To appear as Chapter 6 in Dresher, B. Elan & van der Hulst, Harry (eds). *The Oxford History of Phonology*. Oxford: Oxford University Press.

6 The Greco-Roman Tradition

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Abstract

The Greco-Roman grammatical tradition crystallized much of the linguistic metalanguage used today, either as the Greek forms or as Latin calques. Grammar came to account for any instance of language, spoken or written, and evolved from being a practical to a scientific discipline (Gk. τέχνη *tékhnē*, Lat. *ars*), with its own set of rules. Crucial observations and analytical tools in the organization of sounds—allophony, natural classes, accentuation, syllable structure and weight, phonological processes, morphophonological alternation, and abstract underlying bases—can be counted among the contributions of the ancient western grammarians, and phonological change was noted through citing older forms or censuring newer ones. The tradition subsequently formed the basis of medieval and later linguistics in Europe and further east, and many of its themes have persisted throughout linguistic history.

Keywords

Ancient Greek, Latin, grammarians, pronunciation, allophony, prosody, accentuation, syllable, phonological processes, morphophonological alternation

6.1 Introduction

Many of the terms used in modern phonological description and analysis—'prosody', 'syllable', 'consonant', 'tone', to name but a few—originate in the work of the Greek and subsequently Roman grammarians, where they find their first treatment in the western tradition. This chapter examines the phonological interests of those ancients, comparing the techniques they employed in analyzing sound structures to those which are used by present-day scholars, and noting the influence of ancient grammarians on later European thought (and areas in which their legacy was negligible).

The most important legacy of the Greco-Roman tradition is the appreciation of language science as an independent discipline requiring its own terminology, principles, and techniques, even if those undertaking it might be 'philosophers, logicians, rhetoricians, poets, historians, philologists, and literary critics, as well as bona fide grammarians' (Taylor 1995a: 84). As early as Plato (*Cra.* 431–32, *Sph.* 253a; fourth century BCE),[1] the study of the sounds of letters is the subject matter of τέχνη γραμματική *tékhnē grammatikḗ* 'craft/art of grammar' (reflecting the term's root γράμμα *grámma* 'letter'), before its scope broadened in later centuries (Householder 1995a: 92). Apollonius Dyscolus (second century CE) posits that language is rule-governed, and it is the job of grammatical analysis to discover these regularities and explain exceptions. He proposes a system of combinatorics whereby letters combine into syllables,[2] syllables into words, and words into sentences in which word meanings combine, essentially deriving a clear distinction between phonology, morphology, syntax, and semantics (Taylor 1995a: 87–8). The Roman tradition emerged out of an amalgamation of Stoic logical analysis of propositions and Alexandrian textual criticism (Law 2003c: 60), but also a bilingual Greek-Latin literary tradition where the forms used in reading and writing were consciously considered (Taylor 1995c: 103).

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[1] Except where indicated, abbreviations of Latin authors, works, collections, and editions cited are as per Glare's (1996) *Oxford Latin dictionary* (henceforth OLD). Greek authors, works, collections, and editions are as per Liddell, Scott, & Jones's (1996) *A Greek-English lexicon* (henceforth LSJ), aside from the grammarians (see list of editions and primary sources). Inscriptional forms are denoted in small capitals.

[2] See §0 for the use of the term 'letter'.

Ars grammatica 'grammar' came to be recognized as the first of the *artes liberales* 'liberal arts' in Rome (Martianus Capella, fifth century CE; Taylor 1995c: 104).[3]

Despite being the first aspect of language to be analyzed, phonetics/phonology is often viewed as 'a field in which there is little discernable history' in ancient times (Matthews 1994: 8), and phonology as we know it was not considered separately from pronunciation, orthography, metrics, and morphology in classical grammatical treatises.[4] However, these interests produced several phonological insights which have remained in the western grammatical tradition. Although the distinction between phonemic and allophonic sounds was not stated in this way, key aspects of the difference were clearly characterized; natural classes were identified and described; syllables were commonly discussed, and their importance in verse scansion provided the impetus for an understanding of syllable weight (or quantity); alternation was noted, although alternating stems were considered as paradigmatic patterns in the same way as non-alternating stems; phonological operations inserting/deleting/transposing/changing sounds were not distinguished from morphological ones, but there was a clear recognition that defined 'changes' in sound were required in diachronic and synchronic phonological processes; finally, they provide evidence for the chronology of developments by citing older forms or censuring newer ones.

A major problem in assessing the Greco-Roman contribution lies in the fact that much if not most of the linguistic literature of the time has failed to survive. For example, most of the great linguistic contributions of Marcus Terentius Varro (first century BCE) are not extant, nor are any Stoic grammatical treatises, hence the latter's

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[3] On the socio-cultural settings in which the late Roman grammarians worked, see Kaster (1988). For essays providing an overview of their interests, see Ferri & Zago (2016).

[4] Discussions of vocal quality can also be found owing to the classical interest in oratory (see Laver 1981).

theses must be gleaned or reconstructed from later quotations, versions, reports, and criticisms (Blank & Atherton 2003: 310–11; see Hülser 1987–88 for the collection of Stoic fragments on grammar, in particular chapter 3, vol. 2: 516–789 on the linguistic sign and grammatical theory). Therefore, we must rely upon the portions that have survived, acknowledging that we may have an incomplete grasp of the ancients' views. Finally, it should be noted that the object of ancient grammarians' study was overwhelmingly literary language, although spoken language also came to be reported and discussed, especially when the written and spoken languages came to diverge (e.g. in Sextus Empiricus).

6.2 Segmental structure

6.2.1 Orthography

The greatest legacy of classical Greece and Rome to phonology is the alphabetic writing system, established in Greece around 800 BCE, obligatorily indicating both vowel and consonant phonemes for the first time (see Sproat, this volume). Although the development of a writing system is not itself phonology, it indirectly evidences sensitivity to the phonological concern with contrast, and was a prerequisite to phoneme-based phonological analysis in the Greco-Roman fashion (§0). The Greeks' adaptation of a North Semitic (Phoenician) script, which did not represent vowels, through repurposing unused letters (e.g. Phoen. glottal stop <A> (*ʔalp*) for /a/) and inventing new ones for native sounds (Diringer 1968: chapters 12 and 19; Allen 1981: 115) demonstrate an awareness of both the principle of biuniqueness in grapheme-to-phoneme correspondence, and the similarity in the roles of consonants and vowels in terms of forming distinctions. As might be expected from a borrowed writing system (see again below on Latin), the script still did not attain a one-to-one grapheme-to-phoneme correspondence, and only two of the five vowel qualities had different symbols to characterize contrastive length, <ε η> for /e eː/ and <ο ω> for /o oː/

(Allen 1974: 66–75). The Greeks were aware of the alphabetic shortcoming in denoting the length contrast, labelling the vowel letters <α ι υ> as δίχρονα *díkhrona* 'bi-temporal' (Allen 1981: 116).

Speakers of languages native to Italy in turn borrowed a West Greek (Doric) version of the alphabet. The (non Indo-European) Etruscans were the first to do this,[5] with Latin speakers later adapting the Etruscan-Greek script using knowledge of the Greek original (Diringer 1968: 1.419). As the Etruscans had no voice contrast in plosives, in the velar series they used three letters to denote /k/: Greek voiced *gamma* <Γ>, taking the shape <C>, and voiceless *kappa* <K>, and in addition *koppa* <Q>, which had originally represented the Semitic uvular plosive but was used in very early Attic inscriptions to denote /k/ before back vowels, in which capacity it survived in West Greek. The three are used in complementary distribution—the 'C/K/Q convention' (Wachter 1987: 14–24)—whereby <C> (called *gemma* in West Greek) was used before front vowel letters <E I>, <K> before <A> and consonants, and <Q> before rounded vowel letters <V O>. Some of the earliest Latin inscriptions continue this convention (Allen 1978: 15; Sihler 1995: 21), and the <K> spelling is retained in the month name *Kalendae* 'Kalends'. The use of the C/K/Q convention in Latin presumably arose due to a combination of factors: (i) having too many letters for the voiceless velar, a consequence of the absence of the voice contrast in Etruscan, (ii) the independent need for <Q> to represent the labiovelar /k^{w}/ (from the earliest Latin inscriptions), inherited from Proto-Indo-European, thereby reinforcing its use before lip-rounding, and (iii) a sensitivity to sub-phonemic differences in the realisation of /k/. Allophonic spelling therefore finds a precedent here, but lasted only briefly and inconsistently before <C> became the regular spelling of /k/ in all positions, resulting in a more phonemic orthography. A unique letter for voiced /g/ was invented in the

[5] Rix's (1998) hypothesis that Etruscan is related to Rhaetic (eastern Alps) and Lemnian (Aegean Sea) to form a 'Tyrsenian' language family has gained acceptance.

fourth to third centuries BCE, by adding a short line to the letter <C> to give <G> (Allen 1978: 15). This may demonstrate a sensibility to symmetry in the plosive voicing contrast, represented in the dental and labial series, hence also in the velars.

The ancient names of the letters reveal a metalinguistic awareness of their phonological functions. In Latin, plosive letters were pronounced with a following vowel *e*, e.g. *be ce de ge te*, whereas fricatives, nasals, and approximants (see §0) had the sound placed after a vowel, e.g. *ef el em en er es*. This ordering reflects the distribution of these sounds in Latin, with low-sonority plosives mainly occupying onset position, but other higher-sonority consonants occurring frequently in codas also (Marotta 2015: 66–8).

Orthography, and its phonological accuracy, becomes a major interest in the tradition, as evidenced by the many treatises specifically on the topic in the second century CE alone, by Terentianus Scaurus, Velius Longus, and Flavius Caper. Discrepancies between orthography and phonology are meticulously noted, especially after sound change neutralized contrasts rendering the spelling system less phonemic (e.g. Sextus Empiricus on Greek; see §0). To illustrate, the Roman grammarians identified a discrepancy between writing and pronunciation in the case of the intervocalic geminate glide /jj/ written simply as single <i> from early imperial times, e.g. *maior* [majjor] 'larger', while other geminates had been written with double letters since the end of the third century BCE (Quint. *Inst.* 1.4.11; Priscian *G.L.* 2.14; Terentianus Maurus *G.L.* 6.343; Gellius 4.17).[6] Such discussions indicate an interest in sound beyond spelling, although as glide length was not contrastive in this environment, the twin focus was primarily phonetic and metrical.

[6] See §0 for more on glides.

