.* 2.760–2). Archimedes thus employs Homeric terms in order to create the expectation of a solution as well as to undercut it. Halfway through the *CP*, the reader is promised that they might become more than one of the masses and ἐναρίθμιος among the Greek leaders if they can solve the mathematics, and the conclusion elevates this to the possibility that they might be an Agamemnon having control over all the troops. Yet it is a decidedly ambiguous representation of the solver in the final lines. These allusions to *Iliad* 2 raise but do not confirm the possibility that the reader can compute the number of cattle in the same way that the poet counted the troops in his Catalogue after they had been herded by the leaders, in the imagery of Homer's simile.

It is equally important to observe that the question of how easy it might be to grasp such a large amount is not only posed by the Iliadic intertexts. It also extends across the first couplet as a whole and particularly in the move from the opening hexameter to the following pentameter. In explaining the interrelation of the hexameter and pentameter, I consider to be instructive the one surviving fragment of the fifth-century Carian poet Pigres. This brother (*Suda s.v.* Πίγρης 1551) or son (Plut. *Mor.* 873f) of Artemisia, the ruler of Halicarnassus and ally of Xerxes, composed an *Iliad* in elegiacs, inserting after each of Homer's hexameters a further pentameter. His modification to *Il.* 1.1 is as follows:

μῆνιν ἄειδε θεὰ Πηληϊάδεω Ἀχιλῆος
Μοῦσα· σὺ γὰρ πάσης πείρατ' ἔχεις σοφίης.

(Pigres fr. 1 *IEG*)

Sing, goddess Muse, of the wrath of Achilles son of Peleus: for you hold the limits of all wisdom.

Pigres plugs Homer's own concerns with the limits of mortal knowledge in the Invocation in *Iliad* 2 back into the opening invocation of the *Iliad*. He also reworks the proem into an elegiac couplet and introduces a notably elegiac theme. The term σοφία is common in Theognis' articulation of wisdom in his sympotic elegies (563–6, 790, 876, 1074 *IEG*), and it is an attribute associated specifically with poets by Solon in his Elegy for the

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Muses: ἄλλος Ὀλυμπιάδων Μουσέων πάρα δῶρα διδαχθείς | ἱμερτῆς σοφίης μέτρον ἐπιστάμενος ('Another, taught with gifts from the Olympian Muses, knowing the measure of lovely wisdom', fr. 13.51–2 *IEG*). Similarly, μέτρον ('measure') is common in earlier elegiac poetry, denoting self-control in sobriety and desire.[62] In both Solon and Pigres, these terms sit in the pentameter, the line which differentiates the genre from epic hexameter. In Solon's elegy, the pentameter negotiates the distinctiveness of elegy as a genre – with ἱμερτή suggesting a more erotic mode (cf. Theognis 1063–8 *IEG*) – and focalises the agency of the poet and his ability to know. Whereas Solon intimates the bounded nature of poetic knowledge per se through his use of μέτρον, Pigres' pentameter emphasises how epic and elegiac poets differ in their claims to wisdom and authority. Rather than expanding the request for knowledge from the goddess across a series of lines, specifying the remit of the present song as was typical in early incipits, Pigres' rewriting both curtails this request and emphasises the Muse's supreme control over knowledge. His couplet does not position the elegiac poet as in control of *sophia*, but rather the Muse; it (re)asserts the authority of the Iliadic – and so, epic – Muse by means of an elegiac strategy. Moreover, despite Pigres doubling the length of the *Iliad* through pentameters, it is the Muse who retains 'mastery' over Homeric material. Archimedes likewise addresses the question of human and divine knowledge through the addition of the pentameter. There, he commands that the reader measure the multitude 'if they have a share in wisdom' (εἰ μετέχεις σοφίης, 2). Unlike Pigres, Archimedes does not make it immediately explicit who it is that possesses wisdom. He offers up to the reader the hope that they may gain wisdom but, given the irresolvable ratios, the *CP* demonstrates the exclusive and elusive nature of wisdom, something that Pigres' elegiac addition had simply stated. That is, the pentameter supports the language and allusion of the hexameter in setting up another expectation for the hopeful solver that is destined to be unfulfilled.

The move from the hexameter to the pentameter hints at the potential impossibility of measuring the multitude in poetry in

[62] On μέτρον cf. Solon fr. 16 *IEG* and Theognis 876 *IEG* with Prier (1976).

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another manner, too. πληθύν in *Iliad* 2 signalled the opening of a hexameter catalogue. Similarly in the *CP*, the reader's expectations are fulfilled when Archimedes provides his exposition of the ratios of the cattle, a catalogue of cattle responding to Homer's imagery in *Iliad* 2. A catalogue in elegiac couplets, or epigram as the prose introduction has it,[63] however, strains the concept of the generic form. Epigram is a traditionally compressed genre that would seem to be poles apart from the extended narratives of epic. A later Greek epigrammatist attempts to lay down the law when it comes to poetic length and its generic association, quipping in a single couplet that 'a two-line epigram is very fine; but if you exceed three couplets, you are rhapsodising and are not saying an epigram' (πάγκαλόν ἐστ' ἐπίγραμμα τὸ δίστιχον· ἢν δὲ παρέλθῃς | τοὺς τρεῖς, ῥαψῳδεῖς κοὐκ ἐπίγραμμα λέγεις, *AP* 9.369).[64] At a total of twenty-two couplets, the *CP* would rank as one of the longest extant epigrams. It could perhaps be compared to the equally ambitious Hellenistic inscription found at Salamacis on the history of Halicarnassus.[65] By the same token, the blurred line between epigram and elegy that I noted in Section 1 reinforces the sense of strained generic forms; the recent advent of catalogue elegy represents a generic compromise between the concision of epigram and the expanse of epic.[66] In an analogous vein, Archimedes combines a move into elegiacs with textual extension: his versified catalogue of the Cattle of the Sun is over ten times longer than Homer's original (forty-four lines vs four lines). Yet, in Pigres' case, doubling the length of the *Iliad* did not counteract the fact that the Muse is the one who possesses wisdom. The very meaning of his first inserted pentameter underscores this. The *CP* likewise offers the hope of wisdom in the pentameter but never in fact confers it upon the reader. In other words, length does not directly translate into more wisdom or knowledge contained within the poem. In that

[63] The phrase ἐν ἐπιγράμμασιν refers to epigram rather than elegy; cf. p. 128 n.28 above. As I have noted, however, Archimedes appears to be influenced by, and plays with, epigrammatic and elegiac forms.
[64] For all that is known about the poet Cyrillus and his possible dates, see Page (1981) 115.
[65] See Isager (1998) and discussion in Gagné (2006) and Sider (2017).
[66] On which see Asquith (2005).

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respect, too, the extension of the *CP* into a form of catalogue epigram or elegy simulates Homer's own expansive catalogue of numbers and figures which for all its length does not in the end explicitly supply the total amount of the πληθύς for the audience. The opening couplet of the *CP*, then, introduces the challenge to the reader but also draws on language redolent of the quintessential epic catalogue, as well as of elegiac concerns about wisdom, precisely in order to suggest that such a feat might not be within the bounds of mortal knowledge.

On my reading, these Iliadic intertexts set up the expectation that calculating the number of cattle, and especially without the help of the Muses, will not be a success. This is subsequently supported with the pentameter's turn to questions of wisdom and its attainability. Archimedes has set his sights on the question of human knowledge and its limits. This would have been a potent and political issue for Eratosthenes at the Library of Alexandria. In this respect, I want to tentatively suggest that the use of μέτρησον at the end of the opening hexameter is pointed. The verb μετρέω and its cognates are connected to measurement of all kinds from the earliest times, but it sees increasing use in the Hellenistic period in contexts which highlight not just a manipulation of, but a control over, Greek culture and its Homeric aspects. In the case of the Tabulae Iliacae, Michael Squire has demonstrated that the ability to circumscribe, condense and schematise Homeric narratives is constructed as a wondrous feat and an expression of mastery and wisdom (σοφία) by those who claim to have done so.[67] Archimedes' opening hexameter, flanked by πληθύν and μέτρησον, offers a similar possibility to the reader and to Eratosthenes, that they might succeed by employing the concrete tools of mathematics and have some grasp of one aspect of the Homeric tradition. There is an irony, moreover, in addressing the challenge to Eratosthenes in the library where Homer's epics were most famously edited, ordered and commented upon in a way that sought mastery and control over the Homeric texts.[68] How easily will this servant of the Muses calculate the πληθύς without the

[67] Squire (2011) 102–10, 247–83. [68] See Erskine (1995) 42–6.

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Muses' explicit support? Even before the irresolvable ratios, Archimedes' epic intertext and elegiac turn in the pentameter suggest that this is far from guaranteed. The opening couplet questions the possibility of measuring the multitude in poetry, a tension that additionally raises the possibility of, but also resists, the circumscribing of Homeric subject matter more widely.

3.3 Calculating Cattle and Cultural Competition

The *CP* represents itself as operating in line with Homer's poetics of calculation in *Iliad* 2, but its metrical form also hints at the strain of composing a catalogue of calculations in verse. My argument in this section is that this tension that arises when one attempts to compress such a large amount of mathematical material into a poem has a specific cultural-political motivation. Here, I examine cataloguing and calculating in contemporary and earlier poetry. The calculations in these texts do not compare to the complexity of Archimedes' ratios; they are for the most part displays of simple addition. The difference in the mathematical operation exhibited notwithstanding, I demonstrate that an abiding aspect of these passages is the enacting or performing of calculation as a form of geographical possession. This poetics of census-taking seems to have a particular aim in the context of the *CP*'s geographically focused claim to a Homeric Sicily. My proposal is that the very form of Archimedes' calculating catalogue articulates a politics of space and identity in order to circumscribe the possibility of Sicily's (metaphorical) possession.

I begin with perhaps the clearest contemporary instance of a poetics of census-taking. Theocritus, Archimedes' older contemporary and fellow Syracusan, demonstrates the politics of a counting catalogue in his *Encomium to Ptolemy* (*Idyll* 17), where the fertility and productivity of Egypt are described.

ἀλλ' οὔτις τόσα φύει ὅσα χθαμαλὰ Αἴγυπτος,
Νεῖλος ἀναβλύζων διερὰν ὅτε βώλακα θρύπτει,
οὐδέ τις ἄστεα τόσσα βροτῶν ἔχει ἔργα δαέντων.
τρεῖς μέν οἱ πολίων ἑκατοντάδες ἐνδέδμηνται,
τρεῖς δ' ἄρα χιλιάδες τρισσαῖς ἐπὶ μυριάδεσσι,
δοιαὶ δὲ τριάδες, μετὰ δέ σφισιν ἐννεάδες τρεῖς·

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τῶν πάντων Πτολεμαῖος ἀγήνωρ ἐμβασιλεύει.[69]

(Theocritus *Idylls* 17.79–85)
(300 + 3,000 + 30,000 + 6 + 27 = 33,333)

But none [other tribes] brings forth so much as low-lying Egypt, when the Nile gushing breaks the wet soil, nor has any [other country] so many towns of men skilled in work. Three hundred cities have been built there, and three thousand upon thirty thousand, and two times three and three times nine in addition to them; great Ptolemy rules over all of them.

As with Archimedes' poem, the explanation of a number through calculation emphasises multiplicity, although of course Theocritus aims at nothing so complex. Both exhibit a similar means of connecting fertility and calculation. Just as the Nile's fertile bubbling up (ἀναβλύζων, 80) is paralleled in the ensuing count of the many cities, so too do Archimedes' cattle when ordered in a triangular formation 'begin bubbling up from a single one' (ἀμβολάδην ἐξ ἑνὸς ἀρχόμενοι, 38): numerical growth simulates natural and economic growth. Given that the passage concludes by stating that Ptolemy rules over this large number, however, its evocation of 'the Egyptian and Ptolemaic passion for counting and census-making' has the serious function of characterising political control through a control of numbers.[70] The ability to express such a large number within just three lines further simulates this Ptolemaic control: the great number of cities in Egypt are still accountable to Ptolemy, and so their number is countable for a Ptolemaic poet.

A similar claim to land through enumeration can be seen in Lycophron's *Alexandra*, a 1,474-line Hellenistic iambic poem which gives Cassandra's final prophecy during the sack of Troy, which spans all the way from the time of the Trojan War through mythic history and down to the Hellenistic period itself. It describes Aeneas' founding of Lavinium after fulfilling Helenus' prophecy, in a narrative familiar from the *Aeneid* (3.390–2).

κτίσει δὲ χώραν ἐν τόποις Βορειγόνων
ὑπὲρ Λατίνους Δαυνίους τ᾽ ᾠκισμένην,
πύργους τριάκοντ᾽, ἐξαριθμήσας γονὰς
συὸς κελαινῆς, ἣν ἀπ᾽ Ἰδαίων λόφων

[69] The Greek text follows Gow (1952); my translation adapts Hunter (2003) *ad loc.*
[70] Hunter (2003) 158.

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καὶ Δαρδανείων ἐκ τόπων ναυσθλώσεται,
ἰσηρίθμων θρέπτειραν ἐν τόκοις κάπρων·

(Lycophron *Alexandra* 1253–8)

He [Aeneas] will found a place among the areas of the Aborigines, beyond the settlements of the Latins and Daunians, and thirty towers, having numbered up the offspring of the dark sow, which he will have brought by ship from the peaks of Ida and the Dardanian regions, the nurse of those equal-numbering piglets in the litter.[71]

It is emphatically Aeneas' enumeration here that leads to his founding of Lavinium and determines its number of towers. The *Alexandra*, although once considered to be early third-century, is most likely a product of the mid-second century.[72] This passage from the so-called Roman section is relatively early evidence for the development of Roman foundation myths, especially in a wider Greek context.[73] While the prophecy on the enumeration of the sows is alluded to here first in poetry, as a myth it predates the *Alexandra* having been recorded by Fabius Pictor in the late third century (*FGrH* 809 F 2).[74] In a less mythical – but no less fantastic – vein, the *Alexander Romance* (1.33.11) reports a numerical conundrum posed to Alexander in a dream by a god, who delineates a series of numbers (200-1-100-1-80-10-200) which reveals their nature when converted into letters (σ-α-ρ-α-π-ι-ς, Σάραπις, 'Sarapis').[75] Certainly, this is a different form of mathematical challenge. Still, its appearance in the context of recognising the god so as to legitimate and support Alexander's foundation of Alexandria highlights a further example of the

[71] The Greek follows Mascialino (1964) and the translation is an adaptation of Hornblower (2015) *ad loc*.

[72] For a welcome corrective and full explanation of the down-dating, see Hornblower (2015) 36–9; Hornblower (2018) 3–10.

[73] For Roman myths in a Greek context and the importance of Troy, see Erskine (2001).

[74] A version of the Mopsus and Calchas contest (see below) is about the number of offspring in a sow's womb (Apollod. *Epit*. 6.3–4). Both a boar (σῦς) and figs (συκέα) appear at *Od*. 24.330–46 in a similarly enumerative context (see below); the two traditions of enumeration may thus have their roots in subsequent (mis)interpretations of the one scene.

[75] The text as it stands is corrupt – see Kroll (1926) *ad loc.* and Stoneman (2007) 74 with commentary at 544–5 – and the date of the *Alexander Romance* itself ranges from the beginning of the Hellenistic to the Late Imperial period; see the discussion of Stoneman (2007) xxv–xxxiv. Nevertheless, since the Ptolemies encouraged the Sarapis cult, this section is generally thought to be a later echo of that earlier, Hellenistic Ptolemaic propaganda.

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intersection of counting and foundation. It is important to underscore in these examples that at the time Archimedes was composing the *CP*, scenes of enumeration were a productive means of staging (re)imaginations of political geography.

A further passage that has not been discussed in relation to the *CP* is Odysseus' reunion with his father, Laertes. Having reunited with Penelope, Odysseus heads to the farm where his father lives and labours. Meeting him alone in the vineyard, he at first pretends to be someone else who had met Odysseus on his travels; only when Laertes breaks down in sorrow does Odysseus reveal himself to his father.[76] In order to prove his identity, he offers the following tokens as evidence.

τὸν δ' ἀπαμειβόμενος προσέφη πολύμητις Ὀδυσσεύς·
"οὐλὴν μὲν πρῶτον τήνδε φράσαι ὀφθαλμοῖσι,
τὴν ἐν Παρνησῷ μ' ἔλασεν σῦς λευκῷ ὀδόντι
οἰχόμενον· σὺ δέ με προΐεις καὶ πότνια μήτηρ
ἐς πατέρ' Αὐτόλυκον μητρὸς φίλον, ὄφρ' ἂν ἑλοίμην
δῶρα, τὰ δεῦρο μολὼν μοι ὑπέσχετο καὶ κατένευσεν.
εἰ δ' ἄγε τοι καὶ δένδρε' ἐϋκτιμένην κατ' ἀλωὴν
εἴπω, ἅ μοί ποτ' ἔδωκας, ἐγὼ δ' ἤϊτεόν σε ἕκαστα
παιδνὸς ἐών, κατὰ κῆπον ἑπισπόμενος· διὰ δ' αὐτῶν
ἱκνεύμεσθα, σὺ δ' ὠνόμασας καὶ ἔειπες ἕκαστα.
ὄγχνας μοι δῶκας τρισκαίδεκα καὶ δέκα μηλέας,
συκέας τεσσαράκοντ'· ὄρχους δέ μοι ὧδ' ὀνόμηνας
δώσειν πεντήκοντα, διατρύγιος δὲ ἕκαστος
ἦην – ἔνθα δ' ἀνὰ σταφυλαὶ παντοῖαι ἔασιν –
ὁππότε δὴ Διὸς ὧραι ἐπιβρίσειαν ὕπερθεν."
ὣς φάτο, τοῦ δ' αὐτοῦ λύτο γούνατα καὶ φίλον ἦτορ,
σήματ' ἀναγνόντος τά οἱ ἔμπεδα πέφραδ' Ὀδυσσεύς·

(Homer *Odyssey* 24.330–46)

And resourceful Odysseus answered him and said: 'This scar, first, let your eyes take note of, which a boar gave me with his white tusk on Parnassus when I went there. It was you who sent me, you and my honoured mother, to Autolycus, my mother's father, so that I might get the gifts which, when he came here, he promised and agreed to give me. And come, I will tell you also the trees which

[76] This scene, since it appears in Book 24, has been thought spurious following the statement in the *scholia* that Aristarchus and Aristophanes of Byzantium set the end of the *Odyssey* at 23.296. Many have debated the authenticity of all or part of Book 24; for discussion see Moulton (1974); Wender (1978) 45–62; Russo et al. (1992) 353–5. Whatever the case, its authenticity does not affect my argument for a reception in the Hellenistic period.

