Latin syllable structure in typological perspective

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Abstract

Three parameters are considered in the typology of Latin syllable structure:
1) phonotaxis of syllable structure,
2) correspondence of syllable structure with morpheme structure,
3) syllable structure processes.

With respect to these parameters, Latin may be characterized as follows:
1. Latin allows moderate complexity of the onset, which, during its history, gets further reduced. Similarly, complexity of the nucleus is mostly reduced to a single short vowel. Latin allows relatively complex rhymes, which, however, get reduced in the language history.

2. Latin (as well as Romance languages) goes relatively far in blurring morphological boundaries, even left stem boundaries and, thus, word boundaries, by 'liaison'.

3. Latin phonology is relatively faithful to lexical representations. However, syllable structure is simplified, at the expense of the phonological manifestation of grammatical boundaries.

1. Introduction

The purpose of this contribution is to characterize the Latin syllable on the background of a general theory of syllable structure and of typological variation encountered in this area. The theory has to take into account the phonetic basis of the syllable, the principles of its structure at the phonological level, the nature of syllabication and phonological processes that change syllabic structure.

Major emphasis is given to the ways in which structural complexity of the syllable is gradually built up in languages by the introduction of lower-level constituent structure. Latin will be characterized with respect to various parameters of structural complexity. Furthermore, attention is paid to Latin syllabication and to the extent to which it respects or blurs grammatical boundaries. The role of syllable weight for Latin prosody is considered. Finally, the impact of phonology on the surface representation of lexical structure is briefly assessed.

2. The position of the syllable in phonological theory

The syllable has its place in a complexity hierarchy of phonological units which is shown in T1:

T1. *Levels of phonological complexity*

cursus
phonological word[1]
foot
syllable
mora
segment
feature[2]

Just as the corresponding hierarchy in grammar (sentence, clause, syntagm, word-form, stem, morpheme), the principle underlying the hierarchy and its extreme levels – cursus and segment/feature – are universal. Intermediate levels, however, may not play a role in some languages. Latin phonology, for instance, makes no reference to the foot. For present purposes, it suffices to know that the syllable is the minimum free phonological unit and the locus of suprasegmental features such as stress and tone. The cursus[3] is a string that contains no pause but is limited by pauses. The mora will be defined in section 6.

A unit of a complexity hierarchy may be a primitive (constitutive) or a derived concept. In the former case, it is conceived as part of a unit of the immediately higher level. In the latter case, it is defined analytically as a certain configuration of units of the immediately lower level. In this sense, the syllable – just like some of the other units in T1 – may be a primitive or a derived unit in the phonology of a language.

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[1] = prosodic word

[2] The feature has been set apart from the rest of the hierarchy because unlike the other units, it combines on the vertical dimension to form the next more complex unit.
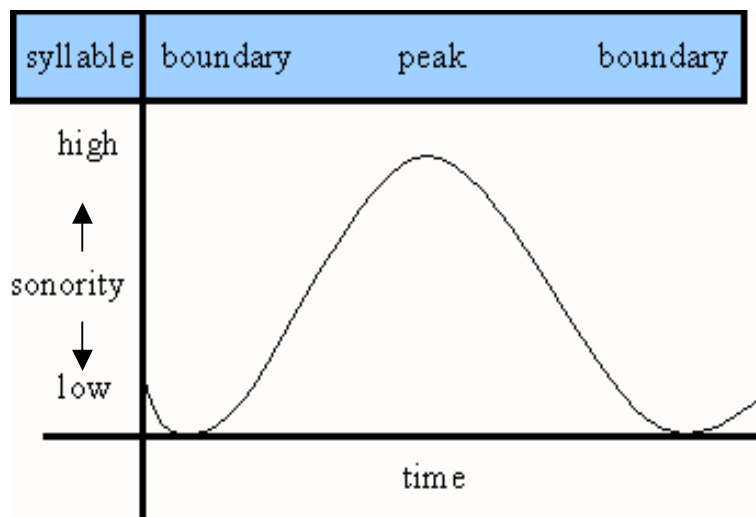
[3] = phonological phrase or breath group; term introduced in Pulgram 1970.