6.2.2 Speech sounds

The recognition in the Greek world that speech can be divided into a (writable, hence essentially phonemic) string of basic speech components can be traced back to Plato (*Tht.* 202e–203c), where a syllable, which can be broken down, is contrasted with a στοιχεῖον *stoikheîon* 'speech element' (Lat. *elementum*), which has no further 'explanation'. Plato uses the term *stoikheîon* without further elucidation, suggesting that it would have been familiar to his audience.

The Stoics were major contributors in shaping linguistic study (see Hülser 1987–88: especially ch. 3; Blank & Atherton 2003; Sluiter 2000). In phonology and morphology, several Stoics wrote treatises entitled Περὶ φωνῆς *Perì phōnês* 'On speech'; that of Diogenes the Babylonian (c. 240–152 BCE; quoted in Diogenes Laertius 7.55–60 and others) discusses the sounds, accents, and breathings (/h/) of Greek, as well as metrics and prosody (see §0), before moving on to morphology, laying down the format for later treatises (Householder 1995b: 95–6). Greco-Roman linguistic analysis was spelling based,[7] but it was nevertheless acknowledged that a letter—the basic element of speech—could represent sound, and practitioners were able to distinguish between the meanings designated by 'letter' as required and without confusion (see Marotta 2015: 64). The standard theory of the letter in western antiquity is attributed to Diogenes, and it was believed to have three aspects: its 'name' (Gk. ὄνομα *ónoma*, Lat. *nomen*), e.g. *alpha* for <α>, its 'shape' (Gk. χαρακτήρ *kharaktḗr*, Lat. *figura*), e.g. <α> for *alpha*, and its 'power' (Gk. δύναμις *dúnamis*, Lat. *potestas*), referring to its pronunciation.

Diogenes defines sound (φωνή *phōnḗ*, Lat. *uox*) either as air that is struck in motion, or as perceived by the hearer; these aspects of the definition survive throughout the tradition, e.g. in Charisius and Diomedes (*G.L.* 1) in the fourth century CE.

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[7] This was naturally the case, given that their alphabets were virtually phonemic and the Romans had the Greek alphabet at their disposal to represent Greek sounds.

Diogenes (DL 7.57) relates the species-specific nature of speech to its mental origin and orthographic representation: air is set in motion 'under an impulse' in sounds made by animals, but 'by thought' in those made by humans, where the sounds are 'articulate', i.e. 'representable by letters' (Matthews 1994: 11). When a sound is written, it becomes a λέχις *léxis* 'writable sound' or 'written utterance', but a sequence of letters is still in the realm of sound, so need not have discernible meaning, e.g. the non-word *blituri*. The last of the three important Stoic terms was therefore λόγος *lógos* 'meaningful sound/utterance', i.e. a word as a semantic unit, or a (part-)sentence (Law 2003b: 39–40). Stoic theory develops a grammar which generates an output from its constituents: from the set of the twenty-four letters, one can first generate syllables, then words, and then sentences. Several key ideas are therefore found in Stoic doctrine, including the establishment of the letter as the minimal unit of language and the hierarchical organization of language (Schmidhauser 2010: 503–4, 506).

Sextus Empiricus (*M.* 1.108id4; second century CE) appears to advocate a notion of minimal elemental difference when concluding that Greek has not seven (ι ε α ο υ η ω), but forty-three vowels when considering possible modulations in length, rough and smooth breathing, and pitch accent (§0; Bett 2018: 66 fn. 100, 68–9; Blank 1998: 162–4, who notes that Sextus's count of possible permutations should have yielded eighty-one). Furthermore, in the opposite analytical direction, while still downplaying the significance of orthography he considers an alternative five-vowel analysis of Greek (*M.* 1.115–16), on the basis that <ε η> and <ο ω> differ in the prosodic feature of length only. There is a very brief mention of a principle of contrast, but not in a phonological context ('if there is no left, there is no right either', 1.135).

Some abstraction in the analysis of sound is evident in the Roman grammarians (Desbordes 2000: 468–9): the *potestas* 'power' of a letter is not simply its pronunciation, but also its function within a syllable, i.e. if it makes a syllable heavy (§0), and furthermore its behaviour, for example whether it can be written as another

letter through *mutatio* 'change' (§0) as in an assimilation context (e.g. Charisius (*G.L.* 1.9.18) *supponunt* 'they presuppose' from *sub+ponunt*). Priscian (*G.L.* 2.7.9, 33ff.) therefore adds *ordo* 'distribution' to the Stoic tripartite definition of 'letter', e.g. the ability of <v> to be a vowel /u/, a consonant /w/, or the second member of diphthongs /au eu/. Priscian (*G.L.* 2.6ff.) considers the difference between spelling and sound through this lens: there is no difficulty in beginning a syllable with <rp> in spelling, but in pronunciation (elements) the sequence must be reversed in order to fill this role.

6.2.3 Pronunciation

The pronunciation of the letters remained a core, but brief, aspect of grammatical treatises in antiquity, with most beginning with such a summary.[8] A few were quite detailed; for example, Dionysius of Halicarnassus (*Comp.* 14; Matthews 1994: 13) describes the articulatory and aerodynamic details of the sound represented by each letter. He states that in the pronunciation of long <ᾱ> /aː/, the mouth is 'opened to the maximum and the breath carried up towards the palate'; in <ῑ> /iː/, 'the impact of the breath is on the teeth, while the mouth is slightly open and the lips do not adorn the sound'; and <μ> /m/ is pronounced 'by the mouth being pressed tightly shut by the lips, while the breath is divided and passed through the nostrils'. The reconstructed pronunciation of Greek <υ> as front rounded [y] is corroborated by Dionysius's description as a sound with a 'contraction around the lips', but which is 'stifled and thin', together with Cicero's (*Orat.* 160) and Quintilian's (*Inst.* 12.10.27) observations that the sound did not appear in native Latin words (Allen 1974: 63–4).

Pultrová (2013) extensively reports the grammarians' evidence on Latin <r>, highlighting the difficulty in its interpretation and apparent contradictions. Dionysius of Halicarnassus' description of Greek /r/ (*Comp.* 14) seems to be of a trill, as does the

[8] Excellent discussions of contemporary evidence for the pronunciation of every speech sound are provided by Allen (1974 for Greek; 1978 for Latin).

oft-cited evidence from Roman grammarians (e.g. Kent 1932: 59; Sturtevant 1968: 150–1; Pultrová 2013; Painter 2011: 59–64):[9] Lucilius (second century BCE) compares its sound to that of a dog; Terentianus Maurus (second century CE; *G.L.* 6.332) and Marius Victorinus (fourth century CE; *G.L.* 6.34) unequivocally describe vibration with 'trembling blows'. R-types (trill, tap, approximant, fricative) were not differentiated by the grammarians.[10]

Differences in vowel and consonant length are well understood in the Greco-Roman tradition, whether they were in contrastive positions or otherwise. Examples of the latter include 'hidden quantity', long vowels whose length is irretrievable through verse scansion as they are in closed syllables, which are regularly scanned long, e.g. Cicero (first century BCE; *Orat.* 159) and several later writers note long vowels before <ns, nf>. Non-contrastive consonant length can be found in the (occasional) word-final geminate consonants in Latin, e.g. Velius Longus (*G.L.* 7.54: 'we write one *c* and we hear two') and Priscian (*G.L.* 2. 592) note that *hic*, *hoc* 'this (masc., neut.)' are pronounced with a long final consonant /kk/ (Allen 1978: 65–75, 76–7).

However, the phonetic sections of the later Roman grammars (*artes grammaticae*) tend to be short and contain little information on the articulatory configurations of different letters, Martianus Capella (fifth century CE) proving an exception (see Desbordes 2000: 468–9). For example, Donatus's (fourth century CE) chapter 'on the letter' provides a classification (see §0), then discusses only the letters <h k q x i v> which were problematic for various reasons: omission in speech (h; Allen 1978: 43–5), restricted distribution (k q, §0), lack of one-to-one letter-sound correspondence (x), and dual vocalic and consonantal function (i = /i j/, v = /u w/).

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[9] Pultrová (2013) concludes that the trill may either be a later development, or a hyperarticulated pronunciation by the grammarians.

[10] Zair & Sen (2017) argue that there is evidence for an allophonic distribution in early Latin: approximant in onsets, tap in codas.

6.2.4 Allophony

The Greco-Roman tradition discusses phonetic realizations due to positional differences which were not usually indicated by orthography, indicating a good grasp of the notion of allophony. Diomedes (*G.L.* 1.421), like other Roman grammarians, defines the letter as *pars minima vocis articulatae* 'the smallest part of an articulate (i.e. writable) vocal sound', but also appears to note the invariance of letters as opposed to the variability of the phonetic signal—'all the shapes of letters number twenty-three; but their values (*potestates*), which we call elements, are understood to be many more'—and concludes 'what is understood is the element, what is written is the letter' (translations from Matthews 1994: 12). This view is foreshadowed by Cicero (*Tusc.* 1.25.62), who states that the inventor of the alphabet 'reduced the sounds of speech, which were infinite in manifestation, to a few written letters' (translations from Allen 1981: 117). Therefore, the 'letter' bore some resemblance to the modern phoneme, or at any rate the symbols of broad phonetic transcription. Desbordes (2000: 469) argues that the continued popularity of the graphic term *littera* 'letter' over *elementum* 'speech element' points to an abstract view of language where distinction between units matters more than phonetic substance, hence concludes of the grammarians 'They have thus placed themselves, though unconsciously, though awkwardly, in the field of phonology, and their *littera* prefigures the phoneme'.[11]

Regarding vowels, Quintilian (*Inst.* 1.4.8) and Priscian (*G.L.* 2.7.15–16) note that the second-syllable vowel in *optimus* 'best' was somewhere in between /i/ and /u/ (the so-called *sonus medius*), the relevant environment being pre-labial (see Weiss 2009: 65, especially fnn. 6–10 on its occurrence and pronunciation). However, the majority of such observations pertain to consonants. Descriptions of the pronunciation of /r/

[11] 'Ils se sont ainsi placés, même inconsciemment, même maladroitement, sur le terrain de la phonologie, et leur *littera* préfigure le phonème'.

indicate some appreciation of allophonic devoicing in Greek, described as and later marked by 'aspiration' (<ῥ>; see §0), in word-initial and (the second half of) geminate rhotics (Herodian *G.G.* 3.1.546–7). This was later transcribed into Latin as <rh>, giving *rhetor* 'rhetorician' and *Pyrrhus* (Allen 1973: 39–42). Variant realisations indicated by orthography are treated (usually unsystematically) in Latin grammars which discuss *mutationes* 'changes', e.g. consonantal assimilations shown in spelling (§0).