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you once gave me in our well-ordered garden, and I, who was only a child, was following you through the garden, and asking you for this and that. It was through these very trees that we passed, and you named them and told me of each one. Thirteen pear trees you gave me, and ten apple trees, and forty fig trees. And rows of vines, too, you promised to give me, even as I say, fifty of them, which ripened one by one at separate times – and upon them are clusters of all sorts – whenever the seasons of Zeus weighed them down.' So he spoke, and his father's knees were loosened where he stood, and his heart melted, as he recognised the firm tokens which Odysseus showed him.

Odysseus gives two forms of evidence: the physical scar on his body and his mental recollection of the gifts that Laertes had promised to give him. Homer, through a variety of intermediaries, has already presented the scar and the narrative which accompanies it (cf. *Od*. 19.391, 393, 464, 507; 21.221; 23.74). The recounting of the trees, however, appears only here. The description of the trees and their count responds to the over-exposed sign of the scar; it represents not heroic deeds or the revealing and naming of the hero, but the naming of home (ὠνόμασας/ὀνόμηνας), its fixedness (τά ... ἔμπεδα) and fecundity (the *hapax* διατρύγιος). As Odysseus reaches the heart of Ithaca at the end of the *Odyssey*, he reconnects with his roots and points to the one sign of belonging that he was unable to take with him but took account of nevertheless. For John Henderson, the enumeration is only one part of a wider rehearsal between father and son; Odysseus' miming of 'bodily commitment', 'his insistent deixis' and his 'remembered walk in the wake of his father across the very scene of utterance' constitute a performance of sameness between father and son, a 'monological evidentiality, a self-identical prestation'.[77] I would emphasise in addition that within this recollection and rehearsal, the count of the trees figures Odysseus' Ithacan inheritance at large: the variety of trees, their continual bearing of fruit throughout the seasons represents not just this plot of land, but also the fertility of Ithaca *tout court*. He has regained his son, his wife, his halls, and now he must recover the land. The passage from Lycophron's *Alexandra* showed how the challenge of enumeration was employed to explain and legitimate claims over land following the Trojan war, and Odysseus' enumeration at the end of the

[77] Henderson (1997) 105–6.

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Odyssey is in a sense a prototype of the later Aeneas, although he is seeking to *re*claim his Ithacan inheritance. As I have argued, the *CP* engages intricately with Odyssean geography; the tradition of claiming the land through counting also has an Odyssean lineage. Archimedes offers the possibility of another Odyssean 'accounting', and so the possibility of another claiming of land, only this time of a different island. He has taken one Odyssean claim to the possession of space and has transferred it to the equally Odyssean *and* equally numerical context of the Cattle of the Sun which had more significance for him as a Sicilian.

Odysseus' and Aeneas' travels and subsequent census-taking most likely arose in response to the Greek colonisation of the archaic period and to the need for myths to explain the foundation of new colonies. As the passages from the *Alexandra* and the *Alexander Romance* show, an oracle – a directive from a god – is a particularly irrefutable way to justify the Greek claims to land across the Mediterranean. A fragment from Hesiod's *Melampodia*, a hexameter poem tracing the lives of mythical seers, further demonstrates that archaic poets were aware that calculated claims to land in oracular contexts could involve contestation. Here is the fragment and Strabo's introduction to it:

εἶτα τὸ Γαλλήσιον ὄρος καὶ ἡ Κολοφών, πόλις Ἰωνική, καὶ τὸ πρὸ αὐτῆς ἄλσος τοῦ Κλαρίου Ἀπόλλωνος, ἐν ᾧ καὶ μαντεῖον ἦν ποτὲ παλαιόν. λέγεται δὲ Κάλχας ὁ μάντις μετ᾽ Ἀμφιλόχου τοῦ Ἀμφιαράου κατὰ τὴν ἐκ Τροίας ἐπάνοδον πεζῇ δεῦρο ἀφικέσθαι, περιτυχὼν δ᾽ ἑαυτοῦ κρείττονι μάντει κατὰ τὴν Κλάρον, Μόψῳ τῷ Μαντοῦς τῆς Τειρεσίου θυγατρός, διὰ λύπην ἀποθανεῖν. Ἡσίοδος μὲν οὖν οὕτω πως διασκευάζει τὸν μῦθον· προτεῖναι γάρ τι τοιοῦτο τῷ Μόψῳ τὸν Κάλχαντα·

θαῦμά μ᾽ ἔχει κατὰ θυμόν, ἐρινεὸς ὅσσον ὀλύνθων
οὗτος ἔχει, μικρός περ ἐών· εἴποις ἂν ἀριθμόν;

τὸν δ᾽ ἀποκρίνασθαι·

μύριοί εἰσιν ἀριθμόν, ἀτὰρ μέτρον γε μέδιμνος·
εἷς δὲ περισσεύει, τὸν ἐπενθέμεν οὔ κε δύναιο.
ὣς φάτο· καί σφιν ἀριθμὸς ἐτήτυμος εἴδετο μέτρου.
καὶ τότε δὴ Κάλχανθ᾽ ὕπνος θανάτοιο κάλυψεν.

(Hesiod fr. 278 M–W = Strabo *Geography* 14.1.27)

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Then one comes to the mountain Gallesius, and to Colophon, an Ionian city, and to the sacred precinct of Apollo Clarius, where there was once an ancient oracle. The story is told that Calchas the prophet, with Amphilochus the son of Amphiaraus, went there on foot on his return from Troy, and that having met near Clarus a prophet superior to himself, Mopsus, the son of Manto, the daughter of Teiresias, he died of grief. Now Hesiod revises the myth as follows, making Calchas propound to Mopsus this question:

'I am amazed in my heart at all these figs on this wild fig tree, small though it is; can you tell me the number?'

And he makes Mopsus reply:

'They are ten thousand in number, and their measure is a medimnus; but there is one over, which you cannot put in the measure.' Thus he spoke; and the number that the measure could hold proved true. And then the eyes of Calchas were closed by the sleep of death.[78]

Colophon was founded when the seer Manto arrived there, having left Thebes in the aftermath of the war of the Seven against Thebes (cf. e.g. *Epigonoi* fr. 3 *EGF*). The famous seer Calchas, in the aftermath of the Trojan War, arrived at Colophon and challenged Manto's son, Mopsus, to a contest of their oracular abilities. Numerous versions of the meeting between Mopsus and Calchas have survived (Strabo 14.1.27; Apollod. *Epit.* 6.2–4).[79] Across the range of retellings, as Naoíse Mac Sweeney has shown, there is variability in the agency ascribed to Manto and to her son, Mopsus, regarding which of the two founded Colophon and the Oracle at Clarus.[80] Whichever narrative one follows, though, a notable constant in the accounts is that Mopsus prevails in the contest with Calchas. In its broadest outline, the contest constitutes an *aition* for the continued Theban and Mantid control of that oracular site following the Trojan War and the challenge of Calchas. The second constant is that the oracular challenge always has a numerical element.

Archimedes may have had this story, or a version of it, in mind. As befits a contest, 'calculating' the figs on the tree has a question-

[78] The translation is adapted from Leonard Jones (1929).
[79] Euphorion of Chalcis, a rough contemporary of Archimedes, may also have written his own version of the story; cf. fr. 102 Lightfoot. For a summary of all versions, see Gantz (1993) 702–3.
[80] Mac Sweeney (2013) 104–18.

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and-answer format. This 'tell me' formula is recognisable from the *Contest of Homer and Hesiod* passage (above, introduction to Part II) and is similar to the opening of the *CP* (ὦ ξεῖνε, μέτρησον, 1). More notably, Mopsus' answer has two stages: he gives Calchas the exact number of figs, but then goes on to explain how that number might be expressed as a volume measurement by introducing the medimnus. The *Alexandra* preserves a variant account which places Calchas in southern Italy by the banks of the river Siris: 'there lies unhappy Calchas, a Sisyphus of uncountable figs' (ἔνθα δύσμορος | Κάλχας ὀλύνθων Σισυφεὺς ἀνηρίθμων | κεῖται, 979–81). The *scholium* to Lycophron's elliptical reference describes how Calchas met not Mopsus, but Heracles after he had carried off the oxen of Geryon, and how he successfully responded to Heracles' challenge to enumerate the figs on a tree. Calchas numbered them as ten medimni and one fig and mocked Heracles when 'having measured them and greatly forcing the one left-over fig into the measure [i.e. medimnus], he was unable to' (τοῦ δὲ Ἡρακλέος ἀναμετρήσαντος καὶ πολλὰ βιαζομένου τὸν ἕνα ὅλυνθον περισσὸν ἐπιτιθέναι τῷ μέτρῳ καὶ μὴ δυναμένου, *Schol*. on *Alexandra* 980a). In response Heracles kills Calchas for mocking him. Both narratives of Calchas' death focus on the fact that certain numerical totals cannot be expressed in a geometric form, such as the volume of a medimnus. Archimedes similarly structures the *CP*.[81] The *CP* first asks for the number of the Cattle of the Sun from the given ratios and then second provides the parameters that the white bulls together with the black bulls are a square number and that the brown bulls and dappled bulls are a triangular number. Given the different objects of calculation, Archimedes substitutes volume for area. As I outlined above, the first half of the problem (5–26) yields infinitely many solutions, with the smallest positive integer solutions yielding

[81] Knorr (1986) 295 proposed that Eratosthenes composed the first half of the problem and Archimedes the second. The prose preface does not suggest this, and there is nothing in the text to corroborate it. As the discussion in Section 1 makes clear, moreover, I believe the political geography of the *CP* suggests rather that the entire poem is Archimedes' creation.

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cattle in their millions.[82] It is the second half (33–40) and the requirement to fit the cattle into a rectangular and triangular arrangement which makes the sum astronomically large and ultimately incalculable for a Hellenistic mathematician. Arguably, the *CP*'s structural echo of the contest in the *Melampodia* and the similar retellings constitutes a hint that the further parameters lead inevitably to failure. Elsewhere Archimedes employs literary allusions to suggest to the astute reader the (im)possibility of their success, and here too they will know from earlier poetry such as the *Melampodia* that you cannot force and fudge a calculation when sensible and indivisible bodies are involved – that is, when doing λογιστική. Just like the lone fig, for the ancient reader, these cattle could not be forced simply into any old measure.

Archimedes' use of this structure also geographically frames the stakes of solving the mathematics of the *CP*: failure in a numerical challenge leads to a failure to gain possession of land. In the *Melampodia*, Mopsus succeeds in the competition and so retains control over Clarus. The *CP* similarly offers up a numerical challenge but also sets the challenger up to fail in that task. Since these are Sicilian cattle and since such counts as those discussed above connect censuses of the land with possession over the *same* land, it would be logical to suppose that Archimedes presents the calculation in the *CP* as offering the potential for possessing Sicily. Archimedes, just like Mopsus at Clarus, retains dominion over Sicily, whereas Eratosthenes would have failed in his attempt to calculate the number of the cattle, as did Calchas. Unlike the passages from Theocritus' *Idyll*, the *Alexandra* or the *Odyssey*, where those counting seem only to have to assert their possession over the land, I would suggest that the *Melampodia* (or something like it) provided Archimedes with a model of an arithmetical challenge between two famed intellectuals who have competing claims to a location. Given that, as I discussed above, this is a poem about Sicily sent to an intellectual who denied its Homeric pedigree, the importance of this model helps clarify the

[82] White Bulls = 10,366,482; Black Bulls = 7,460,514; Brown Bulls = 4,149,387; Dappled Bulls = 7,358,060; White Cows = 7,206,360; Black Cows = 4,893,246; Brown Cows = 5,439,213; Dappled Cows = 3,515,820.

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purpose of the *CP* and the nature of the challenge Archimedes sent Eratosthenes: if you can calculate the number of the Cattle of the Sun, you can then claim possession of (knowledge about) Sicily.

The focus on the number of Sicilian livestock finds a contemporary parallel in Theocritus' *Idyll* 16, as Marco Fantuzzi notes and Reviel Netz develops. That 'patriotic' *Idyll*, addressed to Hieron II of Sicily, looks towards the island's reinvigoration with ἀνάριθμοι | μήλων χιλιάδες ('countless thousands of sheep', Theocritus *Idyll* 16.90–1). Netz pushes this numerical aspect, suggesting that Theocritus' emphasis on 'those who wished to slaughter its [Sicily's] cattle' refers to contemporary events, perhaps Marcellus' attacks and siege of the city.[83] Thus, in two political poems, Theocritus' poetry preserves two contrasting political connotations of enumeration. For the Ptolemies in *Idyll* 17 (above), fertility is something which can be emphatically brought under control and measured; for Sicily, conversely, its fecundity is immeasurable as the island teems with cattle. In the *CP*, admittedly, it is the number of the legendary Cattle of the Sun and the Thrinakia of Homeric poetry that is to be calculated and so controlled rather than the contemporary livestock of Sicily. Nevertheless, many such political interactions between Hellenistic states and *poleis* were effected through appeals to their (fictive and recently fashioned) epic past.[84] Whereas Theocritus states the immeasurability of Sicily's cattle, Archimedes offers the expectation of grasping the quantity of cattle, which the arithmetical complexity duly thwarts; Sicily's cows are innumerable and Sicily unlimited in its resources. His language and mathematics equally contrive an uncontrollable, incalculable situation in the same vein as the teeming livestock of *Idyll* 16, and it is directed against a Ptolemaic intellectual who might well have been in a position to calculate the number of cities in the vein of *Idyll* 17. Unlike the earlier counting contests over land, Archimedes' *CP* resists simple scientific judgements being

[83] Netz (2009) 168, where Fantuzzi's thought *per litteras* is noted. See also Gow (1952) 128.

[84] On kinship ties in antiquity and the role of myth see Jones (1999) 8–16 and chapter 2; for a case study see e.g. Erskine (2002).

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made about Sicily. It cannot be counted by – and so potentially ruled by – the Ptolemaic Empire.

* * *

This chapter set out to demonstrate that the *CP* engages with its readers on literary, intellectual and cultural levels as well as on the arithmetical level: evident by now, I hope, is the sophistication of Archimedes' agonistic arithmetic aesthetics aimed at Eratosthenes. The *CP* works because it problematises scientific and mathematical descriptions of cultural and literary artefacts, especially for Eratosthenes, whose rationalising geography sees him strip Sicily of its Homeric past. Archimedes beats Eratosthenes at his own game, pairing poetry and mathematics, and offers a scientific expression of the Greek cultural idea of the Cattle of the Sun (not to mention the dimensions of Sicily itself). The irresolvable ratios of cattle underscore the sheer fecundity of the Sicilian land and its inability to be fully encompassed, an immeasurability that might even be seen to stand for the boundlessness of the Homeric tradition. This is an aesthetics of arithmetic, in other words, that points up the very tension of setting arithmetic in verse as well as the contested capabilities of mathematics as a means of describing the world.

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4

THE ARITHMETICAL POEMS IN *AP* 14

Archimedes' *Cattle Problem* is an early, extended and complex case of a poem seeking to interlace arithmetic and aesthetics, but it is not the only case. The focus of analysis in this chapter are the so-called arithmetical poems preserved in Book 14 of the *Palatine Anthology* (henceforth *AP*). They similarly challenge their readers to solve the outlined simultaneous equations, and this time, all the arithmetic is solvable. The poems constitute an odd collection: their authorship, date and purpose are all contested. *AP* 14.116–46 in the modern numbering are a collection of arithmetical poems, which are preceded by a collection of riddles (*AP* 14.14–47, 52–64, 101–11) and oracles (14.65–100, 112–15, 148–50). The arithmetical poems are attributed to one Metrodorus, whose identity is difficult to ascertain.[1] There seems to be no consensus as to whether Metrodorus should be thought the author or the compiler of the collection.[2] Poems 14.1–4, 6, 7, 11–13 and 48–51 are also arithmetical in nature, and there is evidence that some of them are part of the Metrodoran collection.[3]

An explanation of the purpose of *AP* 14 is given in a prefatory statement preceding the first poem: γυμνασίας χάριν καὶ ταῦτα τοῖς φιλοπόνοις προτίθημι, ἵνα γνῷς τί παλαίων παῖδες, τί δὲ νέων ('for the sake of mental exercise I also provide the following for the industrious, so that you might know what both the children of former times [did] and those of recent times').[4] It is unclear whether this preface goes back to Constantinus Cephalas, the Byzantine schoolmaster who compiled and edited together earlier epigram anthologies into a vast collection, which serves as the

[1] On the connected issue of dating and the identity of Metrodorus see Buffière (1970) 36–7; Grillo (2019); Teichmann (2020) 87–8 and my own suggestions below.
[2] Tannery (1895) II, xi–xiii; Buffière (1970) 36–7. See also Heath (1921) II, 442.
[3] Although not *AP* 14.1 (see below), Buffière (1970) 45.
[4] The Greek text follows Buffière (1970) 38, with my translation.

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basis of the *codex Palatinus* (the modern day *AP*) and its some 3,700 poems.[5] In any case, the preface can be no later than the *codex*, formed in the middle of the tenth century CE, which contains *AP* in its current shape. The preface could equally apply to the oracles and riddles as well as the arithmetical poems, as examples of mental exercises. A contrast between the genres may then be implied in the contrast between children in the present and those of earlier generations. A reference to the arithmetical poems, though, is *prima facie* probable, given Plato's description in the *Laws* of calculating with real objects, that is, λογιστική. There the mixing and the dividing of tangible objects is a game employed by teachers in order to 'connect practices in elementary numbers to play' (εἰς παιδιὰν ἐναρμόττοντες τὰς τῶν ἀναγκαίων ἀριθμῶν χρήσεις, 819b–c).[6] The practice of λογιστική is a particularly apposite referent of the preface's comment, in other words, since it is the kind of mental training, on Plato's authority, that was engaged in by children.[7]

Given the place of λογιστική at the lower end of the educational ladder and the comments of the preface, scholarship has tended to approach the arithmetical poems within the context of the history of mathematics and of mathematical education.[8] As will become clear with discussion of specific poems, there is an awareness of the poetry's potential pedagogical function, and this chapter will show that the dialogue between number and poetry was one operating in an educational frame at least from the time of the Metrodoran collection. Equally, the literary influences on the arithmetical subjects of individual epigrams are various, and their form cannot be explained *only* as the result of a schoolroom context. The *CP* demonstrates that the intersection of arithmetic

[5] See Cameron (1970) 346–50; Cameron (1993) 135–7. Cameron thinks that the preface, and therefore probably the book, goes back in some form to Cephalas. Maltomini (2008) 189–95 considers the book to have a mixed origin with some parts going back to Cephalas and others being introduced with the formation of *AP*.