The clearest evidence of sensitivity to allophonic distinctions comes from discussions of clear and dark /l/. Evidence for the existence of at least two, and possibly three, variants of /l/ comes from grammarians' statements (see Lindsay 1894: 89–92; Allen 1978: 33–4). Pliny the Elder (first century CE; reported in Priscian *G.L.* 2.29) and much later Consentius (fifth century CE; *G.L.* 5.394) both report dark /l/ in word- and syllable-final position (*sol* 'sun', *silva* 'wood'); this /l/ is described as *plenus* 'full' in Pliny and *pinguis* 'fat' in Consentius. Another /l/—*medius* 'middle, ambiguous' in Pliny only—occurs elsewhere (*lectus* 'bed'), although Pliny reserves a third category—*exilis* 'thin'—for geminate /ll/ (*ille* 'he'). Consentius' *exilis* /l/ appears at the start of words (*lepore, lana, lupo*) and in geminates (*ille, Allia*). Given that the terms *plenus, pinguis,* and *exilis* were elsewhere used for the acoustic qualities of back and front vowels respectively (e.g. Velius Longus *G.L.* 7.49–50), the terminology appears unambiguously to mean 'thin = clear, full/fat = dark'.

This evidence, and especially Pliny's recognition of an onset *medius* variety, corroborates reconstructions based on the diachronic colouring of the preceding vowel to /o u/ before dark /l/ (Sen 2015: 15–41). /l/ was dark in codas (*plenus*), causing backing of a preceding vowel to /u/ (**ensalsos* > *insulsus* 'dull'). In onsets (*medius*), /l/ was conditioned by the *following* vowel: a following /a o u/ darkened onset /l/, resulting in backing of a *preceding* vowel to /u/ (**konseluerunt* > *consuluerunt* 'they took counsel'), whereas before /e/ backing was only to /o/ (**ad-aleskere* > *adolescere*

'grow up', cf. *adultus* 'adult'). Finally, onset /l/ before /i/ (*gelidus* 'frozen') behaved identically to geminate /ll/ (*agellus* 'little field'), in that no colouring occurred, suggesting that the former was contextually palatalized (*medius*), but the latter clear by specification (*exilis*).

6.2.5 Natural classes

Classes of sounds were recognised as early as Plato (*Cra.* 424c) and Aristotle (*Po.* 1456b 25–31) (Matthews 1994: 10–11; Taylor 1995a: 84; Householder 1995a: 92), where letters are divided into φωνήεντα *phōnḗenta* 'vowels' (later, Lat. *vocales*) and consonants, with the latter hosting the groups ψόφοι *psóphoi* 'noises' (presumably <s ks ps>), φωναί *phōnaí* 'voices' (liquids and nasals), and ἄφωνα *áphōna* 'mutes' (Lat. *mutae*), voiceless, voiced, and aspirated plosives, acknowledging voiced and aspirated plosives as categories for the first time. While *phōnḗenta* are diagnosed by their ability to form syllables on their own—demonstrating a classification according to functional as well as physical properties—*psóphoi* and *phōnaí* together constitute Aristotle's σύμφωνα *súmphōna* 'sounding in conjunction' (as they cannot form syllables), a term which was later extended to plosives (Dionysius Thrax *G.G.* 1.11–12), and calqued by the Romans as *consonantes*. Aristotle notes that consonants require a προσβολή *prosbolḗ* 'constriction' (*Po.* 1457a). Consonantal letters which are pronounceable in isolation—fricatives, liquids, nasals, and the double letters—are classed as ἡμίφωνα *hēmíphōna* 'half vowels', Lat. *semivocales*, and this three-way distinction—vowels, semivowels, mutes—becomes the settled taxonomy.[12] Ancient and modern uses of the term 'semivowel' therefore differ, with the latter primarily using the term for glides.

The τέχνη γραμματική *tékhnē grammatikḗ* 'Art of grammar' attributed to Dionysius Thrax (second century BCE) is likely a compilation of linguistic knowledge

[12] Allen (1981: 117–18) provides a good summary of the development of these categories.

at a much later date, possibly including an introductory definition of grammar by Dionysius Thrax himself (Householder 1995c: 99–100; Di Benedetto 2000; Law & Sluiter 1998). Plosives are listed in the order voiced-voiceless-aspirated, each with labial, dental, and velar places, the first clear record of such organization, although place order differs in each series, following the order of the letters in the alphabet (<β γ δ κ π τ θ φ χ>).[13] Dionysius of Halicarnassus (*Comp.* 14; first century BCE) notes three places of articulation for plosives, but has rather lengthy descriptions instead of class titles, e.g. 'from the extremity of the lips', 'with the tongue pressed against the front of the mouth at the upper teeth', and 'with the tongue rising to the palate near the throat' (Matthews 1994: 13). By Priscian (sixth century CE), 'mutes' are standardly classified into aspirated, unaspirated, and 'middle' = voiced; the places of articulation still bear no titles (cf. Sanskrit *dantya* 'dental', etc.; Allen 1981: 121). There is some discussion in the grammarians on whether the Latin labiovelar <qu> (not in Greek) is articulated differently to <c k> (Pompeius *G.L.* 5.104; Velius Longus *G.L.* 7.58; see Allen 1978: 16–17).

The aspiration distinction in Greek voiceless plosives is explicitly discussed using the terms ψιλά *psilá* 'plain, smooth' (Lat. *tenues* 'thin') for the unaspirated plosives and δασέα *daséa* 'rough', (Lat. *aspiratae* 'breathed', though not native to Latin) for the aspirates. However, the diagnosis of voiced plosives as μέσα *mésa* 'intermediate', articulatorily somewhere between plain voiceless and aspirated voiceless plosives,[14] begins in Dionysius Thrax (*G.G.* 1.1.12–13) and remains into the Roman tradition (*mediae* 'middle' sound, despite the absence of aspirated plosives) through to Byzantine

[13] I am grateful to Elan Dresher for pointing out this ordering, and that the traditional Hebrew order of voiced and voiceless plosives is the same, e.g. the consonants that undergo spirantization are referred to as *begedkefet*.

[14] See Allen (1974: 16–24) for a review of the grammarians' discussions of voiceless aspirates.

grammars (Robins 2000: 419), all the way to the modern age (Allen 1981: 120–1). A failure to understand the mechanism of voicing is starkly illustrated by Terentianus Maurus's (second century CE; *G.L.* 6. 331) claim that <t> should be pronounced at the top of the teeth, and <d> with the tongue curving from the lower teeth to the upper. Quintilian (*Inst.* 1.4.16) simply recommends the learning of the *t/d* distinction, without actually explaining it.

Liquids /r l/ are grouped together according to their distribution: when they are preceded by a plosive, they are 'fluid, variable' (Gk. ὑγρά *hugrá*, Lat *liquidae*) in conditioning a preceding syllable as long or short in verse metrics (§0; Allen 1978: 32; Priscian *G.L.* 2.10). In Greek, this applied to nasals as well as liquids, so these too came under the term *hugrá* (Dionysius Thrax *G.G.* 1.14).

The classification of sounds, as well as their pronunciation, therefore played a central role in the grammatical enterprise and its practical application. Thus, in Quintilian's (*Inst.*) account of the Roman orator's ideal education, the first grammatical training involves distinguishing between vowels and consonants, and semivowels and mutes, followed by an understanding of the pronunciation of each letter in different environments through their *mutationes* 'changes' (§0).

6.3 Prosodic structure

6.3.1 Accent, length, and aspiration

Dionysius Thrax's introduction defines grammar as 'the practical study of the normal usages of poets and prose writers', with six divisions, the first of which is 'skill in reading with due attention to prosodic features'. The Greek term προσῳδία *prosōidía* originally referred to a 'song accompanied by instrumental music' (ἀοιδή/ᾠδή

aoidḗ/ōidḗ ‘song’).[15] Its earliest recorded use in a linguistic context is in Plato (*R.* 399a), where it appears to refer to ‘variation in pitch of the speaking voice’ (LSJ s.v.) across an utterance, i.e. intonation. Plato contrasts it with φθόγγοι *phthóggoi* ‘(basic) sounds’, probably recognizing something akin to our segmental versus suprasegmental distinction. By Aristotle’s time (fourth century BCE), the term becomes further specialized (although it also retains its intonational meaning), referring specifically to the language’s lexical pitch accent on a given syllable. The Latin term *accentus* is a calque directly formed on the Greek: *pros*/*ad* ‘to’ + *ōidia*/*cantus* ‘song’. Later, the Greek term came to refer to any feature of the language that was not marked by alphabetic orthography, notably the three features—all contrastive—of aspiration, vowel length, and pitch accent (Arist. *Po.* 1456b). The Alexandrian Aristophanes of Byzantium (third to second century BCE) is credited with the introduction of three categories of symbols to denote these features: the accent signs acute (´), grave (`), and circumflex (ˆ); long- (¯) and short-vowel (˘) markers; and ‘rough’ and ‘smooth’ breathing signs to denote the presence and absence of ‘aspiration’ on initial vowels, i.e. word-initial /h/. The three features are found again in Varro in the first century BCE, where they are considered to be the three dimensions of the *corpus* ‘body’ of speech (Allen 1973: 3–4) despite only vowel length being contrastive in Latin. However, the Romans remained somewhat reluctant to accept /h/ as a segment, viewing it rather as the ‘prosody’ of aspiration (e.g. Marius Victorinus *G.L.* 6.5), a vacillation akin to modern segmental versus prosodic analyses (e.g. Henderson 1949; see Battaner Moro & Ogden, this volume), though with undoubtedly (Greek) orthographic motivations in antiquity.

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[15] See Allen (1973: 3–5) for the history of the term, which forms the basis of the present summary. Luque Moreno (2006) provides a detailed discussion of Greek and Latin prosodic terminology.

The term τόνος *tónos* 'stretching' (Lat. *tonus*) was employed to refer to the pitch accent system reconstructed for Ancient Greek (Allen 1974: 106–7, chapter 6), reflecting the varying pitches of the stretched strings of a musical instrument (Allen 1981: 121–2).[16] The Greeks recognised the high, low (e.g. Plato *Cra.* 399A), and falling pitch accents of their language, designating them respectively as ὀξύς *oksús* 'sharp', with an acute accent on the final syllable (Lat. *acutus*); βαρύς *barús* 'heavy' (Lat. *gravis*);[17] and variously δίτονος *dítonos* 'bi-tonal', σύμπλεκτος *súmplektos* 'compound', or ὀξύβαρις *oksúbaris* 'acute-grave' (e.g. the accent in the word φῶς *phō̂s* 'light'), so analyzing the falling accent as high + low. This analysis is explicitly stated by Dionysius of Halicarnassus (*Comp.* 9): 'some [words] have the low combined with the high in one syllable, and these we call circumflex' (Allen 1974: 113). In long vowels and diphthongs, the high tone could fall either on the second mora, in which case the vowel bore an acute accent, or the first mora, in which case the vowel hosted a circumflex accent, with a fall on the second mora, e.g. φώς *phṓs* 'man' versus φῶς *phō̂s* 'light' (Aristotle *SE* 177b35–178a3). The falling accent was also termed περισπωμένη *perispōménē* (Lat. *circumflexus*) 'bent around', referring to the circumflex diacritic (ˆ). The high tone occurred only on one syllable in a word, and as such was considered the main accent or κύριος τόνος *kúrios tónos* 'tone proper'; conversely, the low tone exhibited by all other syllables (Herodian *G.G.* 3.1.10–11) was considered to be συλλαβικός *sullabikós* 'inherent in the syllable'. The low tone therefore came to be left unmarked in the Byzantine system used to write Greek today; the grave accent, however, came to be employed to mark a word-final high tone, possibly to denote a high lowered by a boundary low (Devine & Stephens 1994: 180–3). Finally, the transition between pitches was described as 'continuous' change

[16] The use of intonation in interrogative sentences is also noted by Apollonius Dyscolus (Allen 1973: 252).

[17] Plato (*Phdr.* 268D) uses these two terms in reference to high and low musical pitch.

(συνεχής *sunexḗs*) rather than 'interval' change (διαστηματική *diastēmatikḗ*) which would characterize singing rather than speaking (Aristoxenus *Harm.* 1.8-9, pp. 101–2).[18]

Most of our knowledge of the placement of the ancient Greek accent (see Probert 2003, especially 33–5; 2006: chapter 1) comes from the grammarians, and in particular from Herodian's Περὶ καθολικῆς προσῳδίας 'On prosody in general', partly reconstructible from later treatises and quotations. It was recognized that accentuation rules primarily related to the shape of vowel elements (long/diphthongal versus short) rather than syllable-shape (Choeroboscus, *G.G.* 1:364, 384–5), although the syllable was still acknowledged to host the accent (§0; e.g. Diomedes *G.L.* 1.431 states that 'prosody' is so called because it provides a tune for syllables). Most notably, there is insightful discussion on the role of formal morphological and morphosyntactic properties on accentuation, e.g. from Arcadius' epitome of Herodian's work (Arc. 65. 17–21): 'Words ending in -μος that have γ before the μ have an acute on the final syllable if they are common nouns: νυγμός [*nugmós* 'pricking']' (Probert 2006: 29). Furthermore, analyzing accentuation results in an acknowledgement of cliticization (e.g. Herodian, *G.G.* 3.1.564; Probert 2003: chapter 7; Probert 2019: chapters 4–6 on Latin), where enclitics—words which were felt to 'lean' (ἐγκλίνειν *egklínein* [eŋkli-]) on a preceding full word—were unaccented and could affect the accent position on the full word (Allen 1973: 240–4, 248–51). Univerbation of 'full word + enclitic' was termed ἐπέκτασις *epéktasis* and resulted in accentuation of the item as a single word. Proclitics were not explicitly recognized by the ancients, although accent markings and some grammarians' statements can be interpreted to reveal their existence; for example, Herodian reports identical accentuation in prefixed ἐπιμείλια *epimeília* 'propitiations' and encliticized ἐπι μείλια (δώσω) *epi meília (dṓsō)* 'I will give a dowry'.

[18] See Probert (2006: chapter 1) for a detailed survey of the evidence for ancient Greek accentuation from antiquity onwards.

Conversely, the Latin accent was of stress rather than pitch, as revealed by clear descriptions such as Servius's (*G.L.* 4.426) *accentus in ea syllaba est quae plus sonat* 'the accent is in that syllable which is louder'. Quintilian (1.5.30) provides a succinct and clear summary of the well-known penultimate law for Latin stress placement: on the penult if it is heavy (containing a long vowel or a vowel followed by a consonant) or if the word is disyllabic; otherwise stress is on the antepenult (whether heavy or light). However, we find Roman grammarians in late imperial times, such as Priscian, describing Latin with acute and circumflex pitch accents in the same way in which the accent alternated across a paradigm in Greek. Such a reconstruction for Latin is otherwise unsupported, and it is overwhelmingly likely that the Roman grammarians were imitating Greek precursors in this respect, though it is also plausible that pitch change was a correlate of stress, motivating the Greek comparison (Allen 1978: 83–86). Furthermore, by late Roman imperial times, even Greek no longer had pitch accents, as its pitch prominences had both been replaced by a single stress accent (Allen 1974: 119–20).[19]

Along with marks for aspiration, length, and accent, the Alexandrians also introduced further symbols with prosodic relevance, notably in marking word boundaries in the *scriptio continua* standardly employed throughout Greco-Roman times (Allen 1973: 4–5):[20] the apostrophe to indicate elision of a vowel at the end of a word (καθ'ημων *kath'ēmōn* 'against us' versus καθημαι *kathēmai* 'I sit'); the comma to denote word divisions (ηλθε,νηπιος *ēlthe,nēpios* 'the infant came' versus ηλθεν,ηπιος *ēlthen,ēpios* 'the gentle one came'); and the ὑφέν *huphén* 'ligature' to indicate a compound with single word-accent (μεγαλητορα *megalētora* = *megalē* +

[19] See Probert (2019) for a thorough discussion of Latin accentuation rules based on Greek models.

[20] The earliest Greek and Latin inscriptions used interpuncts as word dividers, a practice which remained in Latin alongside *scriptio continua* until after the classical period.

ētora 'great-hearted (ACC)' versus μεγαλη,τομη *megalē,tome* 'great intersection'). In the third century CE, *prosōidía* covered not only all of the above features, but also referred to the symbols which indicated them. As the signs for accent and aspiration came to be used more generally and not simply in cases of ambiguity, the distinction became eroded between these and marks of punctuation.

6.3.2 The syllable

Prosodic features were felt to be hosted by the syllable, a term which the Greek (συλλαβή *sullabḗ*, lit. 'that which holds together') and Roman (*syllaba*) grammarians frequently used almost always without further elucidation, from Plato onwards. Dionysius Thrax defines the syllable primarily as 'the grouping of a consonant with a vowel' (Allen 1981: 119). Priscian's definition in the late Roman period (*G.L.* 2. 44.1ff.) is 'a continuous combination of letters (*coniunctio literarum*) uttered with a single accent and a single breath (*sub uno accentu et uno spiritu prolata*)', indicating an appreciation that it hosted the accent and, in a Firthian sense (see Battaner Moro & Ogden, this volume) aspiration, but was itself analyzable into individual speech sounds (see Desbordes 2000: 468–9). Priscian acknowledges that this definition excludes single-vowel syllables, e.g. *ā* 'from', which he states can be called syllables *abusiue* 'improperly'.[21]

Many facets of the syllable that are discussed today (see Kisseberth, this volume) were identified in the Greco-Roman tradition (see Allen 1973: 27, 29–30, 32–34, 53–57; 1981: 119), many relating to syllable weight (see below). Every Latin grammar included in *G.L.* includes a section *De syllaba* 'On the syllable', with the exception of Terentius Scaurus and Velius Longus (Marotta 2015: 55). Syllabification principles are described in the Greek grammars (e.g. Herodian *G.G.* 3.2.393–406), whereby an

[21] See Marotta (2015: 68–9); several other grammarians adopted the combinatory definition of the syllable.

intervocalic consonant belongs with the following vowel (the 'onset-first' principle; Vennemann 1972), but consonant clusters are divided between syllables. However, syllabification was largely considered a practical problem of where words should be divided at line-ends, the main criterion being whether a consonantal sequence could begin a word, e.g. Gk. *e.ti.kton* 'I gave birth to' based on *ktēma* 'possession' (Allen 1974: 98–9). In the Roman tradition, Servius (*G.L.* 4.427.20–35) correctly diagnoses a syllable boundary in the middle of geminate consonants after stating this word-initial criterion (Marotta 2015: 70–1). Charisius (*G.L.* 1.11) includes consonantal sequences beginning Greek loanwords as possible word-initials in the syllabification of Latin, thus (native Latin) *a.mnis* 'river' and *a.xis* 'axle' based on Greek (but not native Latin) word-initial /mn/ and /ks/ (Matthews 1994: 14–15). Although this word-initial criterion often works for stop + liquid sequences (see below), e.g. common short scansion of the initial syllable of *A.prī.lis* 'April', several such syllabifications conflict with metrical evidence, where the syllable preceding each cluster is scanned long, i.e. *am.nis*. Finally, syllable boundaries were argued to align with morphological stems in prefixed forms, thus Terentianus Scaurus (*G.L.* 7.12) states that *nescio* 'I do not know' should be syllabified *ne.scio* due to *scio* 'I know' even though *nes.cio* is guaranteed by verse scansion.

Syllable-internal structure is not discussed in great detail, but the necessity of a vowel for syllables to be well-formed is identified (Dionysius Thrax *G.G.* 1.11–12, 16). Priscian (*G.L.* 2.13) acknowledges that three letters <c k q> (§0) are employed for 'one power in meter and sound' (i.e. the consonant /k/ functioning as a syllable margin), comparing this biuniqueness failure with that in <i u>, where the difference between glides and high vowels (/i j, u w/) is diagnosed as being one of pronunciation, thus one letter represents more than one sound. Despite this diagnosis, the passage reveals Priscian's sensitivity to the function of sounds in syllables, noting that <i u> can be vowels or consonants (also in Diomedes *G.L.* 1.422.14–17: consonantal 'power'

in the initial sounds of *Iuno* 'Juno' and *uates* 'seer'), resulting in their 'different power in meters and in the pronunciation of syllables', i.e. syllable margin or nucleus. The diphthongal versus heterosyllabic treatment of Latin /ui/ is noted (Audax *G.L.* 7.329), with Priscian describing <i> as appearing in the place of a consonant in diphthongs (*G.L.* 2.303). An interest in phonotactics is illustrated in Priscian's discussion of vowel and consonant ordering in diphthongs and clusters (*G.L.* 2.37–43). Priscian (*G.L.* 2.44.6–7) notes that a syllable can consist of anything between one and six letters (e.g. *stirps* 'shoot, stock'), and insightfully sees that a wider range consonants can appear at the start of syllables than the end—long lists are given (*G.L.* 2.45ff.)—because the set of consonants that starts words is larger than the set that ends them. He thus acknowledges an onset-coda asymmetry (Marotta 2015: 70–1).