[6] For more on the connection of this passage of the *Laws* with logistic, see Taub (2017) 40–1.

[7] Indeed, within Metrodorus' collection, youth and children are a recurrent focus (14.3, 116, 117, 123, 128, 143) – see also Section 3, below – as is play (*AP* 14.138.1 and 140.3).

[8] Heath (1921) II, 441–3; Christianidis and Oaks (2013) 129–30; Taub (2017) 39–47; Christianidis and Megremi (2019). Grandolini (2006) works with the assumption that they derive from an educational context.

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and poetry occurred already in the Hellenistic period, anticipating the poems in the Metrodoran collection by at least three centuries (for the estimated dates of the poems and the collections see below). It supports the assertion that these later arithmetical poems need not be aimed solely at educating readers and that poems containing arithmetic could be refined literary products. Indeed, a recent flurry of interest in studies by Simonetta Grandolini, Jenny Teichmann and Jan Kwapisz has elucidated the literariness of the arithmetical poems.[9] These largely philological studies have examined the constitution of the poems and their *scholia* and highlighted the sophisticated – even allusive – imagery and language that they contain. Building on that trend, this chapter seeks to analyse the poems more fully – individually and as a collection – and to provide a clearer cultural context for their intertwining of arithmetic and aesthetics.

I proceed in four sections. In the first section, I offer an overview of the types of poems found in the Metrodoran collection and provide detailed study of select compositions. I pay close attention to the strategies for placing arithmetic information in poetry and the extent to which they rely on recognisable verse forms. That is, the first section outlines a literary archaeology for the arithmetical poems. I then consider a series of novel compositions by Ausonius and Optatian Porphyry in order to situate the poems' workings within the wider late antique literary landscape and to identify a shared practice of involving the reader in the construction of the poems' meaning and of setting numbers in a literary form as means of displaying one's cultural capital. My claim will be that they circulate in a context where arithmetical ability could be flaunted effectively by converting numbers into numbered aspects of the cultural and literary past. In Section 3, I turn to the arithmetical poems as a collection and propose that their arrangement and framing aims to present the poems as handed down the generations and central to the educational process. If the second section underscores the notably late antique nature of the arithmetical poems, then the third section shows that the editor of the collection figured the intertwining of literary and arithmetical learning as a highly

[9] Grandolini (2006); Teichmann (2020); Kwapisz (2020a).

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conservative operation within the Graeco-Roman tradition. Section 4 concludes the chapter by looking to the later Byzantine incorporation of the collection into *AP* 14. Even at the 'end' of the tradition, it will be seen, there remains an awareness of the literary potential of arithmetic in verse.

4.1 An Archaeology of Arithmetical Poetry

This section examines the literary genres which the composers of arithmetical poems develop. My aim is to show how the arithmetical poets read these earlier works and genres as already containing the seeds of arithmetical operations in poetry and built on these models in versifying their own arithmetical challenges.

I begin with an epigram that not only poses a mathematical challenge: it is about a mathematician.

οὗτός τοι Διόφαντον ἔχει τάφος. ἆ μέγα θαῦμα·
καὶ τάφος ἐκ τέχνης μέτρα βίοιο λέγει.
ἕκτην κουρίζειν βιότου θεὸς ὤπασε μοίρην·
δωδεκάτην δ' ἐπιθεὶς μῆλα πόρεν χνοάειν·
τῇ δ' ἄρ' ἐφ' ἑβδομάτῃ τὸ γαμήλιον ἥψατο φέγγος,
ἐκ δὲ γάμων πέμπτῳ παῖδ' ἐπένευσεν ἔτει.
αἰαῖ, τηλύγετον δειλὸν τέκος· ἥμισυ πατρὸς
†τοῦδ' ἐκάη κρυερὸς† μέτρον ἑλὼν βιότου·
πένθος δ' αὖ πισύρεσσι παρηγορέων ἐνιαυτοῖς
τῇδε πόσου σοφίῃ τέρμ' ἐπέρησε βίου.[10]

(*AP* 14.126)

This is the tomb of Diophantus. A! A great marvel; and the tomb speaks the measure of [his] life through [his] skill. The god granted a sixth share of his life to be a youth; he adds a further twelfth to furnish his cheeks with the first down; he lit the marriage torch a seventh later, and after the marriage he granted him a child in the fifth year. Alas, wretched late-born child: †he was burnt stone-cold† taking half the length of his father's life. Again, having consoled himself from grief for four years with the science of quantity he reached the end of his life. (F = 2S; S – 4 = F (⅙ + 1/12 + ⅐) + 5: F = the father's age; S = the son's age)

This is a neat composition employing a number of epigrammatic motifs. A deictic identifying the tomb in front of the reader is common in funerary epigrams, as is the emphasis on finality

[10] The Greek text follows Buffière (1970), although I follow other cautious editors in employing *cruces* in verse 8.

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(cf. τέρμ' . . . βίου) placed in the final position in the epigram. The exclamatory ἆ μέγα θαῦμα has an equally strong pedigree in the epigrammatic tradition.[11] The use of τηλύγετον brings an epic colour to the poem, although it is a term which is often considered to be ambiguous in meaning.[12] However, the description of Diophantus' son as τηλύγετον and the fact that something seizes the 'measure of his life' (μέτρον . . . βιότου, 14.126.8) recall the description of the Eleusinian Demophoon in the *Homeric Hymn to Demeter*. He is a 'late-born', τηλύγετος child of Metaneira (*Hymn. Hom. Cer.* 164) whom his sisters hope the disguised Demeter will raise in their house so that he might reach 'the measure of youth' (ἥβης μέτρον, *Hymn. Hom. Cer.* 166). Demeter attempts to deify the child in her care until Metaneira spies her and halts the attempt, after which, in some versions of the myth, the child dies.[13] This background is certainly not necessary to an appreciation of the poem, although being aware of the echo would elevate the status of Diophantus' child and make his death a matter of divine and epic significance, while at the same time marking a grim contrast between Demophoon, who is spared by Demeter, and Diophantus' child, who is not. But the hymn was also an important model for funerary epigrams and especially for young women, who are often likened to Persephone snatched in her prime.[14] The author of this arithmetical poem follows in that tradition but draws poetic language instead from the characterisation of the male child in the hymn.[15]

The poet also makes a play with language. He provides an etymological interpretation of Diophantus as 'conspicuous (cf. φαίνω) because of Zeus (cf. Διά, Διός, etc.)': θεός governs both ὤπασε and ἐπένευσεν, actions that are associated with Zeus, and the providing of a marriage 'light' or 'torch' could imply that the god is making Diophantus manifest in some respect. He may

[11] Cf. e.g. Meleager 26.3 *HE* = *AP* 5.160.3 and Leonidas 95.3 *HE* = *AP* 6.130.3.
[12] The LSJ *s.v.* τηλύγετος suggests 'son of one's old age', 'only son' and 'well-beloved', but also 'born far away'.
[13] See Richardson (1974) 242 and Foley (1994) 48–9.
[14] See e.g. Tsagalis (2008) 100–10.
[15] In contrast, for example, to two Imperial Greek verse inscriptions – *GVI* 1159 and 1595 – recently discussed in Hunter (2019) 145–8, where the male child is paralleled in various ways with the snatched Persephone.

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also be offering a further pun on the fact that λογιστική traditionally dealt with the division of apples or sheep, both μῆλα in Greek; here the poet uses the same word with another meaning: 'cheek' (LSJ *s.v.* μῆλον II.2).

Thematically, this is not the first epigram to consider mathematicians in connection with their mathematics, but all others that are extant have a geometrical focus.[16] Unlike many Greek mathematicians, however, Diophantus' focus in his *Arithmetica* was on arithmetic and in particular on determinate and indeterminate linear and quadratic equations of the kind also employed by Archimedes in the *Cattle Problem*. In this poem, though, the author has provided a sufficient number of equations to be able to identify the unknowns. The poem thus embodies the intertwined nature of Diophantus' life and arithmetical interests, following a tradition that can already be seen, for example, in two epigrams on the scholars Philetas and Eratosthenes, where their deaths are closely connected to their intellectual activities.[17] The combination of epigrammatic style and Diophantine equations allows his life *and* learning to be exemplified in just five couplets, where the μέτρα and τέρμα of his life converge.[18]

In terms of the deeper literary history reflected in the epitaph on Diophantus, and others with a funerary subject matter (14.123, 128 and 143), the poet has exploited a connection that underlies countless compositions. Number and enumeration relating to age are, unsurprisingly, generically determined in funerary epigrams.

[16] Eratosthenes of Cyrene composed an epigram to Ptolemy Philopator on his mechanical solution for the duplication of the cube (see Eutocius *In Archim. De sphaera et cylindro* 4.68.17–69.11 Mugler); one Perseus on his 'discovery' of spiral sections (Proclus *In Euc.* 111.23–112.2); an anonymous author (of indeterminate date) on Pythagoras' theorem (Diog. Laert. 8.12 = *AP* 7.119); and another on Euclid (Cougny III, 309).

[17] Dionysius of Cyzicus' epitaph on Eratosthenes says that he did not die from some obscure disease, but 'Eratosthenes, you slept the sleep due to all at the peak of your studiousness' (εὐνήθης δ' ὕπνον ὀφειλόμενον | ἄκρα μεριμνήσας, Ἐρατόσθενες, 1.2–3 *HE* = *AP* 7.78.2–3). Similarly, an anonymous epitaph, in the voice of Philetas, announces that 'the lying word brought about my death, along with hard work at night after the sun went down' (λόγων ὁ ψευδόμενός με | ὤλεσε καὶ νυκτῶν φροντίδες ἑσπέριοι, Ath. 9.401e = T 22 Lightfoot). The lying word seems to have been some sort of logic puzzle, possible the Cretan liar paradox; study into the night is a typical representation of studious scholars; cf. Aratus according to Callimachus 56 *HE* = *AP* 9.507.

[18] The measure of one's life in relation to numbers has a long history which goes back to Solon fr. 27 *IEG*.

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For example, an epitaph on a fourth-century marble Attic lekythos describes the deceased Kerkope as 'numbering nine decades of years in old age' (γήραι ἀριθμ[ή]σασ' ἐννέα ἐτῶν δεκά<δ>ας, *CEG* 592.4). In a second-century BCE inscription from Smyrna the length of one Dionysius' life is a particular focus: 'You will find the length of my life by counting seven decades from the years and a small bit in addition' ἑπτά που ἐξ ἐτέων δεκάδας καὶ βαιὸν ἐπόν τι | εὑρήσεις ἀριθμέων μῆκος ἐμῆς βιοτῆς· (*SGO* 05/01/38 1–2). All the key terms used to enumerate the deceased's age can be seen in the epigram.[19] What is more, it both provides the deceased's age and figures the reader as enquiring after and calculating his lifespan: epigrammatic enumerations were as much an interest for the reader encountering a grave site as those commemorating a loved one.

Certainly, enumeration of objects occurred elsewhere in the epigrammatic tradition: victories were counted and dedications inventoried.[20] Yet the idea that sepulchral epigrams were particularly oriented to provide a reckoning was at least well-known enough in mid-first-century CE Rome for Philip of Thessalonica to develop it: 'everyone once counted Aristodice a proud mother since six times she had thrust away the pain of labours …' (ἠρίθμουν ποτὲ πάντες Ἀριστοδίκην κλυτόπαιδα | ἑξάκις ὠδίνων ἄχθος ἀπωσαμένην, 29.1–2 GP = *AP* 9.262.1–2). The interrelation of tombs and tallies can be seen most clearly in the Milan Posidippus.[21] The section of the collection (provisionally) entitled the ἐπιτύμβια (lit. 'things upon tombs') variously explores the notion of keeping count. The section may well open with the fantastic age of one hundred: ἡ ἑκατ[(42.1 AB), just as Onasagoratis is at 47 AB: 'at the age of one hundred, the people of Paphos deposited here the blessed offspring of On[asas] in the [fire-devoured] dust' (ἣν ἑκατονταέτιν Πάφιοι μακαριστὸν Ὀν[ασᾶ]

[19] For forms of ἔτος, see *CEG* 477.1, 480.2, 531.1, 538.3(?), 553.6, 584.3(?), 590.3, 592.4, 660.3, 747b.1, 757.2–3, 894.6 and 12; for δέκας see 477.1, 531.1, 554, 592, 660; for ἀριθμέω see 592. Individual numbers of years recur, too, but for reasons of space I point the reader to the appendix of *CEG*.

[20] For epigrams relating to victories cf. 795, 811 *CEG* and Simonides 27 Sider (= *AP* 13.14); for dedications cf. 747, 881 *CEG* and Theocritus Epigram 24 Gow (= *AP* 9.436).

[21] The author and editor are generally thought both to be Posidippus, see Acosta-Hughes et al. (2004) 4–5, although it would not affect my argument if this were not so.

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| θρέμμα πυ[ριβρώτ]ωι τῆιδ' ἐπέθεντο κόνει, 5–6).[22] Similarly, the woman praised in 45 AB 'was eighty years old, but still capable of weaving the [delicate] warp with her shrill shuttle' (ὀγδωκοντ [αέτις μέ]ν̣, ἔτι κρέξαι δὲ λιγε[ίαι] | κερκίδι λε[πταλέον] στήμονα δυναμέ̣[νη, 3–4), as is Menestrate at 59.1–2 AB. Such successful aging is poignantly contrasted with the youths who do not survive: Hegedike who was only eighteen (ὀκ[τωκαιδε]κέτιν, 49.3 AB) and Myrtis who was ten (τὴν δεκέτιν Μυρτίδα, 54.2 AB). The deceased's lives are also measured by the children they produce: the anonymous mother at 45 AB 'saw the fifth crop of daughters' (θυγατέρων πέμπτον ἐπεῖδε θέρος, 6) and Menestrate (59.3 AB) and Aristippus (61.6 AB) are both blessed with numerous grandchildren. Onasagoratis is a wonder of fecundity, and the rhythmically dactylic third line of the epigram tots up her tots: 'the group is four times twenty; [she], in the hands of her eighty children . . .' (τετράκις εἴκοσι πλῆθος· ἐν ὀγδώκοντ' ἄ̣[ρα] παίδω[ν] | χερσὶ, 47.3–4 AB). Already in the Hellenistic era there is a keen awareness that enumeration is a mode of accounting for life particularly suited to funerary epigram.

The numbered nature of time and its progression, as opposed to a lifespan, also finds a place in Posidippus. Poem 56 AB describes an unnamed Asiatic woman who gives birth five times (πέντε, 1), who 'died during the sixth labour' (ἕ]κτης δ' ἐξ ὠδῖνος ἀπώλεο, 3) and whose infant died 'on the seventh day' (ἐν ἑβδομάτωι . . . ἠελίωι 5). The question of causality hangs uneasily over the sequence and the extent to which it means anything: there is an unclear connection between the sixth labour and the infant's death on the seventh day. In different numerological contexts the number seven was connected with significant changes within the body and was known as an unproductive number.[23] Enumeration underscores a dread sense of the natural, arithmetical inevitability of things.

[22] The apparatus of the *editio minor* suggests ἡ Ἑκατ[ης πρόπολος or ἡ ἑκατ[ονταέτις *exempli gratia* Bastianini and Austin (2002) 64.

[23] For the general idea see Webster (1951), and on the fascinating and difficult Pseudo-Hippocratic treatise *On Sevens* (Περὶ ἑβδομάδων) see Mansfeld (1971) 1–31. Within arithmological thought, seven was considered not easy to work with and to signify the motherless and virginal Athena because it is neither a factor nor product of the numbers of the decad, i.e. 1–10. Cf. Speusippus fr. 28.30 Tarán, Philo *Leg. all.* 1.15 and Alexander of Aphrodisias on Aristotle *Met.* 985b26.

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The passage of time is a recurrent interest in the Metrodoran collection as well beyond the epitaph for Diophantus: how long it takes women (14.134 and 142) or bricklayers (14.136) to complete tasks and how much time has passed according to astrological phaenomena (14.140–1). The most basic form of time calculation also finds a place.

ὡρονόμων ὄχ' ἄριστε, πόσον παρελήλυθεν ἠοῦς;
ὅσσον ἀποιχομένοιο δύο τρίτα, δὶς τόσα λείπει.

(*AP* 14.6)

Tell, o greatest of clocks, how much of the morning has passed? There remains twice so much as the two thirds that have passed by. (L = ⅔P; P + L = 12 hours: L = time left; P = time past)

γνωμονικῶν Διόδωρε μέγα κλέος, εἰπέ μοι ὥρην,
ἡνίκ' ἀπ' ἀντολίης πόλον ἥλατο χρύσεα κύκλα
ἠελίου. Τοῦ δή τοι ὅσον τρία πέμπτα δρόμοιο,
τετράκι τόσσον ἔπειτα μεθ' Ἑσπερίην ἅλα λείπει.

(*AP* 14.139)

Diodorus great fame of dial-makers, tell me the hour since which the golden wheels of the sun jumped to the pole from the east. So then there is left until the western sea four times so much as the three fifths of the course. (L = ⅘P; P + L = 12 hours: L = time left; P = time past)

The tradition must be early since Posidippus composes an epigram that describes, and is represented as accompanying (see the deictic τοῦθ', 52.1 AB), a sundial which the deceased father Timon has set up for his daughter Aste.[24] The closing makes the father's intention clear and touching: 'so that she might measure the beautiful sun through many a year' (σωρὸν ἐτέων μέτρει τὸν καλὸν ἠέλιον, 52.6 AB). Following those lives spanning a century mentioned earlier on in Posidippus' collection, the reader is asked here, together with the youthful addressee (cf. κούρη at 5), to reflect on the much shorter and perhaps more precious measures of a human life. A keen focus on not only the age of the deceased, but also the day and hour at which they died, is evidenced by numerous Latin inscriptions that detail specific *horae*.[25] A further Greek example focuses on life, instead of death.

[24] For further discussion see Puelma and Angiò (2005). [25] Ehrlich (2012).

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ἓξ ὧραι μόχθοις ἱκανώτατοι· αἱ δὲ μετ' αὐτὰς
γράμμασι δεικνύμεναι ζῆθι λέγουσι βροτοῖς.

(*AP* 10.43)

Six hours are most sufficient for work: the subsequent hours showing through letters say to mortals 'Live!'

The epigram is preserved in the *Palatine Anthology*. There is a probable reference to the epigram on a sundial at Herculaneum (cf. *IG* 5862), which suggests that the epigram or something like it was known already by the mid-first century CE. It interweaves literary and numerical thinking by employing the same numerical-cum-literary reading practice explored in Chapter 2. The epigram explains that the seventh through tenth hours, when written in Greek numerals (ζ, η, θ, ι), can be interpreted as the imperative ζῆθι. The two poems in the collection above are building on the long tradition of epigrams on sundials toying with epigrammatic and time-keeping conventions, but they innovate by taking the accounting seriously.[26]

A further genre that employs enumeration is sympotic epigram, encapsulated by another Posidippean epigram representing the arithmetical *Realien* of the symposium.

τέσσαρες οἱ πίνοντες· ἐρωμένη ἔρχεθ' ἑκάστῳ.
ὀκτὼ γινομένοις Χῖον ἓν οὐχ ἱκανόν.
παιδάριον, βαδίσας πρὸς Ἀρίστιον εἰπὲ τὸ πρῶτον
ἡμιδεὲς πέμψαι, χοῦς γὰρ ἄπεισι δύο
ἀσφαλέως, οἶμαι δ' ὅτι καὶ πλέον. ἀλλὰ τρόχαζε,
ὥρας γὰρ πέμπτης πάντες ἀθροιζόμεθα.

(Posidippus 124 AB = *AP* 5.183)

Four are drinking at the party, and a girl is coming for each. That makes eight; one jar of Chian wine is not enough. Go, boy, to Aristius and tell him the first he sent was half-full: it is two gallons short certainly, I think more. Go quickly: we are all gathering at the fifth hour.

Posidippus presents the situation numerically: the amount of wine, the number of guests, the time of the party. Time, as I have already noted, was a theme turned to the advantage of arithmetical

[26] There is also a deeply astronomical aspect to this ratio-based approach to time-keeping. Aratus' discussion of the ecliptic (497–9, 509–10) – an essential phenomenon for measuring time with the *gnômôn* – is likewise given in the form of ratios.

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exercises, and the same is true of the other factors. The amount of wine at a symposium was understood early on to be regulated by number. For Posidippus, the proportions of wine mixed with other ingredients elsewhere served as an image for his range of literary influences: ἕβδομον Ἡσιόδου, τὸν δ' ὄγδοον εἶπον Ὁμήρου | τὸν δ' ἔνατον Μουσῶν, Μνημοσύνης δέκατον ('The seventh [measure] of Hesiod, the eighth I say is of Homer, the ninth of the Muses and Mnemosyne the tenth', Posidippus 140.5–6 AB = *AP* 12.168.5–6). This undoubtedly had a programmatic function within his own collection, given that other poems draw on sympotic themes in introducing epigram collections.[27] Closer to the time of the arithmetical epigrams, Ausonius' *Riddle of the Number Three* (*Griphus tenarii numeri*; more on which below) underscores the orderliness that numbers gave to sympotic proceedings and the arithmetical extremes to which that might be taken: 'drink thrice, or three times three … [or] nine times uneven three to complete the cube!' (*ter bibe uel totiens ternos … imparibus nouies ternis contexere coebum*, Auson. *Griph*. 1 and 3).[28] If three is the numerical rule to follow, why stop at nine: 'three cubed' drinks also works! Beyond the world of poetry, arithmetic at the symposium does not escape the interest of Athenaeus. In Book 15 of his *Dinner Sophists* (Ath. 15.670f–671a), he discusses the division of apples and wreaths at symposia not only in language that suggests he has *mêlitês* and *phialitês* numbers in mind, but with specific reference to Plato's discussion of arithmetical games in education (*Laws* 819b–c) discussed at the beginning of this chapter. In addition to the influence of Posidippus' sympotic epigrams, that is, 'sympotic calculation' remained an interest for the intellectual figures at – and readers of – Athenaeus' literary dinner.

Sympotic calculations are found among the arithmetical poems. A notable development of Posidippus' calculation of guests is observable in the following epigram.

[27] Gutzwiller (1998) 160–5.
[28] The 'uneven' threes seem to mean only that it is an odd number, as in Verg. *Ecl*. 8.75; see Green (1991) 449.

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δάκρυ παρὰ στάξαντες ἀμείβετε· οἵδε γὰρ ἡμεῖς,
  οὓς τόδε δῶμα πεσὸν ὤλεσεν Ἀντιόχου
δαιτυμόνας, οἵσίν <γε> θεὸς δαιτός τε τάφου τε
  τόνδ' ἔπορεν χῶρον, τέσσαρες ἐκ Τεγέης
κείμεθα, Μεσσήνης δὲ δυώδεκα, ἐκ δέ τε πέντε
  Ἄργεος, ἐκ Σπάρτης δ' ἥμισυ δαιτυμόνων,
αὐτός τ' Ἀντίοχος· πέμπτου δέ τε πέμπτον ὅλοντο
  Κεκροπίδαι· σὺ δ' Ὕλαν κλαῖε, Κόρινθε, μόνον.

(*AP* 14.137)

Let fall a tear as you pass by, for we are those guests of Antiochus whom his house slew when it fell, and the god gave us this place as both a banquet and a tomb. Four of us from Tegea lie here, twelve from Messene, five from Argos, and half of the banqueters were from Sparta, and Antiochus himself. A fifth of the fifth part of those who perished were from Athens, and you, Corinth, weep for Hylas alone. (G = 4 + 12 + 5 + 1 + 1 + G(½ + ½₅): G = total number of guests)

The epigram draws on a pre-existing dialogue between funerary and sympotic themes, making the connection explicit in verses 3–4 and by exploiting the bivalency of κείμεθα (5; cf. Simonides el. 102 Sider). In terms of content, the identity of Antiochus is unknown, but the scene is familiar. It recalls the story of Simonides' presence at a feast hosted by his patrons the Scopadae and his surviving the collapse of the banquet-hall when the Dioscouri appear and request his presence outside the building.[29] According to Cicero and Quintilian, that story was used to explain Simonides' 'invention' of mnemonics, since he was subsequently asked to remember who had been at the banquet and where they were sitting, although in all likelihood it is a biographical fiction.[30] This epigram rehearses the basic idea of the story, although in order to exemplify a different sort of mental dexterity. The epigram does not ask the reader to remember *who* was at the banquet, but to do the kind of sympotic summing seen in Posidippus' epigram and calculate *how many* dined and died at the dinner. Accounting for the dead is itself an aspect of Simonidean poetry, such as in his epitaph for all those who died at Thermopylae: 'once, four thousand from the Peloponnese fought against 3 million' (μυριάσιν ποτὲ τῇδε

[29] As early as Callimachus *Aetia* fr. 64.11–14; for all relevant sources and further aspects of the narrative see Simonides *PMG* 510 with useful clarifications in Molyneux (1971); the connection is noted by Buffière (1970) 199.

[30] Cic. *De or.* 2.351–3 and Quint. *Inst.* 11.2.11–16; see Slater (1972) and Lefkowitz (1981) 49–51.

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τριηκοσίαις ἐμάχοντο | ἐκ Πελοποννάσου χιλιάδες τέτορες, 9 Sider = Hdt. 7.228). The overall effect is thus to present counting as an activity important for memory. The epigram presents enumeration as connected to the memorialisation of the war dead as seen in funerary inscriptions, but it also offers an explanation of that activity's origin by drawing on the recognisably Simonidean narrative that provided the origin of mnemonics. It employs the sympotic context to reposition the aetiology of commemoration, as well as its recognising and identifying of the fatalities, closer to the practice of arithmetic.

Beyond the *Palatine Anthology*, there survives another arithmetic poem with a sympotic setting, and it is to be found in Diophantus' *Arithmetica*. There are six books of the *Arithmetica* extant in Greek and a further four in Arabic; the order is thought to be the first three Greek books, then the four in Arabic, followed by the final three Greek books.[31] At the end of the fifth Greek book there is an epigram that versifies an arithmetic problem.

ὀκταδράχμους καὶ πενταδράχμους χοέας τις ἔμιξε
τοῖς ὁμοπλοῖσι ποιεῖν χρήστ' ἐπιταττόμενος·
καὶ τιμὴν ἀπέδωκεν ὑπὲρ πάντων τετράγωνον,
τὰς ἐπιταχθείσας δεξάμενον μονάδας
καὶ ποιοῦντα πάλιν ἕτερόν σε φέρειν τετράγωνον
κτησάμενον πλευρὰν σύνθεμα τῶν χοέων·
ὥστε διάστειλον τοὺς ὀκταδράχμους, πόσοι ἦσαν,
καὶ πάλι τοὺς ἑτέρους, παῖ, λέγε πενταδράχμους.[32]
(Diophantus *Arithmetica* V.30 Tannery)

Someone mixed eight-drachma and five-drachma measures of wine having been ordered by their fellow sailors to make it good. The price he paid for it all is a square number which when the units are ordered side by side will give back to you another square number, which possesses a side [i.e. a root] that is the sum of the measures. So discern the eight-drachma measures and speak about the other five-drachma ones, child, how many they are.

It is not the work of Diophantus himself: the *Arithmetica* otherwise exhibits little in the way of literary flourishes besides the introductory address to Dionysius, an orientation for the reader not

[31] That is: I–III (Greek), 4–7 (Arabic), IV–VI (Greek). However, Book IV is not necessarily Book 8 of the original, and V is not necessarily 9 etc., since it appears that material is missing between the end of the Arabic text and the restart of the Greek. See Rashed and Houzel (2013) 6–8 for further discussion of the text and its history.

[32] The text follows Tannery (1895) I, 384, a reading which he justified in Tannery (1891).

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uncommon in mathematical treatises.[33] I think it is safest to consider it a later composition interpolated into the text which reworks the prose arithmetical problem into verse, and for my present purposes a poetic response to his arithmetic inserted into the *Arithmetica* only adds to the picture of Diophantus' poetic reception.[34] It is clear from the *scholia* to the *Palatine Anthology* that Diophantus was an important source for resolving the poems in Book 14.[35] So too, whether it was composed specifically for its place in the *Arithmetica* or taken from elsewhere, the interpolation of this epigram likewise shows an arithmetical poem being read together with Diophantine mathematics.

The epigram draws on a range of sympotic themes. The reference to the wine-mixer being ordered by his fellow sailors (ὁμοπλοῖσι, 2), if this is the correct reading,[36] leans on a well-trodden equation of symposiasts as sailing together in a ship.[37] The central problem is working backwards from the mixing of two wine measures (χόες) that were bought for different prices. The mixing of wine is a common theme in sympotic epigram, as Posidippus attests; mention of the units consumed also occurs (cf. Hedylus 3.2 *HE* = Ath. 11.486b2 and 6.2 *HE* = Ath. 11.473a5). Likewise, the commercial aspect of buying the wine recalls shopping-list epigrams recounting transactions (Asclepiades 25.9 *HE* = *AP* 5.181: λογιόυμεθα, 'we will reckon'; 26.3 *HE* = *AP* 5.185.3: ἀριθμήσει δέ σοι αὐτός, 'he [the fishmonger] will count them himself'). A further important sympotic resonance is the speaker's concluding address to a παῖς to carry out the calculation. The request brings to mind sympotic addresses to

[33] Cf. e.g. Archimedes' *On Spiral Lines* or Apollonius of Perga's *Conics*.

[34] Allard (1980) II, 47–8, having provided a detailed palaeographical and philological analysis, concludes that while it is not by Diophantus, it is the work of someone well acquainted with Diophantus' method and that the textual tradition points to it existing already in the common archetype of the surviving MSS, the earliest of which comes from the thirteenth century. These are good grounds for thinking that it is a sophisticated and ancient poetic response to Diophantus' arithmetic.

[35] Tannery (1895) II, 43–72 preserves the *scholia* with the epigrams as testimonia to the Diophantine tradition of arithmetic.

[36] Tannery (1891) 378 proposes the corruption to the difficult ὀβελοῖς of the manuscripts from ὁμοπλοῖσι as a slip arising from confusion between β and μ in an archetype.

[37] See Archilochus fr. 4, Choerilus fr. 9, Bernabé and Timaeus 566 F 149 = Ath. 2.37b–d, together with Slater (1976); Corner (2010); Gagné (2016) 223–4; Franks (2018) chapter 2.

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a youth functioning as wine-pourer, for example Anacreon's command 'come now, bring to us the bowl, o youth' (ἄγε δή, φέρ' ἡμίν, ὦ παῖ | κελέβην, fr. 33 Gentili). Given the nature of the request, though, the epigram is also characterising the symposium as a site of intellectual competition and education. Challenges were set to test one's cultural prowess: in the game of *skolia* symposiasts could each be required to contribute a verse to a song;[38] they could probe each other's knowledge of, say, Homer;[39] or they could be interrogated about which fish is best in which season.[40] Equally, the symposium in Archaic and Classical Greek society was where younger elite males were expected to absorb Greek culture as well as to learn how to behave, and that idea lasted well after education became more formalised outside of the dining room.[41] In this respect, the speaker offers a sympotic challenge to a younger participant as a test of his educational progress in arithmetic. The epigram stages a youth being put on the spot and asked to calculate the number of wine measures in total just before they would be serving up the wine to the attendants: even complex arithmetic is part of one's sympotic acculturation.

As well as integrating numbers into various generic forms, there are poems in the collection that take a playful approach to the content of tradition. The single couplet of *AP* 14.12 looks back to a figure more well known from Herodotus' *Histories*: 'Croesus the king dedicated six bowls weighing six minae, each one heavier than the next by one drachma' (ἓξ μνῶν ἓξ φιάλας Κροῖσος βασιλεὺς ἀνέθηκεν | δραχμῇ τὴν ἑτέρην μείζονα τῆς ἑτέρης: the first bowl weighs 97.5 drachmas). Herodotus had surveyed Croesus' dedications to Apollo at Delphi, which included two large bowls – one of gold, one of silver – weighing many talents and minae (Hdt. 1.51.1–2). He gives both the geometric form of solid gold ingots and their total – 'he made the longer sides six palm-lengths, the

[38] On the nature of the *skolion*, see Dicaearchus frr. 88 and 89 Wehrli and the discussion of Collins (2004) 84–98.

[39] In Aristophanes' *Banqueters*, for example, a father takes the opportunity at the symposium to check his son's knowledge of Homer by asking him the meaning of the *hapax* κόρυμβος (fr. 233 KA; cf. *Il.* 9.241).

[40] Cf. Clearchus fr. 63.1.28–31 Wehrli. See Kwapisz (2014) 211 for the wider context of the fragment.

[41] See Griffith (2015) 45–7 with references and bibliography.

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shorter sides three palm-lengths and the height one palm. Their number was one hundred and seventeen' (ἐπὶ μὲν τὰ μακρότερα ποιέων ἑξαπάλαστα, ἐπὶ δὲ τὰ βραχύτερα τριπάλαστα, ὕψος δὲ παλαστιαῖα, ἀριθμὸν δὲ ἑπτακαίδεκα καὶ ἑκατόν, Hdt. 1.50.2) – and their weight in talents – 'four of them were refined gold, each weighing two and a half talents, the others ingots were of white gold, with a weight of two talents' (ἀπέφθου χρυσοῦ τέσσερα, τρίτον ἡμιτάλαντον ἕκαστον ἕλκοντα, τὰ δὲ ἄλλα ἡμιπλίνθια λευκοῦ χρυσοῦ, σταθμὸν διτάλαντα, Hdt. 1.50.2). Moreover, he also provides a little calculation of his own when accounting for the solid gold lion which weighed ten talents that Croesus dedicated but which was burnt in a fire at Delphi: 'and now it lies in the treasury of the Corinthians, but weighs only six and a half talents, for the fire melted away three and a half talents' (καὶ νῦν κεῖται ἐν τῷ Κορινθίων θησαυρῷ, ἕλκων σταθμὸν ἕβδομον ἡμιτάλαντον· ἀπετάκη γὰρ αὐτοῦ τέταρτον ἡμιτάλαντον, Hdt. 1.50.3). Herodotus had already demonstrated that one needs arithmetical acumen to count up Croesus' gifts, and this poem develops that numerically exacting survey to offer a more challenging account of Croesus' 'ever growing' (cf. τὴν ἑτέρην μείζονα τῆς ἑτέρης) riches.

Two further poems revolve around the number of Muses, who divide apples among themselves. In one, the Graces share apples with the Muses (*AP* 14.48). It asserts the intrinsic numerical nature of the goddesses even though, as Bonnie MacLachlan's study on the Graces and Tomasz Mojsik's on the Muses have shown, their number varies depending on the ancient tradition and on the choices of each cult.[42] In the other, the setting and language bring to mind two parallel literary themes, with Eros complaining to his mother Aphrodite that the Muses have stolen his apples (Πιερίδες μοι μῆλα διήρπασαν, *AP* 14.6.3). Although late in the tradition, this recalls the use of apples in contexts of declaring one's love and more specifically of the apple of discord that ultimately precipitated the Trojan War, which according to Colluthus Aphrodite wanted for her Erotes (*De rapt*. 67). Two others in the collection have apples apportioned not by the Muses

[42] MacLachlan (1993) 51 n.23; Mojsik (2011) 74–97.

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or Graces, but by the Bacchants Agave, Ino, Autonoe and Semele (14.117–18). There is humour in replacing their famous *sparagmos* of Pentheus with a different, less lethal kind of 'dividing up', and this replacement is thematised through the similar-sounding μῆλα ('apples') and μέλη ('limbs'). The fact that Semele is included in both poems – while dead during the events of Euripides' *Bacchae* (cf. 1–63) – places this particular apportioning prior to the fatal events that conclude the play: even before Dionysus' arrival, that is, Theban women knew well how to divide things between themselves.