A problem lay in the syllabification of stop + liquid, and also stop + nasal in Greek, since at different times and to different degrees, the sequence could be treated as either tautosyllabic or heterosyllabic, resulting in a preceding light or heavy syllable respectively (Allen 1973: 137–9; 1974: 101–2; 1978: 89–90; Sen 2015: chapter 4 for the archaic Latin treatment), e.g. both *pa.tris* and *pat.rem* 'father (GEN and ACC)' at Verg. *A.* 2.663. The resulting uncertainty (without scanning in verse) regarding the weight of the preceding syllable led to the classification of syllables before such sequences as Gk. κοινή *koinḗ* 'common', Lat. *communis* 'common' or *anceps* 'doubtful'.

The importance of literary study, and in particular Homer, to the linguistic enterprise resulted in a focus on verse metrics, notably in the work of Alexandrian scholars such as Aristophanes of Byzantium and Aristarchus (see Lambert 2000). Examinations of syllable weight naturally ensued from this interest, given that one set of syllables could inhabit 'long' positions and others 'short' positions in Greek meters. Longinus (*Proll. Heph.* p. 83) holds 'without the syllable there could be no meter', and

(p. 87) notes that the 2:1 long:short ratio is in function, not duration, revealing an abstract interpretation of a phonetic dimension.

Both the Greeks (Dionysius Thrax *G.G.* 1.17–20) and Romans (Priscian *G.L.* 2.51.21) identified a binary syllable weight distinction, thereby noting the phonological irrelevance of the distinction between structurally heavy (ending in V̄ or VC) and superheavy (ending in V̄C) syllables, e.g. the first syllables of *fac.tus* 'made' versus *āc.tus* 'done'. Furthermore, the Romans insightfully distinguished heavy (*longa* 'long') and light (*breuis* 'short') syllables from long (*producta* 'drawn out') and short (*correpta* 'abbreviated') vowels.[22] Dionysius of Halicarnassus (*Comp.* 15) and Pompeius (*G.L.* 5.112.6–10) in the Greek and Roman traditions respectively note the weightlessness of onsets and that only vowels and postvocalic consonants are involved in computing weight (Marotta 2015: 73), the former seeing that both *splēn* 'spleen' and *ēr* 'or' are heavy syllables despite the first being longer in duration. A concept akin to the mora (Hayes 1989; Hyman 1985; see Duanmu & Kubozono, this volume) is also in evidence—a short vowel or light syllable occupied one χρόνος πρῶτος *khrónos prôtos* 'primary measure' (from the musical writer Aristides Quintilianus) or simply *tempus* 'time' in Latin (e.g. Pompeius *G.L.* 5.112.21–2), whereas a long vowel or heavy syllable took two—although the basis for this was the common 'resolution' of one heavy into two light syllables in verse metrics (Allen 1973: 48, 56–7; 1974: 99–100).

[22] Our terms 'heavy' and 'light' are from the Indian grammarians (Allen 1973: 98). Allen (1973: 54) laments that the confusion between the two 'length' distinctions 'is still unfortunately encountered in some modern handbooks', stemming from the medieval and later doctrine of treating a short vowel in a heavy syllable as 'long by position'. Allen (1978: 91–2) and Marotta (2015: 74) report that the confusion began in the ancient Greek tradition, and is found early in the Roman tradition, despite the existence of different terms in the latter.

The rules for syllable weight, however, did not refer to syllabification (the word-initial rules above), as they would in most modern approaches (see Ryan 2019: 1 for the distinction between interval- and syllable-based approaches to weight). Rather (e.g. Donatus *G.L.* 4. 368f.), syllables containing 'drawn out' vowels or diphthongs were long 'by nature' (*syllabae natura longae*); those containing 'abbreviated' vowels followed by one consonant were short (*ma* in *mare* 'sea'), but long 'by position' (*syllabae positione longae*) if followed by two consonants (*arma* 'arms') or a 'double' consonant, such as <x> (*axis* 'axle'). These rules were recognised to apply across word boundaries, e.g. the first syllable is short in *et arma* 'and arms', but long in *et mare* 'and the sea'. Dionysius Thrax makes explicit that under this account of weight, the sequence of two consonants could be either tauto- or heterosyllabic under the word-initial syllabification rules, thus claiming incorrectly that a syllable was long where the *following syllable* started with two consonants (cf. *A.prī.lis* 'April' with short scansion of the initial syllable). Despite the persistent failure to acknowledge the link between syllabification and syllable weight (i.e. *am.nis* 'river' with a heterosyllabic cluster creating an initial heavy syllable), there is a good understanding of syllable weight and its relevance in metrics in antiquity.[23]

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[23] Although feet (Allen 1973: 122–5) were only considered units of verse metrics (not a unit as in the modern prosodic hierarchy; e.g. Nespor and Vogel 1986), the fifth-century BCE sophists, whose main interest was rhetoric, displayed an interest in the rhythms of prose, particularly sentence-finally, a context which the Romans eventually described as *clausulae* (Householder 1995a: 91). Rhythm (ῥυθμός *rhuthmós*; Allen 1973: 96–102) is defined by Plato (e.g *Phil.* 17D) chiefly in terms of music or dance as 'an ordering of movement' which can be measured, and Aristides Quintilianus as a 'structure of time units combined according to a certain arrangement', containing 'incidents' contrasting 'loudness' (ψοφός *psóphos*) and 'quietness' (ἠρεμία *ēremía*). Cicero (*De Orat.* 3. 184–6) notes that prose is less constrained than verse, but 'polished

6.4 Dynamic aspects of phonology

6.4.1 Processes

The ancients made widespread use of the four πάθη *páthē* 'changes' (described by Plato *Cra.* 394b, 414c-d, 426c, 432a; Lat. *quadripertita ratio* in Quintilian *Inst.* 1.5.38; Ax 1986): addition, deletion, substitution, permutation. These terms could refer to any level of the grammar (letter, syllable, word, sentence), with resulting meanings ranging from spelling mistakes to ungrammatical sentences (e.g. in Apollonius Dyscolus; Householder 1995d: 112); for example, addition could be epenthesis, but could also refer to pleonasm (inclusion of redundant words), and permutation could be metathesis, but also hyperbaton (separation of connected words for emphasis, including transposing the natural word order). In Plato, they refer to etymological development or differences in morphological realization, as in irregular inflection; in Aristotle's *Poetics* (chapters 19–22, 1456a–1459a), they refer to the derivation of poetic words from ordinary ones (Householder 1995b: 94). Apollonius Dyscolus reports the deletion of ἐ- in ἐθέλω *ethélō* to give θέλω *thélō* (variant forms of 'I wish' (*Pron.* 58. 28)) and the deletion of the final syllable and then lengthening of the -ο- to -ω- to form the Doric dialectal forms τουτῶ/αὐτῶ *toutô*/*autô* from Koine τουτόθεν/αὐτόθεν *toutóthen*/*autóthen* 'from here'/'from the very spot' (*Adv.* 190. 17–20, 207. 27–208. 2; Probert 2006: 30 fnn. 38–9). Quintilian (*Inst.* 1.5.6, 10–14) assigns the *quadripertita ratio* to 'barbarisms' in writing (mistakes in individual words) reflecting phonological alterations (e.g. *precula* for *pergula* 'stall' with both permutation and substitution), but also morphological ones (e.g. deletion in employing a non-standard active verb *adsentio* for common deponent *adsentior* 'I agree'). He then formulates a similar four-item list of barbarisms when

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and systematic prose must have a rhythm' because 'nature herself modulates the voice for human ears' which 'could not be the case unless rhythm were inherent in the voice'.

speaking (1.5.17–33): ‘separation, combination, aspiration, and sound’ (Taylor 1995d: 109); examples of the latter include errors in (contrastive) vowel length and (non-contrastive) stress placement (*Cámillus* for *Camíllus*). Given that morphological and phonological operations are treated identically (e.g. addition of a sound could be epenthesis or affixation), the ‘changes’ cannot be equated with the modern notion of phonological process, but synchronic phonological operations come under their rubric.

Although descriptions were available, the terminology of phonological processes takes a long time to settle. For example, the loss of a letter is *syncope* in the later grammarians, but Varro (first century BCE) does not yet have this term at his disposal, using the verb *excludere* instead, a usage which recurs in Quintilian (*Inst.* 1.4.14) (de Melo 2019 on *L.L.* 10.57).

Nevertheless, the changes in individual sounds were systematically and comprehensively discussed in some grammars, with Martianus Capella (fifth century CE) and Priscian providing the only extant discussions of the synchronic *mutationes* ‘changes’ of every single letter of the Latin alphabet. These impressive lists report morphophonological alternations alongside other alterations such as the adaptation of Greek loans. For example, assimilations are described as replacements of one letter/sound for another in the vicinity of a trigger (rather than a sound becoming more like a nearby sound), e.g. Charisius (*G.L.* 1.9.18) notes that <b> can be pronounced as <p> ‘to which it often changes’, as in *supponunt* ‘they presuppose’ from *sub + ponunt*. See §0 below for morphophonology, *mutationes*, and assimilation.

Phonological processes are probably most clearly acknowledged in the Greek and Roman grammarians’ treatment of vowel hiatus, given that both base lexical forms and outcomes were transparent. Resolution involves συναλοιφή *sunaloiphḗ* (loan: Lat. *synaliphe*) ‘blending’, which can involve the loss of a syllable (θλῖψις *thlîpsis*), usually the first one (ἔκθλιψις *ékthlipsis*, Lat *elisio*; see Marius Victorinus *G.L.* 6.66, Sacerdos *G.L.* 6.448), e.g. Lat. *aequō animō* → *aequ’ animō* ‘with even mind’, but sometimes the

second (αφαίρεσις *aphaíresis*, Eng. 'prodelision'), e.g. Gk. ποῦ ἔστι *poû ésti* → ποῦ ᾽στι *poû ’sti* 'where is it?'. Alternatively, the two vowels can be coalesced (κρᾶσις *krâsis* 'contraction', e.g. μὴ οὖν *mὲ oûn* → μῶν *mῶn* 'surely not', or συναίρεσις *sunaíresis* 'combination', e.g. τὸ ἱμάτιον *tò himátion* → θοἱμάτιον *thoimátion* 'the cloak'; the Romans used *episynaliphe*); or the first vowel, if high and long in Latin, can be made into a glide (συνίζησις *synízēsis* borrowed unchanged in Latin, although its scope is different in Greek), e.g. Lat. *ōdī et amō* 'I hate and I love' = [oːdjɛt-] (Allen 1974: 92–6; 1978: 78, 81–2).

6.4.2 Morphophonology

Morphophonological alternation was of interest to the ancients, although the same mechanisms accounted for alternations based on phonological environment and changes in grammatical endings based on word category (e.g. gender). Alternations were analyzed employing the governing principle of αναλογία *analogía* 'analogy' (e.g. in Apollonius Dyscolus), a term introduced by Aristophanes of Byzantium, in a word-and-paradigm type approach, rather than as the result of phonological processes (Taylor 1995a: 87–8).