As the *Cattle Problem* so clearly demonstrates, composing arithmetic in verse went hand in hand with searching the literary past for a suitable image or images through which to express the manipulation of numbers. The arithmetical poems in *AP* 14, it should now be clear, enact the same sort of excavation of traditional genres and content, in order to furnish their poems with the sensible bodies – the 'stuff' – of logistic that must be calculated. To put it another way, this section has shown that producing arithmetical poetry involved a specifically numerical reception and (re)reading of the earlier tradition.

4.2 The Cultural Capital of Calculation

The preceding section has demonstrated that, at the level of individual poem, the result of packaging arithmetical content in poetic form is a trend of reading pre-existing genres and motifs as containing the seeds of arithmetic. That is, the intent to cultivate mathematical dexterity through poetry pushed authors of the poems to reinterpret and reuse traditional literary forms and to reify their numerical aspects. Late antique poetry is now a burgeoning area of scholarship, with numerous studies seeking to reappraise its poetry as creative reactions to changing literary and cultural contexts and not as belated and derivative show pieces palely imitating earlier models.[43] This section thus aims to provide a wider intellectual context for the arithmetical poems and how

[43] The bibliography on this subject is ever-growing, but in terms of orientation and the larger view of the period I have found the following particularly useful: Roberts (1989); Pelttari (2014); Elsner and Hernández Lobato (2017).

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they might have functioned within a late antique literary culture. I look to the Latin poetry of Late Antiquity and its reflections on number in poetry; the analysis is offered as comparative material informing a reading of the Greek arithmetical poems: I am not claiming that they were composed with knowledge of the following Latin works. In terms of the level of mathematics, too, there is nothing comparable, but the poems should nevertheless be understood as constructing a recognisably late antique mode of engagement for their readers as well as being representative of a wider trend of incorporating arithmetic within displays of poetic novelty and learning. Arithmetic finds a place within poetry, I propose, as an additional means for gauging the cultural capital of both educated elite composers and readers.

First, however, it is worth locating the arithmetical poems' context of production. Their common thread is the numericalisation both of pre-existing literary forms and of figures or objects from the literary past. This is a strategy of fitting calculations into verse that arose, *inter alia*, with Archimedes' *Cattle Problem*. The difference, though, is both the lack of surrounding cultural historical context, as there is in the case of the *Cattle Problem* and its exchange between two famous intellectuals, and the lack of a broader poetic project into which the poems fit, as there is, for example, in the passages from Lycophron's *Alexandra* or Hesiod's *Melampodia* discussed in Chapter 3. A parallel for the arithmetical poems' reworking of earlier genres and topics as well as their self-contained nature can be identified in the wider educational curriculum. The preserved rhetorical handbooks or *progymnasmata* detail the literary education of the imperial student, providing a series of different exercises in the art of speaking and writing; these included how to deploy anecdotes, recount mythical narratives and fables, offer arguments for and against a proposition and deliver encomia and invective. One of the later exercises to be completed is prosopopoeia, the personification of an object or a person from history or myth.[44] The student would have to compose a response in verse or prose to such questions as 'what

[44] In the earliest extant example, the *progymnasmata* of Theon, he makes no distinction between ethopoeia as the characterisation of people and prosopopoeia as the personification of things. This distinction does not affect my argument.

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words would Cyrus say as he attacks the Massagetae?' (τίνας ἂν εἴποι λόγους Κῦρος ἐλαύνων ἐπὶ Μασσαγέτας, Aelius Theon 115.17–18 Spengel) or 'what words would Andromache say to Hector?' (τίνας ἂν εἴποι λόγους Ἀνδρομάχη ἐπὶ Ἕκτορι, Hermogenes 15.7 Spengel). The exercises not only asked students to dwell on the material of the inherited literary tradition, they asked them to recompose it, to produce compositions matching the style and metre of the original but with new things to say. This educational background is part of the impetus for the return to Homeric subject matter and the Homeric voice or, say, to rhetorical performances in the style of the Attic orators, while at the same time offering something novel.[45] Yet many short verse compositions survive in the *Palatine Anthology*, exemplifying what such exercises might produce, and they may have once formed a collection (for example, *AP* 9.457–80). In their reliance on the forms and models of the past as well as in the revivification of mythical or historical figures, the arithmetical poems echo the strategies of these *progymnasmata*. Their rehearsing and reconfiguring of the literary past not only produces mythical 'what would X say to Y' scenarios, it reaches across disciplines to incorporate aspects of mathematical education too.

The parallel of the *progymnasmata* proposes a post-Hellenistic context of production for the arithmetical poems. In terms of their context of reading and of reception, I think that it makes most sense to view them as a late antique development. To exemplify what is particular to engagements with the reader in the poetry of Late Antiquity, I want to consider two Latin works that underscore the importance of arithmetic for conceptualising the form and interpretability of a poem. Ausonius' preface to his *Cento nuptialis* (*Wedding Cento*) is a key passage of late antique literary theory, and it rests on an explicitly arithmetical comparison. A cento is a poem stitched together from lines of existing poetry, and in this case the poem is a bricolage of Vergilian half-lines reassembled in order to describe a night of nuptial consummation. In introducing the poem to his correspondent Paulus, he outlines the practice of

[45] For the 'revival' of oratory see Anderson (1993) chapter 3 and Schmitz (1999b); for the reanimation of Homer see broadly Zeitlin (2001) and Greensmith (2020) chapter 1 for Quintus of Smyrna's *Posthomerica* in particular.

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composing centos.[46] His explanation exemplifies the composing of centos with the Greek game called στομάχιον ('Belly-teaser'), a tangram in which a square cut into fourteen polygons can be rearranged to create many other figures (such as a ship or a gladiator).[47] It was also explicitly theorised by Archimedes, who dedicated a treatise to the topic, a single fragment of which has been recovered from a palimpsest.[48] Whatever the precise focus of Archimedes' treatise, it undoubtedly influenced the later use of the image for underscoring the possibilities of combination.[49] Given the close relationship I argued for in Chapter 3 between mathematics and Homeric epic in a work by Archimedes, Ausonius' choice of the στομάχιον to describe his own use of epic may have been informed by a now lost literary or cultural implication of the calculations mentioned in the treatise.[50] As Fabio Acerbi has shown, moreover, combinatorics was certainly a matter of theory by the time of Hipparchus (second half of the second century BCE), who criticised the Stoic thinking of Chrysippus and his calculation of the possible claims that could be made given ten 'assertables' connected by a conjunction such as 'and'.[51] For my purposes, it is sufficient to note that combinatorics was applied in the domain of language and the construction of sentences from the Hellenistic period. Ausonius' example of the στομάχιον, while not requiring the application of arithmetic, attests to an arithmetic understanding of compositional possibilities and of the construction of new meanings out of canonical forms.

[46] For an extended discussion of the preface and its importance see McGill (2005) chapters 1–21; Pelttari (2014) 104–7, and for the textual issues in the passage see Green (1991) 521–2.

[47] Aside from Archimedes – see below – Lucretius uses the image to explain how colours come about from colourless elements (2.772–87) and the Latin grammarians Caesius Bassus (*CGL* 6.270.30) and Aelius Festus Aphthonius (*CGL* 6.100.4) to refer to metrical combinations. See too Ennodius (*c.* 340 Vogel).

[48] On the reconstruction of the text see Netz et al. (2004), Netz in Netz et al. (2011) 285–7, with a cautionary and sensible evaluation of the evidence by Morelli (2009).

[49] Both Caesius Bassus and Aphthonius – p. 181 n.47 above – refer to the original, divided square as a *loculus Archimedius*.

[50] For what it is worth, the puzzling name στομάχιον could have had the secondary interpretation (or indeed primary meaning which was subsequently corrupted) of στόμα Χῖον ('Chian mouth'), referring to Homer's mouth. A game of almost infinite variety would resonate with his place as the fountainhead of Greek culture and his single mouth's ability – despite demurring – to list the entire multitude at Troy.

[51] Acerbi (2003).

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An additional example that again functions with the idea of compositional combination will set in high relief the role of arithmetic in conceiving of a poem's interpretability. The early fourth-century poet Publilius Optatianus Porfyrius – commonly known as Optatian – is a late antique poet who is now gaining his fair share of scholarly interest. He was a composer of *carmina cancellata* ('latticed poems'), poems in grid-like patterns that preserve hidden sentences and verses at their edges and in variegated patterns across the gridded page.[52] For example, poem 16 presents 38 hexameters comprising a panegyric to Constantine with an acrostic that likewise extols Constantine as ruler and inheritor of Augustus' mantle. Three further mesostichs also run vertically from the top to the bottom of the grid starting from the tenth, nineteenth and twenty-eighth letter of each verse. They produce a string of letters that, when converted into Greek, announce instead Christ's bestowing of power on Constantine.

Rather different from these *carmina cancellata* is poem 25.

ardua componunt felices carmina Musae
dissona conectunt diuersis uincula metris
scrupea pangentes torquentes pectora uatis
undique confusis constabunt singula uerbis.[53]

(Optatian 25)

The productive Muses compose laborious poems,
they connect discordant chains from diverse metres;
composing difficulties, twisting the poet's heart,
they fit individually whichever way the words are combined.

The poem develops a Hellenistic model of composition first attempted by Castorion of Soli (*SH* 310 = Ath. 10.454f), in which the feet of his *Hymn to Pan* can be arranged in any order, and where the content of the words also advertises the fact. With Optatian's poem, the reader is freer since the words rather than the feet can be reorganised. Thus, these four verses of five words each can be combined in a truly staggering array of combinations.[54]

[52] The edition of Polara (1973) remains fundamental, although see Squire and Wienand (2017) 28–51 for a new typesetting of the figure poems.
[53] The text follows Polara (1973).
[54] See Levitan (1985) 250–1; Squire (2017) 88–90. Pelttari (2014) 77–8 outlines the rules restricting the combination of words, which nevertheless allows for many combinations.

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The poem sets an arithmetic challenge to the reader: in just how many ways can the words be rejigged (*confusis … uerbis*, 4)? There were attempts – possibly dating back to the fourth century CE – to calculate the poem's potential permutations, and the question is equally alive in modern scholarship (just over 39 billion variations, according to one commentator).[55] Optatian's four-line poem is a textual Rubik's cube that outdoes Leonides' isopsephic epigram by concealing not a numerical account, but an innumerable amount of further poetry. Poem 25 also outdoes the *Cento nuptialis*: it is the poetic instantiation of the στομάχιον game, since it provides the 'square' of words that – unlike the *Cento* – can be rearranged any way the reader likes. Fascinating, in this respect, is that in some manuscripts the combinatory challenge has led the copyist to try out the permutations, scaling the poem up as far as 84 verses.[56] A later reader has attempted to answer the implicit question exhaustively. This evidences the imbrication of numerical and literary appreciation that confronts readers of the poem; the copyist – and indeed the scholiast – makes a claim about the numerical extent of the poem's reconfigurability.

Ausonius and Optatian's explorations of poetic form establish that arithmetic had a role in conceptualising the possibilities and the limits of literary innovation. Their importance for understanding the arithmetical poems lies in the connection between the arithmetic and the deep involvement of the reader in the construction of meaning. Ausonius explains this through a mathematical image, and the readers of Optatian's poem 25 clearly aimed to calculate the number of meanings possible. The arithmetical poems are neither as self-conscious nor as theoretical in their comments. Nevertheless, they demand the work of the reader to make sense of the poem and get beyond the surface of the expressed ratios, just as a reader must work to configure the many meanings of Optatian's chequerboard *carmina cancellata* and to appreciate the Vergilian undercurrent of Ausonius' *Cento*. In a seminal study of Hellenistic epigram, Peter Bing argued that

[55] For the date of the *scholia* see Pipitone (2012) 28–30, 91–3. For the number of combinations: 1,792, Levitan (1985) 251 n.17; 3,136, Flores and Polara (1969) 116–20; 39,016,857,600, Pelttari (2014) 78.

[56] Flores and Polara (1969) 116–22.

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they were often written in such a way as to require the reader to supply further information about context, addressee or imagined location not made explicit, an effect which he called 'the game of supplementation' (*Ergänzungsspiel*).[57] Given that many arithmetical poems are influenced by Hellenistic epigram, this readerly demand may be part of the genre's adaptation to arithmetical content. A similar process is at work: in both cases the reader must take the epigram's contents and out of that construct a plausible scenario beyond what the poem describes on the surface. While number and epigrammatic poetry thus have a long interrelation, the notably late antique development of the arithmetical epigrams is the extent to which the experiment with form is taken. The presence of numbers on epitaphs has become a full series of calculations that require computing, just as Optatian's poem outdoes earlier 'reconfigurable' poems in its possible permutations.[58] The arithmetical poems belong to Late Antiquity, simply put, in their increased reliance on the role of the reader in uniting the individual components of a text into a meaningful whole.

A further operative aspect of poetry in Late Antiquity is the construction of innovative poetry and the display of virtuosic skill using the material building blocks of the literary tradition: Vergilian lines are cut and pasted to form Ausonius' *Cento*, while Optatian's poems draw on numerous canonical works which disintegrate and reform in front of the reader's eyes.[59] The arithmetical poems, by contrast, do not work at the level of the material text but with the constituent objects described within it. However, as I noted in the previous section, these topics themselves draw heavily on the heritage of various literary forms. The matter of the tradition itself becomes the objects with which the poets demand the reader grapples and engages. Fortunately, the poetry of Late Antiquity also

[57] Bing (1995).

[58] In addition to the example of Castorion (above), see the Midas epigram quoted by Socrates in the *Phaedrus* (264c–d; with variant reading at *Cert.* 15 and in *GVI* 1171a and b), Simonides' poem (el. 92 Sider = *AP* 13.30) possibly in reference to Timocreon and Timocreon's reply (*AP* 13.31). For Nicodemus of Heraclea's rearrangeable poems, see Page (1981) 541–5.

[59] For Optatian's affinities with and allusion to earlier Latin literature see González Iglesias (2000) and Schierl and Scheidegger-Lämmle (2017).

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furnishes an example of where tradition and its constituent objects and tropes are treated numerically. A poem that is almost entirely composed out of numbers and enumeration is Ausonius' *Riddle of the Number Three*. The poem rings the changes on things existing in threes or nines, under the influence of three cups at the symposium. There has been much discussion about the possible 'answer' to the riddle, although I am most persuaded by the proposal that, since the Greek γρῖφος means riddle but also a woven fishing-basket or net (LSJ *s.v.* γρῖφος A.1; cf. Ath. 10.457c–458a), the title *Griphus* indexes 'the dense texture of its literary allusions'.[60] Ausonius is steeped in the numbered-ness of tradition. His prose preface contains multiple references to no less than four canonical Latin authors.[61] The *Griphus*' composition is figured as the result of drinking, following the style of Horace's poem (3.19) 'in which, on account of midnight, the new moon and Muraena's augurship the inspired bard calls for three times three cups' (*in qua propter mediam noctem et nouam lunam et Murenae auguratum ternos ter cyathos attonitus petit uates*, *Praef. ad Griph.* 16–17). Two further references to Horace, in significant third positions (*Satires* 1.3 and *Odes* 3.1), make for a three-pronged allusion to the Augustan lyricist, supported also by an opening reference to Catullus *c.* 1, which plays with the idea of a three-book collection (see Chapter 2, Section 3).

While the preface establishes that talking in threes is a habit inherited from canonical authors, the verses aim to affirm the three-ness of various cultural institutions. As in the arithmetical poem on the Muses and Graces, Dunstan Lowe has noted that Ausonius in the *Griphus* asserts the numerical nature of the Muses as nine (22), despite elsewhere thinking of them as either three or eight (*Epist.* 13.64), and that he numbers the Sibyls at three, although that number is nowhere else attested.[62] Ausonius' strategy amounts to an attempt to collect and order cultural data from

[60] Lowe (2012) 344.
[61] Lines 2–4 ~ Ter. *Eun.* 1024; 5–6 ~ Cat. *c.* 1.1; 16 ~ Cic. 2 *Verr.* 1.66; 17–18 ~ Hor. *Odes* 3.19.9–15; 28 ~ Hor. *Sat.* 1.3.29–30; 38 ~ Hor. *Odes* 3.1.1.
[62] Lowe (2012) 342–3. Varro's list of ten Sibyls seems to have been the standard (cf. Lactant. *Div. inst.* 1.7–12).

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the past and to regulate it so as to make it manageable. Indeed, Ausonius' regulatory mode is a key part of the preface. He sent the letter to Symmachus with the expectation that the enclosed poem may be either approved or destroyed (*Praef. ad Griph.* 11–13), but this is paired with the concern that his original composition has been 'mutilated for a long time by secret yet popular readings' (*diu secreta quidem, sed uulgi lectione laceratus*, *Praef. ad Griph.* 10–11). Regulation is part of the impetus for preserving the text; literary and cultural artefacts are associated with specific numbers, which Ausonius must protect against the distortions of time and populism: indeed his list of threes does not extend to anything related to the *profanum uulgus* ('unitiated crowds').[63] He is aiming, not exhaustively but symbolically, to impress the idea of literature and culture's numerical nature within elite circles and their shared late antique *paideia*. The *Griphus* too is an argument for the cultural capital of numbers.

Reading the *Griphus* in this way makes Ausonius' allusiveness in the preface particularly piquant. He characterises the original composition of the *Griphus* as nothing more than 'a frivolous piece worth less than Sicilian baskets' and 'a trifling booklet' (*haec friuola gerris Siculis uaniora . . . nugator libellus*, *Praef. ad Griph.* 9–10). Yet his claims to mere playfulness belie his referentiality. The second phrase refers back to the Catullan allusion at the start of the preface and Catullus' opening poem responding to a three-volume history (*c.* 1.6). The first phrase refers to *gerrae*, another form of wickerwork that had a metaphorical meaning of nonsense, but it is also modified by *Siculus*, which makes it a product of the three-cornered Sicily.[64] Ausonius intimates that the composition is certainly playful and may be nothing more than an experiment; but his allusiveness suggests that even in trifling works, reading a little deeper uncovers a whole world of numbers and numberedness.

Of course, the arithmetical poems are more challenging than the *Griphus* in that its answer – if that is the right word – is not hidden to the reader. Nonetheless, further works do reveal Ausonius'

[63] A Horatian tag, cf. *Odes* 3.1, and a clear allusion to Callimachus 2 *HE* = *AP* 12.43 and his aesthetics of social exclusion.
[64] Sonny (1898).

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cultural capital of numbers in action.[65] *Epistle* 14 addressed to Theon – an otherwise unknown friend – records a gift of thirty oysters and, noting the lack of literary accompaniment, reworks an old letter in return, the poem that follows the prose introduction. The poem is divided into four metrical schemes: hexameter (1–18), iambic (19–23),[66] hendecasyllable (24–35) and asclepiads (36–56). The hexameters introduce the theme of the oysters and list a series of single verses (*monosticha*, 4) characterising the number: for example 'as many as the Geryones, if they were multiplied by ten' (*Geryones quot errant, decies si multiplicentur*, *Epist*. 14b.6). In the following iambics, Ausonius characterises the number arithmetically, for example 'three times ten, I think, or five times six' (*ter denas puto quinquiesue senas*, 24). The hendecasyllables describe the sourcing and cooking of the oysters. The focus is on lexical dexterity and 'a general luxuriance of expression'.[67] In the concluding asclepiads, he notes the excessive length of his writing and commands his pen to stop writing (or the composition be erased), in case the parchment costs more than the oysters. The concluding reflection that the papyrus may cost more than the (presumably free) thirty oysters invokes the relationship – by now recognisable from Part I – between poetic content and the extent required to express it. The humour here is that Ausonius may have overdone his attempt to supply a composition in lieu of one from Theon. This virtuosic piece displays the mythological, mathematical and lexical skills required to be a learned writer. Significant for my purposes is the arithmetical section's introduction.

quod si figuras fabulis adumbratas
numerumque doctis inuolutum ambagibus
ignorat alto mens obesa uiscere,
numerare saltim more uulgi ut noueris,
in se retortas explicabo summulas.[68]

(Ausonius *Epistles* 14b.19–23)

[65] In addition to *Epistle* 14, arithmetic combined with literary reference is displayed at *Epist*. 10.5–25 and 15.5–14.
[66] *Pace* Green (1991) 632, who gives the hendecasyllables as 35–46 and the asclepiads as 47–56.
[67] Green (1991) 634. [68] Latin text after Green (1991).

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But if in some way a mind fattened to its innermost depths does not know forms shadowed by stories and number wrapped in learned riddles, I will unfold the factorised sums so that you might know how to count in the common way at least.

These lines mark the transition between the literary and arithmetical characterisation of thirty and mark out the stakes attached to the different types of learning. Unlocking the number through literature requires a knowledge of narratives and an ability to decipher obscurities or riddles, whereas arithmetical calculation alone belongs to the *uulgus*. Theon is mocked for his size elsewhere (*Epist.* 16.31), but the imagery in these lines makes a more general point about mental exercise: a mind wrapped in fat (out of disuse) will not be able to deal with the already obscure and wrapped-up descriptions of numbers. It is the expression of numbers through poetry that makes the exercise intellectual and not accessible to the masses, that is, what makes it elite.

Ausonius' use of *ambages* – an obscurity or enigma – to characterise his descriptions of the number thirty through literary references provides one explanation for the designation of the *Griphus* and its three-counting as a riddle. More importantly, however, Ausonius' distinction provides a parallel for the nature of the arithmetical epigrams. It is my contention that their form is a result of the same sense of the cultural capital of numbers. Their exercising of the reader's knowledge of, and control over, the numerical aspects of the cultural and literary past is part and parcel of the wider habit of deploying learning competitively. Around a third of the arithmetical epigrams directly invoke mythological topics, while others take on topics such as the constellations (e.g. *AP* 14.124). But it is not solely about content. As I have demonstrated, almost all wrap their arithmetic in the *ambages* of a pre-existing poetic form. The possibility of solving the series of simultaneous equations encoded in the arithmetical poems offers readers the opportunity to cash in their own cultural capital, and it is a capital derived from knowing literary tropes, traditions and clichés as much as it is knowing enumerable 'objects' or 'stuff' of the mythical past. More than an awareness of the numbered nature of the cultural and literary past, though, the poems provide real and serious arithmetic problems to be solved that go beyond Ausonius'

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display of factorisation: they are both an arithmetical and literary exercise. Ausonius' poem explicitly notes, furthermore, that in erudite exchanges, arithmetic retains its currency best when expressed in obscure and circumlocutory language, framed in stories (cf. *fabulis*). By versifying numerical aspects of antiquity, the poems not only provide a literary and arithmetic challenge for the reader simultaneously, they supply it in a form that also increases the distinction of the author (and solver) within an elite group.

The arithmetical poems are a quintessentially late antique product in that sense, since their insertion of arithmetic into poetry demands the reader's participation in the construction of meaning, displays the authors' education and skill in transforming the literary tradition and results in an innovative and experimental poetic form. Accounting for the potential educational context, moreover, does not mitigate this claim. Rather, if they are the product of rhetorical training, then they evidence a practice taking seriously Ausonius' emphasis on the value of computing in poetry, not to mention providing *exempla* for the combination of literate and arithmetical learning. Ultimately, though, attempting to distinguish definitively between the function of the poems as either educational *exempla* or virtuosic show pieces is unhelpful; the two are not mutually exclusive and the poems beyond the Metrodoran collection show that they circulated in multiple contexts. The wider significance of the cultural capital of calculating for which I have argued in this section, then, is that it modifies the literary historical trajectory of numbers in poetry. Whereas the poems of Archimedes and Leonides have often been imagined to be esoteric, peculiar experiments of form that survive only out of curiosity, the view from Late Antiquity is rather different. The arithmetical poems make clear that composing calculations was not only the preserve of mathematicians grappling with the inherent difficulty of incorporating their disciplinary content into verse, but an expectation for educated late antique authors as well as readers.

4.3 Arithmetic Anthologised

At some point after the appearance of the arithmetical poems, they were brought into a collection by the shadowy figure Metrodorus.

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In this section, I want to trace out the poems' reception and interpretation as they were anthologised by Metrodorus. I illuminate the dialogue between poems encouraged by their editorial organisation and selection within the Metrodoran collection. I then identify an overarching theme that comments on the nature of the collection and the purpose of the compositions. Following the conclusion of the previous section, I argue that the nature of the Metrodoran collection foregrounds the same sophisticated balance of arithmetic novelty expressed through traditional poetic forms that was operative in individual poems.

First, though, it is necessary to set out the evidence for Metrodorus' collection. The organisation of the poems within Book 14 may date back to Constantinus Cephalas in the early tenth century CE and is no later than the formation of the *codex Palatinus* in the middle of that century, the basis for the modern *AP*.[69] His collection is reconstructed on the basis of a comment in the *scholia* to Book 14 in the *codex Palatinus*. At poem *AP* 14.116 the scholiast introduces the following poems as 'the arithmetic epigrams of Metrodorus' (Μητροδώρου ἐπιγράμματα ἀριθμητικά), and this probably extends all the way to 14.146.[70] The collection is accompanied by an intermittent marginal numbering that in all likelihood represents the poems' order in the Metrodoran collection: *AP* 14.116 is designated β (2), 117 as γ (3), etc. This coherence is supported by the wording of arithmetical solutions given in a number of *scholia* which implies that the poems are drawn from a single collection.[71] Outside of this section, poems have been found with a marginal numbering that is missing in the core sequence: *AP* 14.6 and 14.7 are 19 (ιθ΄) and 28 (κη΄) respectively. They are thus also added to the Metrodorus collection, as are *AP* 14.2–5 and 14.48–51, which are thematically and stylistically of

[69] See p. 163 n.5 above.

[70] I will discuss 14.147 below. The final three poems of *AP* 14 are oracles and seem to have no connection with the arithmetic poems but rather look to have been displaced from the oracle section or added later. Since the *scholia* cross-reference different arithmetical poems, it has reasonably been thought that they accompanied a previous collection. Tueller (2021), which considers the interrelation between the *scholia* and the poems in Metrodorus' collection, appeared too late for me to fully address here. He understands the *scholia* also to be Metrodoran; I would say that this has yet to be proved and that the *scholia* could well have been added in the course of the collection's transmission.

[71] See Teichmann (2020) 102 n.76 and 103 n.85.

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a piece with the securely Metrodoran compositions. *AP* 14.1 is not thought to be from the Metrodoran collection.

The arithmetical epigrams share with the wider literary context an immersive participation in the production of significance on the part of the reader. The 'game of supplementation', however, could also operate across a poetic collection, in which the arrangement invites the reader to make connections between poems as they navigate through the work. An early example of this editorial ordering is the Milan papyrus of Posidippus, the individual poems of which echo and cap each other, both within and across its thematic sections.[72] Posidippus' ἐπιτύμβια is again particularly important here, since the theme of accounting operates across the section, contrasting different forms of enumerating and valuing life. Admittedly, the Metrodoran collection and its bounds cannot be identified with the same precision as Posidippus', recovered from a mummy cartonnage (more or less) intact, but its integration into Book 14 is sufficiently contained to allow for analysis and cautious conclusions.

Preliminarily, poems in the Metrodoran collection evince an order suggestive of editorial placement, with similar poems set in thematic dialogue and close proximity, creating a cohesive anthology playing variations on a theme.[73] The epigram on Diophantus appears within a sequence of epigrams counting up life and death (*AP* 14.124–7) and other funerary-themed epigrams ask instead for the inheritance to be calculated from its respective proportions (14.123, 128 and 143). Poems were also connected on the lexical and stylistic level. For example, 14.125 is a funerary epigram for Philinna that asks for the number of her children to be calculated. Philinna is a common enough name to encounter in an epigram, but it is noteworthy that it appears in two earlier epigrams in the collection.[74] Philinna is the name of one of the maidens who divide up the walnuts in 14.116 and 14.120. The shape of the

[72] The bibliography on this topic is now quite large. For an introduction to the various interrelations in the papyrus, see the contributions of Bing, Kuttner, Sider, Stewart and Sens in Gutzwiller (2005).

[73] See Tarán (1979).

[74] Cf. *AP* 9.434.3 (an epitaph on Theocritus) and Apollonides 11 GP = *AP* 9.422.3; probably later than this epigram is Paul the Silentiary 5.258.1 and Agathias 5.280.1.

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collection parallels a reader's progress with the mathematically themed events in an imagined Philinna's life: as a youth she plays with her age-mates and later is buried by her remaining family. Given the epigrams on dividing up walnuts and apples (14.116–20), the description of her offspring as the 'fruit of her womb' (καρπὸν . . . λαγόνων, *AP* 14.125.2) frames the calculation as following the same rubric as those that began the collection: the topic is new, but the arithmetical process will be the same as before. In a similar vein, 14.120 begins as a poem on dividing walnuts following 14.116, but by the end of the poem it has resumed a focus on the Graces and the Muses, echoing 14.3. Likewise, the dual focus of 14.124 on astronomy and the lifespan of an unnamed man echoes the language of the Diophantus epigram. The child of the unnamed man is also 'late-born' (τηλύγετον, *AP* 14.124.6), he sees his child (and wife) perish (7–8), and then he attains the end of life (βίου . . . τέρμα περήσεις, 9; cf. 14.126.10 above). Represented as a prediction, though, its future tenses invert the funerary finality with which Diophantus' life is laid out. There is little to determine which poem has priority. Important rather is the shared language echoing across the collection. It points to an editorial arrangement that expects readers to move through the collection, make connections and read the compositions in a similar manner to other literary anthologies, in addition to possibly extracting a poem for educative or socially competitive purposes.

One further theme in the collection that has (to the best of my knowledge) received no attention is the focus on family relations. It is not just the inheritance for children, the number of offspring or family members that must be calculated. Three extant poems have a more marked sense of familial connection.

ἁ Κύπρις τὸν Ἔρωτα κατηφιόωντα προσηύδα·
τίπτε τοι, ὦ τέκος, ἄλγος ἐπέχραεν; ὃς δ' ἀπάμειπτο·

(*AP* 14.3.1–2)

Cyprus addressed downcast Eros: 'what grievance touches upon you?' He answered . . .

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τίπτε με τῶν καρύων ἕνεκεν πληγῇσι πιέζεις,
ὦ μῆτερ; τάδε πάντα καλαὶ διεμοιρήσαντο
παρθένοι.

(*AP* 14.116.1–3)

Why, mother, do you distress me with blows on account of the walnuts? All these the beautiful maidens divided up.

ποῦ σοι μῆλα βέβηκεν, ἐμὸν τέκος; ἕκτα μὲν Ἰνὼ
δοιὰ καὶ ὀγδοάτην μοῖραν ἔχει Σεμέλη·

(*AP* 14.117.1–2)

Where have the apples gone, my child? Ino has twice a sixth share and Semele an eighth.

The mother asks an initial question which prompts the delineation, and then the child outlines the proportions but does not offer the calculation. Embedded alongside the intertwining of arithmetical and literary and generic allusion is a frame that presents the arithmetical challenge as one exchanged between mother and child, in which the child requires help with resolving the ratios. Since this occurs in both hexameter and elegiac compositions it is reasonable to think that there is an underlying explanation for the shared frame (whether they are the product of multiple authors, or the concerted variation of a single author).

An anonymous poem preserved in an appendix to the *Planudean Anthology* helps to shed light on this framing and its connection to arithmetical problems.

ἡμίονος καὶ ὄνος φορέουσαι σῖτον ἔβαινον·
αὐτὰρ ὄνος στενάχιζεν ἐπ᾽ ἄχθεϊ φόρτου ἑοῖς·
τὴν δὲ βαρυστενάχουσαν ἰδοῦσ᾽ ἐρέεινεν ἐκείνη·
μῆτερ, τί κλαίουσ᾽ ὀλοφύρεαι, ἠύτε κούρη;
εἰ μέτρον ἓν μοι δοίης, διπλάσιον σέθεν ἦρα·
εἰ δὲ ἓν ἀντιλάβοις, πάντως ἰσότητα φυλάξεις.
εἰπὲ τὸ μέτρον, ἄριστε γεωμετρίης ἐπίστορ.

(Cougny III, 563 = Jacobs, Appendix 26)

A mule and an ass plodded along carrying food; but the ass groaned at the weight of her cargo. Seeing her groaning deeply she asked: 'Mother, why do you cry and lament like a girl? If you were to give me one measure, I would carry twice as much as you; if you were to take one from me, you would preserve equity entirely.' Tell me the measure, o greatest one skilled in geometry! (D + 1 = 2 (M – 1); D – 1 = M + 1: D = daughter's cargo; M = mother's cargo)

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The poem is recorded as being addressed to Euclid and, although he is not mentioned, this is supported by the final words of the poem: Euclid would be a likely candidate for the title of best geometer in the ancient mind. While the poem is ostensibly a conversation between a mule and an ass, a further operative frame emerges in verse four, which forms a hinge between the set-up and the arithmetic. It heightens the language of lament from the previous two lines and employs the simile used by Achilles to address the petulant Patroclus in the *Iliad* (16.7), in order to imply a parental association between the mule and ass. The arithmetic, however, is confined to verses 5–6, where there is no language to distinguish it as particularly poetic or to locate it within the framework of a mother-and-child relationship, to say nothing of implicating it as the words of a talking mule. Those two verses are reminiscent of two poems from Book 14.[75]

δός μοι δέκα μνᾶς, καὶ τριπλοῦς σοῦ γίνομαι.
κἀγὼ λαβὼν σοῦ τὰς ἴσας σοῦ πενταπλοῦς.

(*AP* 14.145)

Give me ten minas and I am three-times you; and if I [the other speaker] get the same amount from you, I am five-times you. (A + 10 = 3(B – 10); B + 10 = 5(A – 10); A = speaker one; B = speaker two)

The fact that this sort of arithmetical challenge circulated freely suggests that the poet of the verses addressed to Euclid has surrounded a core arithmetic challenge with lines that imbue (or at least seek to imbue) the arithmetic with a literary quality and contextualise it as an exchange between mother and child.[76] It is external, supporting evidence for an author embedding within the poems their context of use as well as for an author setting arithmetic within the frame of a maternal exchange.

These three arithmetical poems are placed as the second (*AP* 14.116), third (14.117) and fifth poems (14.3) of the Metrodoran

[75] One of which is a modified version of the other. In *AP* 14.146 τριπλοῦς is replaced with διπλοῦς and πενταπλοῦς by τετραπλοῦς. Cf. *AP* 14.51.

[76] Arithmetical problems in this form are dealt with by Diophantus at I.15. That *AP* 14.145–6 represent a somewhat more free-floating form of calculation may be inferred by the fact that there are no *scholia* elucidating the problems, which accompany the majority of poems from the Metrodoran collection. The similar type represented by *AP* 14.51 was known to Olympiodorus 4.8.43–9, but as the inscriptions on statues.

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collection. The fifth poem in Metrodorus' collection thus pointedly varies the theme of the first two: *AP* 14.116 described walnuts divided by a group of maidens in hexameter, *AP* 14.117 addressed the division of apples, but this time by Corinthian women in elegiacs, and then *AP* 14.3 combines the use of hexameter with a return to the topic of apples. Accordingly, three of the five opening poems of the original Metrodoran collection frame the exchange of arithmetical problems as a maternal matter, the third even doing so archetypally in the use of gods, as well as of the eternal child, Eros. The fact that the maternal framing is intentional is supported by the identity of the author or editor Metrodorus. Francesco Grillo has recently shown that it is difficult to identify the Metrodorus mentioned in *AP*; through a combination of scholarly mistakes and wishful thinking a range of figures have been suggested, but none can be proposed with any degree of certainty.[77] Buffière raised the possibility that the name may be a pseudonym, although he is not explicit why 'for an author of problems in verse, it would not be unwelcome'.[78] I assume him to have had in mind a *Μετρόδωρος, which characterise the collection as a gift (δῶρον) of measures (μέτρα). That meaning may have been intended on the aural level, but the spelling Μητρόδωρος speaks against it. Nevertheless, Μητρόδωρος already makes sense as a pseudonym playing an etymological name game: just like the arithmetical education framed in the opening poems, the collection itself is a 'mother's gift' (μητρο-, δῶρον).

The focus on the maternal, to my mind, encapsulates the unique nature of the arithmetical poems for which I have been arguing. On a pragmatic reading, since mothers would have been expected to care for infants, the framework of mother–child interactions mirrors the probable reality of early education, and it may imply the pedagogical function of the poems. According to Plato in the *Laws*, λογιστική is part of their early education, while in the second book of the *Republic* (377c) he charges mothers with teaching children through (the approved) myths. Arithmetic

[77] Grillo (2019).
[78] '[P]our un auteur de problèmes en vers, il ne serait pas mal venu': Buffière (1970) 37.