Varro's (first century BCE) word-based theory discusses *declinatio* 'morphological variation', and distinguishes for the first time between *declinatio voluntaria* 'voluntary/derivational morphology' and *declinatio naturalis* 'natural/inflectional morphology' (Taylor 1974). Inflectional morphology is said to be dependent upon both a word's *figura* or *vox* 'phonological form' and *materia* or *res* 'grammatical substance' (the pairs of terms are interchangeable); innovatively, lexical meaning does not play a role. For example, *rex* 'king' and *lex* 'law' have similar phonological forms and are both nouns, so should inflect in the same way, despite their dissimilarity in meaning. Such *analogia* 'proportion, analogy' can allow us to discover the *similitudo* 'linguistic similarity' between words in both form and substance (thus discounting chance

similarities such as *suis* ‘of a pig’ and *suis* ‘you are sewing’), enabling us to work out how a word may be inflected. Varro formulates grammatical analogy by appeal to arithmetical proportions: *rex:regi::lex:legi* ‘king (NOM: GEN)::law (NOM: GEN)’ is as 1:2::10:20. Although not explicitly discussed in such terms, morphophonological alternations such as that caused by voice assimilation or rhotacism (see next paragraph) fall out of analogical patterning, as words showing similar proportions exist providing proportional bases for each other, e.g. *nemus:nemoris* ‘grove’ :: *tempus:temporis* ‘time’.

Sound changes such as Latin intervocalic rhotacism (*VsV > VrV; fourth century BCE) often resulted in alternations such as NOM *opus*, GEN *operis* ‘work’ and *festus* ‘festive’ versus *feriae* ‘festival’. Most grammarians were aware of this phenomenon, but failed to appreciate the relevance of the intervocalic environment and consequently the analogical spread of /r/ in other positions through paradigmatic levelling, or the resulting morphophonological alternations where such levelling did not occur. Varro (7.26–7), for example, writes: ‘In many words, in the place where the ancients used to say <s>, <r> was said afterwards’, for example, *foedesum foederum* ‘of treaties’, where the nominative singular remained *foedus* with /s/ word-finally, a fact which Varro does not discuss, and *meliosem meliorem* ‘better (ACC)’, where the nominative *melior* owes its /r/ to levelling (de Melo 2019, see commentary).

However, Varro sees the problem caused by deriving all noun forms from a nominative singular, where that form, but not other cases, has undergone voice assimilation (in a modern analysis).[24] Varro (10.56–7) argues that deriving (in the usual fashion) oblique cases from nominative singulars like <dux> [duks] ‘leader’ (1a) or <trabs> [traps] ‘beam’ (1b) would be unclear, presumably because the latter has

[24] Herodian (2nd cent. CE; *G.G.* 3.2.661) states that the nominative is the ‘mother’ of the genitive, which in turn is the mother of all other forms.

undergone voice assimilation, whereas the former has not, so a learner would not know how to form the correct plurals *duces* (voiceless) and *trabes* (voiced).

(1) Voice assimilation in nominative singulars

a. Paradigm of *dux* 'leader' with no assimilation

	Singular	**Plural**
Nominative/Vocative	*dux* [duks]	*duces* [dukeːs]
Accusative	*ducem* [dukem]	*duces*
Genitive	*ducis*	*ducum*
Dative	*duci*	*ducis*
Ablative	*duce*	*ducis*

b. Paradigm of *trabs* 'beam' with assimilation

	Singular	**Plural**
Nominative/Vocative	*trabs* [traps]	*trabes* [trabeːs]
Accusative	*trabem* [trabem]	*trabes*
Genitive	*trabis*	*trabum*
Dative	*trabi*	*trabibus*
Ablative	*trabe*	*trabibus*

Therefore, Varro proposes that the nominative *plural* should be taken as the starting-point in such derivations, given that 'singulars can be seen more easily from the plural form of words than the plural form of words from the singulars'. The principle motivating this approach is that even though singulars are 'prior', they are also more prone to be 'corrupt' and subject to the 'fancy of men', presumably referring to phonological reorganization; if we want a more 'obvious' and 'uncorrupted' starting-point, plurals, Varro argues, are better for didactic purposes, since they show 'more of a systematic relationship for the formation of words' (see de Melo 2019 for commentary on this and the following passage).

At 9.44, Varro again considers base clarity as the key issue, rather than alternation caused by assimilation, but recognizes the phenomenon of neutralization. Varro notes that the final letter <x> in *crux* 'cross' and *Phryx* 'Phrygian' in (2) sound the same ('Nobody who hears these words spoken (*voces*) can distinguish the letters with his ears'), but they are 'not similar' because the plurals are *cruces* 'crosses' and *Phryges* 'Phrygians', revealing (in our terms) stem-final /k/ versus /g/.

(2) Singular identity versus plural difference

		'Cross' (NOM)	**'Phrygian' (NOM)**
Singular	Orthography	*crux*	*Phryx*
	Pronunciation	[kruks]	[p^{h}ryks][25]
	Morphology	/kruk + s/	/p^{h}ryg + s/
Plural	Orthography	*cruces*	*Phryges*
	Pronunciation	[kruke:s]	[p^{h}ryge:s]
	Morphology	/kruk + e:s/	/p^{h}ryg + e:s/

Assimilation enjoys a much better treatment in Terentius Scaurus's *De orthographia* (*G.L.* 7.27), which discusses whether *urbs* 'city' and *obtinere* 'to obtain' should be spelled with morphemic <b> or sound-level <p>. Modern editors have generally settled on morphemic spellings (but not for perfects such as *scripsi* 'I wrote' beside *scribo* 'I write', which also seems to have been the normal spelling in antiquity),[26] but spellings such as <pt ps> for <bt bs> were common in all periods, a pronunciation supported by various inscriptional spellings (e.g. PLEPS for classical *plebs* 'people', CIL 12.4333.12; 11 CE), and by the evidence of Quintilian (*Inst.* 1.7.7) and Velius Longus

[25] See Allen (1978: 26–7, 52–3) for the classical Latin pronunciations of <ph> and <y>.

[26] There is also no current standard in prefixed forms, e.g. the OLD reports morphemic *adferre* as a variant of assimilated *afferre* 'bring forth'.

(*G.L.* 7.62), who both contrast etymological voiced spellings with phonetic voiceless ones.

Priscian (*G.L.* 2.32–3) also considers morphophonological alternations, positing changes s → n (*sanguis* 'blood' → genitive *sanguinis*), s → r (rhotacism), s → d (*pes*, *pedis* 'foot'), and s → t (*virtus*, *virtutis* 'virtue'). However, his 'changes' in this section conflate morphophonological alternations with adaptations of Greek loans (*Aiax* from *Aias*) and comparisons with Greek cognates (Gk. *hex* = Lat. *sex* 'six').

The criteria for analogical similarity highlighted by Varro and the earlier Alexandrians are further expanded by Herodian (*G.G.* 3.2.634; second century CE) to include more fine-grained phonological (and syntactic) considerations of environments when applying changes. One such κανών *kanṓn* 'rule', resulting from morphological concatenation, anticipates the recognition of compensatory lengthening (*G.G.* 3.2.272): 'There is a rule which says that whenever the second vowel of a diphthong beginning with *a* is lost, the *a* is then lengthened, e.g. κλαίω κλάω *klaíō klā́ō*'.[27] It remains clear in Herodian's approach that both phonological and morphological operations manipulating sounds are treated as equivalent instances of transformation, e.g. 'one may say that every monosyllabic nominative [ending in *s*] which is inflected parisyllabically [i.e. the other cases have the same number of syllables as the nominative singular] forms its genitive by deletion of the *s*, e.g. ὁ Γρᾶς του Γρᾶ *ho Grâs*, *tou Grâ* (a proper name)' (*G.G.* 3.2.678) (Householder 1995d: 113–4, his translations). This approach continues to the end of the Greco-Roman period.

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[27] As Householder (1995d: 114) notes, the rule refers to an earlier diachronic stage, given that long vowels had all become short by Herodian's time (2nd cent. CE), and vowel length marks had not become part of the orthographic system even in that earlier time (Allen 1974: 86). There is no indication that the vowel was considered underlyingly long, or long in any abstract way.

Nevertheless, there is some acknowledgement that certain changes may have specifically phonological motivations through the desire for *euphonia* 'euphony'. Julius Caesar, in a work on analogy of which we have fragments, notes phonotactic restrictions on analogical proportions in a way that becomes standard among later grammarians: he states that Varro's suggestion that the nominative and accusative of *lac* 'milk' should in fact be *lact*, based on the genitive *lactis*, must be incorrect as no Latin word ends in two plosives (Funaioli 1907: 152, Caesar fragment 14; 293–4, Varro fragment 273). Priscian (*G.L.* 2.43, 2.506) notes that although a present tense third conjugation verb ending in *–bo* (e.g. *scribo* 'I write) ought, by analogy, to have a perfect tense in *–bsi*, it is in fact formed with *–psi* (*scripsi* 'I wrote') according to the euphonic principle, as <bs> could not begin a syllable, whereas <ps> could, based on Greek models (see §0 on ancient syllabification). The motivation for the change is therefore the non-violation of a syllable-based phonotactic constraint (in a fashion analogous to some constraint-based modern approaches, despite differences in the precise motivation), rather than assimilation in voice, a concept not well grasped in ancient times.

There are therefore several pertinent observations on alternation in the Greek and Roman treatises. However, without the notion of a morphological stem (not an already inflected root form; see §0), such observations could not be further systematized.

6.5 Sound change and variation

Sound change is noted by several grammarians in their discussions of letters and etymology. In the former class, various diachronic changes are noted, such as the Latin losses of /h/, of /n/ before fricatives, and of /m/ word-finally. The latter etymological discussions are often rather fanciful, but Varro's approach (see Pfaffel 1981), though largely based on phonological similarity (e.g. de Melo 2019 chapter 4 and on *L.L.* 5.70), is more principled: Latin words are derived from other Latin words, rather than

Greek—dialectal and archaic forms can provide those bases—and developments have occurred according to the four transformations: addition, loss, transposition, and alteration (Law 2003b: 44). This approach allows him to note sound changes, e.g. *bellum* 'war' < archaic *duellum* (7.49), *Naeus* < *Gnaeus* (Funaioli 1907: 333 Varro fragment 330), and even formulate reconstructed forms, e.g. **esum* for *sum* 'I am' beside *es* 'you are', and *est* 'he/she/it is' (9.100; Taylor: 1995c: 105), a reconstruction accepted today and supported by attested *esom* (see de Melo 2019 for commentary).