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cloaked in mythical dress would seem to be a particular maternal form of early education. Yet their function only partially explains the maternal framing; many of the poems do not frame their problem as an exchange between two people. As I argued in the preceding section, the repertoire of the elite as perceived by Ausonius included displays of arithmetic (preferably in verse) but also a proficient grip on the numerical nature of the late antique literary and cultural inheritance, and the reader brings these to bear in approaching, solving and appreciating the arithmetical epigrams. Ausonius' conservative cultural outlook is metaphorised in the maternal framing of the arithmetical poems. The connection between mother and child not only provides a continually valid context in which to place the poems, it also implies an unbroken lineage transmitting the traditions of antiquity to the subsequent generations. Indeed, individual poems in the collection pay close attention to the literary past, looking for legitimation within pre-existing literary forms for their use of arithmetic in verse. That it is a maternal as opposed to a paternal relationship arguably further emphasises the conserving of the tradition unchanged.[79] In each case, moreover, either the child is expected to answer, or they provide only the series of equations before the poem concludes, without the maternal voice resuming. As the reader identifies the proportions embedded in the verses, they take on the role of the child, aiming both to solve arithmetic problems and to discern and construct the underlying meaning of the poem from its constituents.

Thus, the pseudonym Metrodorus figures the cultural exchange across generations in the ambiguity of the μητρο- stem, since it could index either a subjective genitive (the gift the mother gives) or an object genitive (the gift the mother receives). As educational poems they would be given from parents to children, but equally that education can be repaid and reproduced, as demonstrated by *AP* 14.3, in which Eros gives apples (read perhaps: new compositions) to Aphrodite as a gift. The thematic shape of the

[79] As Leitao (2012) chapter 6 has well demonstrated, male pregnancy was an operative image for conceiving of literary production and authorship. The collection's avoidance of the male frame in favour of the focus on motherhood dwells on intellectual transmission as opposed to the creation of novel ideas.

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Metrodoran collection, in short, associates the interpreting and deciphering of the arithmetic problems with the core pattern of generational cultural transmission and preservation at large. Although the poems are innovative in their reworking of the literary past and integration of arithmetic, the collection presents them as deeply traditional.

4.4 Arithmetical Poetry beyond Late Antiquity

The precise date of the Metrodoran collection is difficult to ascertain, although I have suggested that the compositions' investment in the past and the involvement they demand from the reader make most sense within a late antique literary context and that this conservative literary approach is also indexed by the form of the collection. In the concluding section of this chapter I want to emphasise that the appreciation of these poems and their editorial engagement does not end with the late antique collection of Metrodorus. Rather, it can be observed in the final stages of the *Palatine Anthology*'s formation. It, too, exhibits a conscious arrangement of the poems aware of their literary and arithmetical significance.

On the broadest level, it is clear that the arithmetic poems were purposefully set in a book alongside both riddles and oracles. While it might be thought that arithmetical poems fit uneasily with riddles and oracles, there is a deep literary logic to the combination. Consider again Herodotus' first oracle: it exhibits generic aspects of riddles and of arithmetic. On the one hand, the Pythia's claim to know the number of the sands – οἶδα δ' ἐγὼ ψάμμου τ' ἀριθμόν (Hdt. 1.47) – ascribes to her numerical abilities, whereas the further *adynaton* of hearing the dumb (κωφοῦ συνίημι) and the subsequent mixing of expected categories (tortoise and lamb: κραταιρίνοιο χελώνης | . . . ἅμ' ἀρνείοισι κρέεσσιν) is reminiscent of the paradoxes that riddles offer to their audiences to (re)solve. Numbers are also part of the riddle genre, which can be seen in those collected in Book 14.[80] The similarity of these poems is aided by the shared

[80] Cf. *AP* 14.14, 20, 59, 64, 101, 105, 106. The connection is seen already with the riddle of the sphinx; see Taub (2017) 25–6.

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metrical form: oracles are invariably in hexameter, while many riddles and arithmetic problems are as well.[81] An earlier parallel for the mixing of riddles and arithmetic poetry in *AP* 14 can be found in the collection of Latin riddles by Symphosius, which exhibits the influence of Ausonius' *Griphus* in its prefatory material and the many three-line poems.[82] The author of that collection evidently saw a link between Ausonius' reflection on the numerical aspects of culture and the nature of his riddles. As well as a formal dialogue between oracles, riddles and arithmetic problems, there is also a shared intellectual challenge in that they all require reader interpretation. With riddles and oracles, this usually requires lateral thinking with regards to the description of an object and the unravelling of the poem's use of, *inter alia*, metonymy and double meaning, whereas the arithmetical poems require the objects to be treated 'laterally' as numbers or ratios.[83] What binds these generic forms is the involvement of the reader in the construction of meaning and exercising of their intellectual grasp of Graeco-Roman culture. In this sense, they all fall under the category of 'how children in the past learnt', as described by the book's introductory lemma.

In addition to being combined with riddles and oracles, arithmetical poems also take pride of place as the first four compositions in the book. The transmission history of the opening poems of *AP* 14 and its relation to the opening of Metrodorus' collection require discussion, since scholarship on this point contains much supposition. The opening poem of *AP* 14 appears to be attributed to one Socrates by the scholiast, since it is preceded by the lemma Σωκράτους, but the scholiast says nothing more about him. Paul Tannery, in his edition of the works of Diophantus, which included the arithmetical poems, identified the Socrates as an epigrammatist mentioned by Diogenes Laertius (2.47), but again nothing more is known about this figure.[84] Whether the two figures are

[81] Hexameter riddles: *AP* 14.19, 22, 24, 25, 37, 40, 64, 101, 111; hexameter arithmetic epigrams: *AP* 14.1, 2, 3, 4, 6, 8, 48, 49, 116, 118, 120, 124, 127, 129, 130, 135, 136, 139, 140, 145, 146.

[82] For the extent of the connection see Leary (2014) 4–6.

[83] For a discussion of what constitutes a riddle see Luz (2013), with further bibliography. The same strategies apply to the deciphering of oracles.

[84] Tannery (1895) II, xi–xii.

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the same person is a moot point. What there is certainly no external evidence for is that *AP* 14.1 is the first poem of a collection by this Socrates, as Tannery suggests, nor that his collection shared poems with Metrodorus'.[85] Tannery's reasoning is as follows. The marginal account that accompanies the core arithmetical poems is lacking for those that open *AP* 14. Therefore, those poems must have been shared by Socrates' collection and the copyist must have not wanted to add the further Metrodoran numbering and instead stuck with Socrates' ordering. The Socratean numbering relies on reading the ordinal designation at the beginning of *AP* 14 (α at 14.1, β at 14.2, γ at 14.3) as coterminous with the order in Socrates' collection. Tannery's proposal was developed by Félix Buffière, who identified *AP* 14.2 as Metrodorus' inaugural poem (followed by *AP* 14.116–18), with *AP* 14.3 occupying the fifth place in the collection and *AP* 14.4, like 14.1, belonging to Socrates' collection only.[86]

However, in addition to there simply being no evidence for this collection, nor of an independent Socratean numbering, the marginal numbering of *AP* 14.6 (κη΄ = 28) and 14.7 (ιθ΄ = 19) show that the arithmetical poems outside the preserved core were still identified by their number in the Metrodoran collection. The argument that the prime position of 14.1, and the second position of 14.2 (etc.), reflects the position *also* in a Socratean collection cannot be proved or disproved given that the numbering in each case is the same. The arithmetical *scholia* certainly help to determine inclusion in Metrodorus' collection, but this is not a watertight rule.[87] Nor, importantly, is the inverse – that those without *scholia* are from the Socratean collection – a necessary consequence. The existence of a Socratean collection ultimately relies solely on the lemma Σωκράτους immediately following the preface to the book: a particularly precarious castle of sand.[88]

[85] Thus, I cannot follow the argument of Grillo (2021) – which came to my attention too late to fully incorporate here – that this Socrates composed *AP* 14.1 and that it shows him to have Pythagorising Middle Platonic affiliations.

[86] Buffière (1970) 35–6. His reasoning rests on there being no accompanying arithmetical *scholia*.

[87] Certainly, *AP* 14.145–6 do not have *scholia*, but as I have demonstrated they certainly belong to the tradition of arithmetical poems.

[88] The lemma Σωκράτους is preceded by a dicolon. It has been argued that the position of the lemma indicates that more than the opening poem belongs to a collection by one

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When the spectre of the Socratean collection is removed, it can be said that the first poem offers no clear signs of belonging to Metrodorus' collection, but neither does it exhibit anything alien to the collection. Nonetheless, it is my working assumption that it is not part of the Metrodoran collection. *AP* 14.2–4, however, bear all the hallmarks of being from Metrodorus' collection, since they are closely related in form and theme and 14.2–3 are even accompanied by arithmetical *scholia*. Before considering the introductory poem of *AP* 14 and its programmatic aspects, then, I want to consider *AP* 14.2–4 and suggest that they have been moved from the Metrodoran collection to the beginning of the book in order also to have a programmatic function. In other words, I am arguing that the later compiler is reading these poems and actively arranging them into a poetic-cum-arithmetical programme.

First is *AP* 14.2.

Παλλὰς ἐγὼ χρυσῆ σφυρήλατος· αὐτὰρ ὁ χρυσὸς
αἰζηῶν πέλεται δῶρον ἀοιδοπόλων.
ἥμισυ μὲν χρυσοῖο Χαρίσιος, ὀγδοάτην δὲ
Θέσπις καὶ δεκάτην μοῖραν ἔδωκε Σόλων·
αὐτὰρ ἐεικοστὴν Θεμίσων· τὰ δὲ λοιπὰ τάλαντα
ἐννέα καὶ τέχνη δῶρον Ἀριστοδίκου.

(*AP* 14.2)

I am Pallas beaten out in gold; but the gold comes as a gift from strong poets. Charisius gave a half, Thespis gave an eighth share and Solon a tenth share, but Themison a twentieth. The remaining nine talents and the skill is the gift of Aristodicus. (T = 9 + T(½ + ⅛ + 1/10 + 1/20); T = total number of talents)

The speaking statue explains the ratios of gold given for the construction of the statue which was (presumably) made by

Socrates; see Tannery (1894); Tannery (1895) II, xii; Buffière (1970) 34–5. At any rate, given that *AP* 14.2 has its own lemma εἰς ἄγαλμα Παλλάδος ('on a statue of Athena'), I think only *AP* 14.1 could be attributed to a Socrates. Here I differ from Kwapisz (2020a) 462, who takes the dicolon and lemma to cover a larger section than just the opening epigram. The habit of positioning a lemma introduced by a dicolon at the end of the preceding line in order to introduce a subsequent epigram is evidenced elsewhere in the MS, such as before *AP* 14.117 and 118. The paratextual notes in the MS beside *AP* 14.117 and 118 may be from a later hand than the opening lemma (although I find it hard to distinguish), but this does not necessarily imply that the use of the dicolon itself differs in the case of later additions. I have an unsubstantiated suspicion that the presence of Σωκράτους could be an identification of the preface's debt to the Platonic idea of education which involved λογιστική that I noted in the introduction to the chapter. It is a thought which has now been developed by Kwapisz (2020a) 480–1.

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Aristodicus. As Jan Kwapisz has brilliantly elucidated, the epigram can be read programmatically, since the contributors are designated as poets and Solon and Thespis are even recognisable figures. Since this was most probably Metrodorus' opening poem, it self-referentially indexes the collection as formed by the contribution of numerous poets and at the same time represents that act of (editorial) combination as an arithmetical operation.[89] The entire material form of the statue is a gift from numerous poets, and in opening Metrodorus' collection it would likewise have signalled the collection as a gift. If my argument about the maternal framing of the collection is correct, then Athena as a female goddess who is renowned for her wisdom and knowledge of many crafts makes this a collection that has hypostasised female intellectual prowess as its frontispiece, so to speak. As a virgin goddess she is not a mother of children; her progeny is rather the mathematical abilities transmitted in the collection. In any case, in moving the poem out of the Metrodoran collection to the opening of the book, the editor of *AP* 14 retains the epigram's programmatic force and its use of numerical combination to imbue literary significance.

In the case of *AP* 14.3 there is also recontextualisation at work from the Metrodoran collection into the wider book, but it occurs in tandem with *AP* 14.4. It is not assigned to the Metrodoran collection, because it lacks accompanying *scholia*, but is placed in the supposed Socratean collection by Buffière.[90]

ἁ Κύπρις τὸν Ἔρωτα κατηφιόωντα προσηύδα·
τίπτε τοι, ὦ τέκος, ἄλγος ἐπέχραεν; ὃς δ' ἀπάμειπτο·
Πιερίδες μοι μῆλα διήρπασαν ἄλλυδις ἄλλη
αἰνύμεναι κόλποιο, τὰ δὴ φέρον ἐξ Ἑλικῶνος.
Κλειὼ μὲν μήλων πέμπτον λάβε, δωδέκατον δὲ
Εὐτέρπη· ἀτὰρ ὀγδοάτην λάχε δῖα Θάλεια·
Μελπομένη δ' εἰκοστὸν ἀπαίνυτο, Τερψιχόρη δὲ
τέτρατον· ἑβδομάτην δ' Ἐρατὼ μετεκίαθε μοίρην·
ἡ δὲ τριηκόντων με Πολύμνια νόσφισε μήλων,
Οὐρανίη δ' ἑκατόν τε καὶ εἴκοσι· Καλλιόπη δὲ
βριθομένη μήλοισι τριηκοσίοισι βέβηκε.

[89] Kwapisz (2020a) 462–4. [90] Buffière (1970) 36.

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σοὶ δ᾽ ἄρα κουφοτέρῃσιν ἐγὼ σὺν χερσὶν ἱκάνω
πεντήκοντα φέρων τάδε λείψανα μῆλα θεάων.

(*AP* 14.3)

Cypris addressed downcast Eros: 'what grievance touches upon you?' He answered: 'The Pierides [Muses] snatched from me the apples I was bringing from Helicon, each one for the other, seizing them from my garment-fold. Clio took a fifth of the apples and Euterpe a twelfth; still, godly Thalea took an eighth as her lot. Melpomene took away a twentieth and Terpsichore a fourth. Erato following next took the seventh share. Polyhymnia deprived me of thirty apples, Urania one hundred and twenty. Calliope went off weighed down with three hundred apples and so I come to you with my hands lighter, carrying these fifty apples left over by the goddesses.' (A = 500 + A(⅕ + 1/12 + ⅛ + 1/20 + ¼ + 1/7); A = total number of apples)

Αὐγείην ἐρέεινε μέγα σθένος Ἀλκεΐδαο
πληθὺν βουκολίων διζήμενος· ὃς δ᾽ ἀπάμειπτο·
ἀμφὶ μὲν Ἀλφειοῖο ῥοάς, φίλος, ἥμισυ τῶνδε·
μοίρη δ᾽ ὀγδοάτη ὄχθον Κρόνου ἀμφινέμονται·
δωδεκάτη δ᾽ ἀπάνευθε Ταραξίπποιο παρ᾽ ἱρόν·
ἀμφὶ δ᾽ ἄρ᾽ Ἤλιδα δῖαν ἐεικοστὴ νεμέθονται·
αὐτὰρ ἐν Ἀρκαδίῃ γε τριηκοστὴν προλέλοιπα·
λοιπὰς δ᾽ αὖ λεύσσεις ἀγέλας τόδε πεντήκοντα.

(*AP* 14.4)

The great strength of Heracles questioned Augeus, inquiring about the multitude of the herds of cows. He replied: 'Friend, around the streams of Alpheus are half of them; the eighth share pasture about the hill of Cronos; a twelfth far from the shrine of Taraxippus; a twentieth graze in divine Elis; but I left a thirtieth in Arcadia. Here you see the remaining herds are this fifty.' (H = 50 + H(½ + ⅛ + 1/12 + 1/20 + 1/30); H = herds)

The poems bear strong similarities. They are framed as a dialogue and conclude with an amount of fifty left for the addressee. As I noted above, the application of λογιστική involved *mêlitês* numbers (μηλίτας . . . ἀριθμούς). This could be interpreted as referring to either apples or herds. By setting these two poems side by side, the compiler knowingly alludes to and rings the changes on the debate about what *mêlitês* numbers in poetry might look like.[91]

Moreover, the two poems resonate on the metapoetic level when read at the opening of Book 14. In Meleager's *Garland*, the

[91] That the meaning was ambiguous is shown by the *scholium* to *Charmides*, which sees the need to clarify that the so-called μηλίτας . . . ἀριθμούς ('*mēlites* numbers') refer to 'those having to do with flocks' (τοὺς δ᾽ ἐπὶ ποίμνης, *Schol. Charm.* 165e).

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epigrams that he weaves into a collection are described in his introductory poem mostly by comparisons to flowers, but also by comparison to fruits such as 'intoxicating grapes' (μαινάδα βότρυν, 1.25 *HE* = *AP* 4.25; of Hegesippus), 'sweet apple' (γλυκύμηλον, 27; of Diotimus) and 'wild pear' (ἀχράδα, 1.30; of Simias). Likewise in Philip's *Garland*, modelled on Meleager's, he states that he has formed the collection for the reader by 'plucking the flowers [for you] from Helicon, having cut the first-growing buds of famous-wooded Pieria' (ἄνθεά σοι δρέψας Ἑλικώνια καὶ κλυτοδένδρου | Πιερίης κείρας πρωτοφύτους κάλυκας, 1.1–2 GP = *AP* 4.2.1–2). The apples that Eros takes from Helicon – and which survive the division of the Pierian Muses – stand in for the arithmetical problems that the editor has sourced and that the poem introduces.[92] A similar reading works for *AP* 14.4, too.[93] Multiple epigrammatic variations composed on Myron's cow were subsequently conceptualised as a 'herd of poems' in need of rounding up.[94] A further epigram by Artemidorus imagines a collection of bucolic poetry in a similar manner: βουκολικαὶ Μοῖσαι σποράδες ποκά, νῦν δ' ἅμα πᾶσαι | ἐντὶ μιᾶς μάνδρας, ἐντὶ μιᾶς ἀγέλας ('Once the Bucolic Muses were scattered, but now they are all together in one fold, in one herd', 1 *FGE*).[95] The poem can be read as a competing programmatic introduction to an arithmetical poetry collection that instead conceptualises the poems as a herd, by drawing on a pre-existing

[92] Although similar poems conclude with a portion remaining to the speaker or main subject (*AP* 14.116–20), this is the only poem in which the apples are selected by Eros and left behind by the Muses. Since, on my count, there are forty-three arithmetical poems in Book 14 (excluding *AP* 14.1), it is possible that the remaining fifty apples with which the poem concludes refer to a collection of *circa* fifty poems. The deictic τάδε, although spoken to Aphrodite, might also function to introduce the following poems within the context of a poetry book collection. Deictics in book epigrams implying textual format occur already in the Hellenistic period; see e.g. Sens (2015) 43 n.8. For the poems in a collection indexing their own place within it and the reader's progress through it, cf. Höschele (2007). The Muses' arithmetical intervention would metaphorically produce the collection of arithmetical poems.