Varro also discusses analogical change mainly through paradigmatic levelling, harnessing arguments for its pros and cons in his rhetorical anomaly-analogy debate (books 8–9, with Varro's own position in book 10, on which Taylor 1996 is a landmark study); here, he presents an intellectual quarrel between advocates of the primacy of *consuetudo* 'common usage' despite irregularity (anomalists) and proponents of the regularity and ongoing regularization of language through levelling (analogists). Varro admits the importance of analogy in inflectional morphology, but conflates its role in diachrony and synchrony (*L.L.* 8.5, 9.34–5). In the following century, Quintilian (*Inst.* 1. 6.16–27) acknowledges levelling, but rails against the use of regularized forms; for example, he opposes regularizing *audacter* 'boldly' to *audaciter* (cf. *pertinaciter* 'stubbornly'), and *ebur* 'ivory' to *ebor* (cf. *eboris*, GEN). However, he is the only Roman grammarian to differentiate synchronic and diachronic *mutatio* 'change' (*Inst. Orat.* 1.4.12–17): 'changes introduced by conjugation and prefixes', e.g. *cadit excidit*, *calcat exculcat*, versus 'changes that time has brought about', e.g. *Valesius* > *Valerius* 'Valerius' (rhotacism), *arbos* > *arbor* 'tree', *duellum* > *bellum* 'war', *dederont* > *dederunt*, and *Menerva* > *Minerva* (Desbordes 2000: 469).

In the Greek tradition, etymologizing via πάθος *páthos* 'change' was not wholly unconstrained, as noted by Probert (2006: 31): 'the operation of a πάθος on a word leaves the accentuation of the word unchanged, unless this would cause violation of a general accentual law (e.g. the law of limitation), or a specific law applying to the

particular class of word involved' (see §0). For example, the Byzantine *Etymologicum Gudianum* discusses the etymology of ἠθεῖος *ētheîos* 'trusty', invoking a doctrine which the modern editor Lenz (*G.G.* 3.2.171) takes to derive from Herodian; it states: 'But it's more according to rule to derive it from θεῖος [*theîos* 'divine'] than from ἔθος [*éthos* 'custom']. For in the derivation from θεῖος the same accent is kept and only a few changes are given; but in the derivation from ἔθος the accent is different and many changes are given' (*Et. Gud.* 238. 37–41).

Sextus Empiricus (second century CE) discusses several pronunciation differences between the Greek of his day and earlier forms whose spellings remain. This is couched within an attack on the unquestioned notion that the Greek alphabet was (in our terms) phonemic, or in their terms, that each letter had a separate 'power': <oi ei ou ai> were no longer diphthongs, but represented [y i u e] (*M.* 1.115–18, 169); <z> was simply [z] and no longer a sequence [zd]; <s> before <m> was voiced [z]; aspirated plosives had become fricatives, and were therefore classed by some as ἡμίφωνα *hēmíphōna* 'semivowels' rather than ἄφωνα *áphōna* 'mutes' (Householder 1995c: 101; Taylor 1995a: 88; Allen 1974: 21). These changes led Sextus to include a part in the grammar dedicated to ορθογραφία *orthographía* 'spelling, lit. correct writing', not found in the earlier *tékhnē*, but necessary in a time when spelling no longer reflected pronunciation (Householder 1995c: 102). However, Sextus has no principled theory of phonology within which to position these observations (Householder 1995c: 101).

Sextus Empiricus's striking second main observation is that there is widespread individual, stylistic, and register-based variation in the production of language. Dialectal variation had been discussed in detail in previous work (given that different Greek genres were historically written in different dialects), and continued to be reported later. Examples are the 'rustic' pronunciations of Latin, as at Varro *R.* 1.2.14, and Pompeius's (*G.L.* 5. 286–7) report of a dialectal difference in clear and dark /l/ (just as in English, e.g. Carter & Local 2007 for British English), with African Latin

renowned for having only the dark variant (cf. dark /l/ in US English varieties). Sextus, however, was the first to highlight the role of speaker adjustment of style and vocabulary to the interlocutor, stating that we need to know many different συνήθειαι *synḗtheiai* 'usages' to be able to adjust our speech accordingly *(M.* 1.88–9, 176, 191, 195, 206, 220; Householder 1995c: 101). As Householder (1995c: 101) notes, 'All these acute observations were almost without influence on later linguists, and had to be made again independently in modern times'.

6.6 Other key concepts

Some repeated motifs in the role of sound in Greek linguistics are still considered fundamental to language study today. The arbitrariness of sound-meaning correspondence, most famously articulated by Saussure, was acknowledged through detailed debate (for the Greek of their own times at any rate, if not for a legendary precursor of the language) as reflected most notably in Plato's *Cratylus* (see Law 2003a: 20–3). Stoic language study focused on the relationship between φωνή *phōnḗ* 'sound' and τὸ σημαινόμενον *tò sēmainómenon* 'the being signified', a precursor to our own dichotomy.[28] Varro's terms *res*/*materia* on the one hand and *uox*/*figura* on the other overlap with Saussure's *signifié* and *signifiant* respectively (de Melo 2019: volume 1 §5.4 s.v. *figura*, *materia*, 210, 213).

Similarly, notions of the dual patterning or double articulation of language can be detected from at least as early as Plato (*Tht.* 202–4, *Cra.* 424–5, 431–2), culminating in Apollonius Dyscolus' formulation (*Syntax* 1.1–2) of letters and syllables as concrete,

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[28] Stoic thought held that a meaningful utterance had three elements (Sextus Empiricus *M.* 8.11–12): σημαῖνον *sēmaînon* 'signifier' (e.g. the sentence, 'corporeal' due to its sound; Seneca *Ep.* 117.13), τυγχάνον *tugkhánon* 'receiver' or extra-linguistic referent (the corporeal referent named in the sentence), and σημαινόμενον *sēmainómenon* 'meaning' (the incorporeal object of sense-perception) (Sluiter 2000: 377).

and words and sentences as abstract. He then draws isomorphisms between the levels (*Syntax* 1.96), noting that just as some vowels tend to precede others (in diphthongs), some words are prepositional; and just as some letters can be pronounced in isolation (vowels), so some words can produce complete sentences (exclamations) (Householder 1995d: 112). Such an outlook is somewhat akin to the modern approaches in which phonology and syntax have a shared set of organizational tools (see the papers in Honeybone & Bermúdez-Otero 2006).

Perhaps one of the most fascinating ideas in the Greek tradition is the notion of an abstract underlying form from which the correct form is derived via change, startlingly akin to a central tenet of generative phonology. The notion is used primarily for inflectional morphology; the base form is itself inflected, hence not a morphological stem, but abstract in that it need not be a real member of the paradigm. Thus, Dionysius Thrax (*G.G.* 1.1.58–9) posits (very briefly) that a correct form τίθημι *títhēmi* 'I put', one of a small class of *-mi* verbs,[29] is derived from the abstract base τιθῶ *tithṓ*, with the more common 1 SG ending *-ō*, presumably as this base predicts the 2/3 SG of the *imperfect* (but not present) tense of both these *-mi* verbs (3a) and the 'circumflex conjugation' (e.g. νοῶ *noṓ* 'perceive') in *-eis*, *-ei* (3b).[30]

[29] The athematic root and reduplicated classes, e.g. *ti-thē-(<*dheh$_1$)-mi*.

[30] Dionysius' 'circumflex conjugation' consists of contract verbs (Sihler 1995: 521–4), derived from e.g. *noé-ō*, *noé-eis*, *noé-ei*.

(3) Singular paradigms of τίθημι ‘put’ and νοῶ ‘perceive’

a. *-mi* verb

	Present tense	Imperfect tense
1SG	*títhēmi*	*etíthēn*
2 SG	*títhēs*	*etítheis*
3 SG	*títhēsi*	*etíthei*

b. Circumflex conjugation

Present tense	Imperfect tense
noō̃	*enóoun*
noeîs	*enóeis*
noeî	*enóei*

Householder (1995d: 112) explains how the real 1SG could be derived from a further underlying base form *titheō* (with an uncontracted stem-final vowel; see fn. 30) using three of the four transformations (*pathē*) ‘that run through all linguistic theory’: (i) deleting the *-ō*, (ii) lengthening the *-e*, and (iii) adding *-mi*. Sextus Empiricus (*M.* 1.195) condemns approaches which appear to posit abstract (but fully inflected) forms such as nominative κῦς *kûs* /ky-s/ rather than the real κύων *kúōn* ‘dog’ in order to decline the noun more akin (but still not identical) to the common pattern in third-declension consonant stems with nominative in *-s*, genitive in (stem C+) *-os* and dative in *-i*, e.g. κῦς, κυνός, κυνί *kûs*, *kunós*, *kuní* beside δελφίς, δελφῖνος, δελφῖνι *delphís*, *delphînos*, *delphîni* ‘dolphin (NOM, GEN, DAT SG.) (Blank 1998: 223).

In Varro (*L.L.* 7.1), the verb *subesse* ‘to be underlyingly present’ (in the etymological, not morphological, section of the work) is used to refer to base forms before diachronic and synchronic changes; the term is therefore used in a way that is not too distant from an underlying representation in generative phonology (where processes would be purely synchronic) (de Melo 2019: vol. 1 §5.4 ‘Varro’s grammatical terminology’). According to Herodian in the second century CE (*G.G.* 3.2.780), the practice of positing abstract base forms was common in treating declensions and conjugations. Apollonius Dyscolus (also second century) greatly expanded the use of abstract underlying strings to derivational suffixes, and most

notably to whole sentences, leading Householder (1981: 17) to conclude that he was 'the inventor of the abstract base' in syntax-semantics.

6.7 Conclusions: the legacy of the Greco-Roman tradition

Most tangibly, the Roman *ars grammatica* tradition crystallized much of the linguistic metalanguage used today. The *tékhnē* attributed to Dionysius Thrax alone contributed a staggering number of grammatical terms still used in phonology and other branches, either as the Greek forms (diphthong, clitic, prototype, barytone, oxytone), or as Latin calques, a process begun by Varro (inflect, flexion, liquid) (Householder 1995c: 101).