[93] As Kwapisz (2020a) 464–72 has thoroughly demonstrated, moreover, this poem also allusively engages which similar passages in the *Iliad*, Theocritus *Idyll* 25 and Quintus of Smyrna's *Posthomerica*.

[94] See *AP* 9.713–42, 793–8. For a detailed discussion of the epigrams on Myron's cow see Gutzwiller (1998) 245–50 and Squire (2010b), esp. 616–24.

[95] This imagery was also understood in the Byzantine period; a Byzantine epigram on Theocritus' bucolic corpus uses much the same metaphor; see Gow (1952) II, 550.

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motif for editorial activity and on a Homeric motif deeply connected to counting. The position of both poems in juxtaposition at the opening of the book is a (further) programmatic placement by the later compiler.[96]

Furthermore, *AP* 14.4 displays an approach to arithmetic in poetry observable in Archimedes' *Cattle Problem.* As I demonstrated in Chapter 3, Archimedes is a keen reader of Homer's poetics of enumeration, since he combines Homer's reflection on whether he has the capacity to recall the entire πληθύς at Troy with the imagery preceding the Invocation and Catalogue that likens accounting for the troops to the counting and controlling of herds. Regardless of whether in the second verse the poet is cognizant of, and refers back to, Archimedes' πληθύν Ἠελίοιο βοῶν, ὦ ξεῖνε, μέτρησον ('the multitude of the Cattle of the Sun calculate, O stranger', 1), the verse-initial πληθύν with the genitive βουκολίων undoubtedly shows their awareness of Homer's archetypal exploration of handling numbers in poetry. Not insignificantly, then, the programmatic allusion to the Invocation prior to the Catalogue of Ships also informs the final arithmetical poem of the book. As I have noted, the poet's invocation in *Iliad* 2 was adapted into a pointedly numerical challenge in the *Contest of Homer and Hesiod*. Remarkably, those same verses are appended immediately after the Metrodoran section.

ἕπτ' ἔσαν μαλεροῦ πυρὸς ἐσχάραι, ἐν δὲ ἑκάστῃ
πεντήκοντ' ὀβελοί, περὶ δὲ κρέα πεντήκοντα·
τρὶς δὲ τριηκόσιοι περὶ ἓν κρέας ἦσαν Ἀχαιοί.

(*AP* 14.147)

There were seven hearths of fierce fire, in each fifty spits and about each [fire] fifty cuts of meat; there were three times three hundred Achaeans around each cut. (7 × 50 × 900 = 315,000)

This poem is contextualised in the manuscripts with the following comments: Ὅμηρος Ἡσιόδῳ ἐρωτήσαντι πόσον τὸ τῶν Ἑλλήνων πλῆθος τὸ κατὰ τῆς Ἰλίου στρατεῦσαν ('Homer, to Hesiod after he asked how great was the number of Greeks that campaigned against Ilium'). The emphasis on the πλῆθος and the suggestion

[96] One means of organising an anthology was to order the poems alphabetically; orthographically, both *AP* 14.3 and 14.4 have a claim to have opened a sequence of poems.

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of the question-and-answer format of Homer and Hesiod's exchanges make it plausible that the verses were drawn directly from the *Contest*.[97] So too, they make the cultural value of the arithmetic poems clear in that they give their combination of numerical calculation and poetry the greatest possible pedigree. Important for my argument, however, is its concluding position following the arithmetic epigrams; the lines take on new meaning when placed in Book 14. Again, the reworking plays on the two possibilities raised in the Invocation to the Muses, namely the recalling and naming of the πληθύς and the counting of it. It takes advantage of multiplication's ability to avoid the linear relationship between poetic content and poetic extension and reduces the much-prized 285 hexameters of the Catalogue of Ships to three verses. What is more, it looks back to the 'πληθύς of poems' programmatically introduced in *AP* 14.4 with a further allusion to Homer's counting in poetry. In terms of the arrangement of the collection in *AP* 14, placing lines that collapse the Catalogue of Ships into three verses at the end of a catalogue of arithmetical poems provides fitting metatextual closure: lines that end the need for a catalogue through calculation signal the end of a catalogue of calculations.[98]

Thus, there are signs that the compiler of Book 14 appreciated the significance of arithmetical poems as products of a simultaneously arithmetical and literary education and sought to reflect that in their arrangement of the book. This approach is nowhere more evident than in the opening poem of the book, which I take to be attributed to one Socrates and which is most probably not from the Metrodoran collection.

[97] For a thorough explanation why these are likely to be the original verses from the *Contest*, cf. Kwapisz (2020b).

[98] Given that *AP* 14.4 (and indeed 14.1) are equally self-conscious regarding their combination of arithmetic and poetry, it may be that they were intended to bookend a collection of arithmetic poetry together with *AP* 14.147. Indeed, were it not for the three oracles that follow the *contest* poem, this proposition would apply to the arrangement of Book 14. Their heterogeneity in date and historicity – 14.148 is for Julian, 14.150 is for the mythical Aegeus – and incompleteness (cf. 14.149) does not show the same cohesiveness as the oracles preserved in the core of Book 14, the majority of which are attributed to the Pythia and might well have come from a prior collection. It is highly plausible that some previous version of Book 14 concluded with *AP* 14.147, with three further poems being placed at the end of the collection at a later point, and that this might – but need not – have coincided with the addition of the oracles and riddles.

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ὄλβιε Πυθαγόρη, Μουσέων Ἑλικώνιον ἔρνος,
εἰπέ μοι εἰρομένῳ, ὁπόσοι σοφίης κατ᾽ ἀγῶνα
σοῖσι δόμοισιν ἔασιν ἀεθλεύοντες ἄριστα.
τοιγὰρ ἐγὼν εἴποιμι, Πολύκρατες· ἡμίσεες μὲν
ἀμφὶ καλὰ σπεύδουσι μαθήματα· τέτρατοι αὖτε
ἀθανάτου φύσεως πεπονήαται· ἑβδομάτοις δὲ
σιγὴ πᾶσα μέμηλε καὶ ἄφθιτοι ἔνδοθι μῦθοι·
τρεῖς δὲ γυναῖκες ἔασι, Θεανὼ δ᾽ ἔξοχος ἄλλων.
τόσσους Πιερίδων ὑποφήτορας αὐτὸς ἀγινῶ.

(*AP* 14.1)

'Fortunate Pythagoras, Heliconian offspring of the Muses, tell me this thing I ask: how many in your house are competing in the contest of wisdom excellently?'

'Well then, I will tell you, Polycrates: half pay serious attention concerning fine teachings; a quarter again have laboured over immortal nature; and a seventh practise complete silence and internal unchanging discourses. There are also three women, Theano pre-eminent above the others. These are how many interpreters of the Muses I lead.' (G – W = G(½ + ¼ + ⅐): G = group; W = women = 3)

Polycrates was the tyrant of Samos, and Pythagoras one of its most famous inhabitants. They were contemporaries – Pythagoras left Samos because of Polycrates' rule – and this poem imagines a dialogue between them. The opening verse's address to Pythagoras as an offspring of the Muses connects a foundational figure of mathematics and numerology to poetry, which the Muses inspire. The term ἔρνος – literally, a 'sprout' or 'offshoot' of a plant – subordinates Pythagoras to the Muses. The collection which intertwines poetry and arithmetic contains in its opening gambit the claim that mathematical interests are dependent on, and develop out of, the traditional cultural practices which the Muses represent (that is, poetry, but also music, history and astronomy). In terms of form, the dialogue also makes clear the question-and-answer format that is implicit in many of the subsequent poems, in that they are to be posed by one person to another. Most notable about the poem, however, is its meta-pedagogical stance. As commentators have observed, the groupings in the poem seem to reflect the division of Pythagoreans found in some sources into the ἀκουστικοί, who meditate in silence, the μαθηματικοί, studying sciences, and the φυσικοί, contemplating the nature of the

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universe.[99] Pythagoras enumerates those in his circle, and the different forms of enquiry that they make, in a poem that introduces a collection which contains arithmetical poetry (as well as riddles and oracles) gathered together for educational purposes.[100] The mix of numerical and poetic learning is thematised as well in that μαθήματα could refer to 'lessons' or 'knowledge' broadly conceived but also had the specific sense of 'mathematical sciences' (LSJ *s.v.* μάθημα A.3). These 'Pythagorean' students within the poem have a range of interests that encompass the cultural and the mathematical, but they are nevertheless all interpreters of the plural Muses (Πιερίδων). These students reflect the aim of the collection. The effect of reading through it is that one is initiated into the house of Pythagoras, a teacher of mathematics homegrown on Helicon, and that one is endowed not just with mathematical knowledge, but is in commune with all the Muses.

The Byzantine compiler's ordering shows that they too appreciated *AP* 14.1's self-reflexive comment on the dialogue between poetic and arithmetical learning; their positioning of the work at once emblematises and instigates the educational process of dealing with mathematics alongside the Muses. In other words, although probably placed in that location well after Graeco-Roman antiquity as commonly conceived, the poem nevertheless was seen to comment on and justify the significance of arithmetic poetry. Far from these poems being thought of as marginal literary experiments, the Byzantine compiler actively engaged with the significance of arithmetic in poetry. Similarly, I have argued in this chapter that the arithmetic poems themselves encapsulate

[99] Burkert (1972) 191–2, with n.6, suggests that this particular division is one of a number of artificial or secondary distinctions between the ἀκουστικοί and μαθηματικοί. Yet he also shows that there were many such divisions in circulation. Grillo (2021) notes that the division as described in the poem is only paralleled by the Middle Platonist Calvenus Taurus (*fl.* 145 CE), and so he dates the poem and the so-called Socratean collection to the second century. This rare division of Pythagorean groups need not be taken as serious and need not have Taurus in mind. I prefer to take the poem as appealing with a certain whimsy to a more general idea of the Pythagorean sect divided into groups with varying degrees of knowledge and with Pythagoras himself counting up his followers.

[100] Their total of 28, moreover, has particular Pythagorean resonance in being both a triangular number (the sum of the numbers 1–7) and a perfect number (the sum of its divisors; i.e. 1 + 2 + 4 + 7 + 14 = 28). The numbers that emerge from such poems, that is, are not always arbitrary. For further discussion and bibliography see Kwapisz (2020b) 476.

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a broader conversation between poetry and arithmetic in Late Antiquity. Individually and as a (Metrodoran) collection, the poems demonstrate how well arithmetic could not only be versified, but also presented and framed in a way that provides an additional means of enhancing poetry as an object of cultural value and social exchange. Whether it was arithmetical skill or cultural prestige, there was something to be gained by producing and appreciating the arithmetical aesthetics of these poems. The collection testifies that over the course of a millennium the practice of composing calculations in verse really did count for something.

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CONCLUSION

SUMMING UP POETRY

Rather than re-counting the arguments of the individual chapters in concluding this book, I want to return to the wider perspective of number in relation to poetry. From the preceding chapters there emerge three strands which are worth crystallising explicitly.

First, this study has exposed the multifarious ways in which counting and arithmetic were conceptualised within the cultured elites of antiquity. On the one hand, numbers have an important significatory power in that they sever the linear connection between quantity and the verbal means used to express it. Poets are aware of the reductive and expansive power of numbers, although they differ on the value and use of such compressions or extensions. Equally, there is an awareness of the perceived tension of counting and arithmetic within poetic discourse, whether it is the unsolvable *Cattle Problem*, the accounting of Catullus' critics or Leonides' isopsephy. The underlying concern is how number as an evaluative system interacts with a verbal system of expression. No clear answers have emerged from the poets over the course of this study, and I think this is because they are more interested in probing rather than solving the overlap of the numerical and the verbal. In terms of the wider cultural significance of these poems, most important to observe is that enumeration is part of the social prestige involved in reading which is found in many of the poems, but which is explicitly noted by Ausonius when he distinguishes between those able and unable to interpret arithmetic wrapped in poetry. Undoubtedly, the majority of numerical thinking was not poetic and was confined to a standard set of calculations useful for everyday life. This book has nevertheless highlighted that counting and arithmetic did have a cultural capital that distinguished between those with and without the requisite abilities, and individual poems are poised to test those abilities. Indeed, the range of poems that I have addressed has made that distinction at differing

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levels of arithmetic proficiency: the many ratios of the *Cattle Problem* stand in stark contrast to the arithmetical poems, as again does isopsephic counting. The overarching importance of the poems discussed in this book for a history of numeracy is that they provide a new perspective on the relationship between number and culture. Unlike the didactic project of Euclid's *Elements* Books 7–10 or Nicomachus' later *Introduction to Arithmetic* and unlike Diophantus' dense *Arithmetica*, they evidence writers actively interrogating the place of enumeration and computation within Graeco-Roman culture. The poems explore the cultural value of numbers.

By the same token, of course, the added cultural capital of numbers in poetry can have an exclusionary effect. While I hope to have demonstrated the literary sophistication of Archimedes' and Leonides' poetry and the later arithmetical poems, they were not works that had an extended reception in antiquity. Their thorough embracing of isopsephy and an arithmetical aesthetics made it difficult for some readers to 'solve' their calculating compositions and to take account of their intellectual stakes. Callimachus and Catullus, conversely, keep arithmetical challenges at arm's length and instead embed engagements with number within wider discourses about poetry, its form and critical appraisal. Canonical poets may be canonical precisely because their use of number was pitched towards the broadest readership, whereas a deeper engagement pushed other poets into relative obscurity. A rounded picture of this poetic practice, however, is only possible by setting canonical and obscure poetry side by side. This ultimately shows that poetry and number in Graeco-Roman antiquity coincided on many different levels and this encounter had a hand in determining the reception of that poetry.

The complex interaction between number and poetry also has an impact on common conceptions of Graeco-Roman poetry in the modern era. In contradistinction to the idea of poetry as something read and appreciated intellectually in the mind of the reader, the use of number and arithmetic underscores poetry as an action that is performed. Many of the poems that I have discussed in various ways require calculation. An operation must be carried out to produce information. When it comes to composing, Apollonius

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playfully constructs a hexameter which has been fashioned so as to signify a large number, and Catullus spotlights how composition can be numerical when the expression of his feelings morphs into, and enacts, computation. Reading poetry is also an operation. It is manifest in the case of Leonides, where words and letters must be converted into numbers and transformed into totals. The arithmetical poems in the *Palatine Anthology* highlight just how much calculation is an operation which readers enact in producing meaning from the written words before them. There survive examples of geometry in poetry, to be sure, such as the diagram sketched by Thales in Callimachus' first *Iambus*, the shapes described in Dionysius Periegetes' *Description of the Known World* (e.g. 175–80, 277–8, 620–2, 1130–1) or Longinus' reading of Homer as measuring out the cosmos through his similes (9.4–5).[1] However, they are aimed at spatialising and visualising what the poet wished to portray with words. Number, conversely, shows up the interactive aspect of poetry from the point of view of both composition and reception. This is evident in texts which are not solely about enumeration which one might describe as 'more canonical'. Callimachus' Reply represents a tradition of criticism in which poetry is submitted to numerical analysis. As a discourse, poetry is about listing, sorting, arranging and processing information (and nowhere more so than in the catalogic, archival *Aetia*); in short, poetry is accounting for the world. Rather than the world of numbers and letters progressing along two distinct intellectual paths in antiquity, then, approaching and appreciating poetry has a numerical aspect.

At the literary historical level, studying number and poetry over the course of antiquity has allowed me to plot out the rough image of a *tradition* of composing poetry on numerical themes. This book has combined passages that were both well known in antiquity and remain so to scholars in the field today with less well-known works and poetic habits. In and across individual chapters, nevertheless, 'central' poetic texts are aware of, resonate against and even respond to the same poetic-cum-mathematical concerns identifiable in 'marginal' works. And, vice versa,

[1] On Dionysius' geometrical imagery see Lightfoot (2014) 120–3, and on Longinus' see Porter (1992) 96–100.

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'marginal' poems develop their own shared numerical and arithmetical readings of 'central' texts. In navigating through the poetic inheritance, later poets engaging with number not only reread the canon as it was available to them, they began to create their own traditions of reference within it. A case already well known is the use of the *Odyssey* and the figure of Odysseus by Hellenistic and later geographers and historians. In articulating their own projects they both connected to and developed the presence of Odysseus within the literary tradition as well as creating a tradition of Odysseus 'the geographer'.[2] In a similar vein, this examination of the intersection of poetry and number has followed a series of poets as they take a numerical reading through the tradition and how, in the process, they have constructed what might be called a canon of numerical poetic moments. One facet of this 'tradition' is the reception of Callimachus. Despite his resistance to poetic criticism involving counting, Catullus and Leonides returned to his poetics in order to negotiate their own use of numbers. Likewise, the enumerations in *Iliad* 2 enjoy an arithmetical afterlife. Archimedes and the composer of an arithmetic epigram respond to and develop the poetic challenge of enumerating a large mass which Homer had first identified. Given that an arithmetical poem was likely interpolated in Diophantus' *Arithmetica* in addition to the enumerating epitaph on him found in *AP* 14, this could also be seen as the beginnings of a tradition. The same might be said of Catullus *c.* 1 and its echo in the preface to Ausonius' *Riddle of the Number Three*. The point, in any case, is that the patterns of thought in these works are not simply repeated across time, but rather that they constitute an intellectual project to which subsequent poets responded and contributed. This study has shored up numerical reflections in poetry as an operative discourse in the literary landscape. I hope it will provide a square and solid base for further studies: additional accounts await.

[2] For Eratosthenes' use of Odysseus cf. e.g. Strabo 1.2.15; for the Odyssean model in the *Periodos to Nicomedes* see 98–102; for Dionysius Periegetes' Odyssean aspects see Lightfoot (2014) 106 n.85; for historians' use see Marincola (2007).

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