The Greco-Roman tradition undoubtedly had a substantial influence on later western language science in general. During the Hellenistic period, the conceptualization of grammar evolved in two important respects. Firstly, it came to account for any and all instances of the Greek language, spoken or written, and not just older literary texts, as shown by Sextus Empiricus's (*M.* 1.76–84) report of Alexandrian definitions of grammar as 'an expertise on scientific principles which distinguishes in the most precise way the things said and the things thought among the Greeks, except those falling under other sciences', and 'the study of forms of speech in the poets and according to common usage' (Matthews 1994: 55). Secondly, grammar developed from being viewed as a practical (ἐμπειρία *empeiría* in Dionysius Thrax) to a scientific discipline (τέχνη *tékhnē*), hence more akin to music and philosophy than medicine and navigation, where an empirical approach based on prior experience is appropriate, but is ἄλογος *álogos* 'not rule-based' (Sextus Empiricus *M.* 1.60–1, 72).

The Greek tradition, and in particular the *tékhnē* attribute to Dionysius Thrax, had a major influence on the development of linguistics through the medieval period in Georgian, Armenian, and Church Slavonic (Shanidze 2000; Weitenberg 2000; Kakridis 2000), adopting some Greek phonological classifications even when they were unsuited to the language (Armenian, for example, lacks vowel length).

Donatus and Priscian were cornerstones of medieval and later linguistics in Europe, and numerous medieval commentaries on both were written (Hovdhaugen 1995: 116–17; see Koerner & Asher 1995: sections VI-VIII; Auroux et al. 2000: sections XIII-XVI). From as early as the start of the third century CE, the autonomous discipline of grammar, separate from rhetoric, literary criticism, philosophy, etc., was central to the education system, and the development of the genre of grammar-writing probably went hand-in-hand with the establishment of a structured school system (Hovdhaugen 1995: 115). Donatus's *Ars maior* was the culmination of the tripartite grammatical treatise—phonology (sounds), morphology (word derivation, parts of speech, declension, and conjugation), and the 'virtues and vices of speech' (barbarisms and solecisms)—and became 'the norm and model of grammatical literature and the centerpiece of educational curricula for over a millennium' (Taylor 1995a: 89). The major Russian contribution to medieval linguistics was a translation of Donatus's *Ars minor* at the end of the fifteenth century (Kakridis 2000: 451). Priscian's rediscovery in the Carolingian renaissance (ninth century CE) prompted a more theoretical 'speculative' approach to grammar, rather than pedagogical, and the reading of his work remained stipulated in the statutes of the Universities of Paris and Oxford throughout the later middle ages (Luhtala 1995: 128–9; Bursill-Hall 1995: 130). Priscian's techniques were employed by Sanctius (sixteenth century) whose Latin grammar influenced eighteenth- and nineteenth-century linguists, and notably the seventeenth-century Port-Royal grammar, which was considered by Chomsky to be the ancestor of the deep and surface structures of transformational grammar (Householder 1995d: 114; Wheeler 1995).[31]

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[31] Miel (1969: 270–1) concludes that Chomsky can 'do no better than to use the term "Port-Royal linguistics"' [not Chomsky's "Cartesian linguistics"] to describe the relevant seventeenth-century notions of 'language as species-specific to man' and 'underlying structures', 'doing justice thereby to the group which put these ideas together'.

Although Varro was revered and often quoted by later Roman authors, his formal linguistic theories barely made an impression in his successors' more functional-semantic approaches, more in keeping with the dialectical tradition. It was only when Varro's work was rediscovered by Boccaccio in 1355 that it had the significant effect it deserved among Italian Humanists; Varro ultimately appears to have played a significant part in shaping Renaissance linguistics (Law 2003b: 49), focusing on language's reflection of reality, and therefore its non-arbitrary nature.

However, to the end of the tradition, phonology mainly focused on letters and their pronunciation, and syllable quantity. The space devoted by the grammarians to phonetic and phonological considerations was usually miniscule in comparison with that devoted to morphosyntax, i.e. parts of speech, inflections (case, person, number, gender, tense) and derivations, declensions and conjugations, and the formation of sentences.[32] Even in the larger grammatical portion, the absence of the concept of 'morpheme' resulted in observations of morphophonological alternations being treated in a rather muddled fashion. The data used varied from authors' introspection to extensive use of literary sources (e.g. Priscian), particularly in metrical matters (Hovdhaugen 1995: 118). However, although the Greco-Roman study of sound failed to achieve the scientific rigour or systematic descriptiveness of its Sanskrit counterpart (see Kiparsky, this volume), it has had a very significant influence on present-day phonological categories (Allen 1981: 115; Baratin & Desbordes 1981). As Campbell (2001) notes, 'themes important in the ancient Greek tradition have persisted throughout the history of linguistics, such as the origin of language, parts of speech (grammatical categories), and the relation between language and thought, to mention just a few'; crucial observations and analytical tools in the organization of sounds—allophony, natural classes, accentuation, syllable structure and weight, phonological processes,

[32] Matthews (1994: 99) notes that in a modern edition of Priscian of nearly a thousand pages, only fifty relate to the sound level.

morphophonological alternation, and abstract underlying bases—can be counted among the contributions of the ancient western grammarians.

Acknowledgements

I am particularly grateful to Wolfgang de Melo for advice on Varro's work, as well as general discussion. His new edition and commentary on *De Lingua Latina* is an impressive contribution to both Latin scholarship and linguistic historiography. I thank the editors, Frans Planck, and three anonymous reviewers, whose advice on every section has helped improve this chapter immeasurably. All errors remain my own.

Appendix: authors, dates, and major works pertaining to phonology

Authors given in chronological order by language.

A. Greek authors

Author	Dates	Major Works
Plato	429–347 BCE	*Cratylus, Republic, Theaetetus, Sophist*
Aristotle	384–322 BCE	*Categories, De interpretatione, Poetics, Rhetoric*
Dionysius Thrax	c. 170–c. 90 BCE, but probably only the introduction (first five chapters) is from this time	Τέχνη γραμματική *Tékhnē grammatikḗ* 'Art of grammar', the majority of which was written perhaps as late as the 4th cent. CE
Aristophanes of Byzantium	c. 257–180 BCE	Only fragments remain: Homeric and other classical scholarship
Diogenes the Babylonian	c. 240–152 BCE	Περὶ φωνῆς *Perì phōnḗs* 'On speech'

Aristarchus	c. 216–144 BCE	Only fragments remain: Homeric and other classical scholarship
Dionysius of Halicarnassus	late 1st cent. BCE	Περὶ συνθέσεως ὀνομάτων *Perì sunthéseōs onomátōn* = *De compositione verborum* (*Comp.*) 'On the arrangement of words'
Apollonius Dyscolus	mid-2nd cent. CE	*Syntax* and other shorter works
(Aelius) Herodian(us)	mid-2nd cent. CE	Περὶ καθολικῆς προσῳδίας 'On prosody in general', and other short works
Sextus Empiricus	c. 160–c. 210 CE (dates unclear)	Against the grammarians, Book 1 of Πρὸς μαθηματικούς, *Pròs mathematikoús* 'Against the mathematicians' = *M.*, 6 books
Dionysius of Halicarnassus	1st cent. BCE	Περὶ συνθέσεως ὀνομάτων *Perì sunthéseōs onomátōn* = *De compositione uerborum* (*Comp.*) 'On the arrangement of words'
Aristides Quintilianus	c. 3rd cent. CE	*De musica* 'On music'
(Georgius) Choeroboscus	early 9th cent.	*Scholia in Theodosii Alexandrini canones* 'Scholia on the rules of Theodosius of Alexandria'

B. Roman authors

(Marcus Terentius) Varro	116–27 BCE	*De lingua Latina* 'On the Latin language'; only books 5–10 (out of 25) survive

(Marcus Tullius) Cicero	106–43 BCE	*De Oratore* 'On the orator', *Orator* 'Orator', *Tusculanae disputationes* 'Tusculan disputations'
(Marcus Fabius) Quintilian(us)	c. 35 CE–c. 100 CE	*Institutio oratoria* 'Educating the Orator'
Terentianus Scaurus	early 2nd cent. CE	*De orthographia* 'On orthography'
Velius Longus	early 2nd cent. CE	*De orthographia* 'On orthography'
Flavius Caper	2nd cent. CE	*De orthographia* 'On orthography'
Terentianus Maurus	2nd cent. CE	In *G.L.* 6, *Scriptores artis metricae* 'Writers on the art of metrics'
(Marius Plotius) Sacerdos	3rd cent. CE	*Ars grammatica* 'Art of grammar'
(Flavius Sosipater) Charisius	4th cent. CE	*Ars grammatica* 'Art of grammar'
Diomedes	4th cent. CE	*Ars grammatica* 'Art of grammar'
Marius Victorinus	4th cent. CE	*Ars grammatica* 'Art of grammar'
(Aelius) Donatus	c. 350 CE	*Ars minor* 'Shorter grammar'); *Ars maior* 'Longer grammar'
Pompeius	c. 4th cent. CE	*Commentum artis Donati* 'Comment on the *Ars* of Donatus'
Servius	late 4th – early 5th cent.	*Commentarium in artem Donati* 'Commentary on the *Ars* of Donatus'
Martianus Capella	early 5th cent. CE	*De nuptiis Philologiae et Mercurii* 'On the marriage of Philology and Mercury'

Priscian	early 6th cent. CE; works written 526–7 CE	*Institutiones grammaticae* 'Grammatical doctrine' and shorter works

Collections and Primary Sources

Abbreviations of Latin authors, works and collections, and editions cited are as per OLD. Greek authors, works, collections and editions are as per LSJ, aside from the grammarians (see *G.G.* below). The key collections are:

CIL = (1862-). *Corpus Inscriptionum Latinarum*. Berlin: Preussische Akademie der Wissenschaften apud G. Reimerum.

G.L. = Keil, H. (1855–1880). *Grammatici Latini*. 8 volumes. Leipzig: Teubner.

G.G. = *Grammatici Graeci*. Leipzig: Teubner. In four parts:

Part 1 (1883/1901): *Grammatici Graeci. Recogniti et apparatu critico instructi. Pars I Vol. 1: Dionysii Thracis Ars grammatica*, G. Uhlig (ed.); *Vol. 3: Scholia in Dionysii Thracis Artem grammaticam*, A. Hilgard (ed.).

Part 2 (1878/1902): *Grammatici Graeci. Recogniti et apparatu critico instructi. Pars II: Apollonii Dyscoli quae supersunt*, R. Schneider & G. Uhlig (eds.). 3 volumes.

Part 3 (1867, 1868/70): *Grammatici Graeci. Recogniti et apparatu critico instructi. Pars III: Herodiani Technici reliqiuae*, A. Lentz (ed.). 2 volumes.

Part 4 (1889/1894). *Grammatici Graeci. Recogniti et apparatu critico instructi. Pars IV: Theodosii Alexandrini Canones, Georgii Choerobosci Scholia, Sophronii Alexandrini Exerpta*, A. Hilgard (ed.).

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