3. The structure of the syllable

3.1. Sonority

From the phonetic point of view, the spoken chain consists in waves of sonority (or of sound intensity). Points of high sonority alternate with points of low sonority. In this perspective, a syllable is a section between two successive points of low sonority, as illustrated in S1.

S1. *Syllable as sonority wave*

Sonority is an intrinsic property of certain segment classes. "The sonority of a sound is its loudness relative to that of other sounds with the same length, stress, and pitch" (Ladefoged 1975:219), that is to say, its intrinsic acoustic energy potential. A segment's sonority essentially corresponds to its degree of constriction (or, conversely, opening), as shown in S2.[4] S2 is a simplified one-dimensional version of a sonority hierarchy defined in terms of distinctive feature oppositions (see Blevins 1995:211).

S2. *Scale of phonetic sonority*

sonority	category	constriction
maximum	open vowel	minimum
↑	mid vowel	↓
	closed vowel	
	approximant, liquid	
	nasal	
	fricative	
minimum	stop	maximum

Segments of high sonority constitute the syllable peak, while segments of low sonority constitute syllable margins. More precisely, it is the syllable onset that typically has low sonority. The sonority peak by default coincides with the end of the syllable; the gradual fall of sonority towards the end is optional.

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[4] Cf. Ladefoged 1975:220, Durand 1990:210 and Angoujard 1997, ch. 2.1.

Like most concepts of the phonological level, the syllable has a universal phonetic basis (cf. Pulgram 1970,. ch.1), which consists in the undulation of sonority of S1. However, this phonetic gestalt does not directly provide the definition of the syllable or of syllabication in a given language. Instead, this is done at the phonological level, i.e. at the level of the language system (cf. Zirin 1970, ch. I). Here, segments are categorized in different sonority classes. This means that the language will subdivide the continuum of S2 in a more or less arbitrary fashion. Latin makes use of the sonority categories shown in S3.

S3. *Sonority categories in Latin*

sonority categories		segment categories
principal	**subcategory**	
3	3	open vowel
	2	mid vowel
	1	closed vowel
2		approximant, liquid
1,5		nasal
1	3	sibilant
	2	other fricative
	1	stop

3.2. Constituent structure of the syllable

It follows from what has been said before that the sonority scale of S2 manifests itself on the syntagmatic dimension. The phonotactic structure of the syllable may be described by a constituent structure model.[5] While the principle underlying the model is universal, its details are language-specific. S4 shows the Latin version of it. 'σ' means 'syllable proper'. Constituents are illustrated by the monosyllaba *strix* 'crow' and *stirps* 'root'.

S4. *Constituency of the syllable*

constituent	syllable						
	pre-initial	σ					postcoda
		onset		rhyme			
		initial	postinitial	peak	coda		
son. category	1.3	1	2	3	2	1	1.3
examples	s	t	r	i		k	s
	s	t		i	r	p	s

The correspondence between syllable constituency as in S4 and the sonority scale of S2 requires that the sonority of the segments that occupy these syntagmatic positions increases

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[5] Cf. Vincent 1986, Durand 1990, ch. 6.1, Blevins 1995:212f and Cser 2001.

from the initial up to the peak and that it decreases again from the peak down to the coda. There are, however, syllables – including just those illustrating S4 – whose first segment is higher in sonority than the second, or whose last segment is higher in sonority than the preceding one. Latin is like many other languages here in that the only consonant that may do this is a sibilant, notably /s/. This remains intractable if one views the syllable in isolation, but it becomes intelligible when we turn to syllabication of strings (section 5).

In the conception of the syllable as a phonological unit, the peak has absolute priority over the boundary. What makes a syllable is its peak, not its boundaries. In a given cursus, the number of syllables and the location of their peaks are practically always uncontroversial, while it may be hard to pin down the boundaries. In fact, in several respects, the constituent structure model is only a crutch for the proper understanding of syllable structure. We have to face phenomena of ambiguous and of double constituency. Let us briefly look at two sorts of such phenomena.

Returning first to the problems of syllable boundaries, these essentially stem from two sources. First, the pre-initial and the postcoda are labile and functionally ambiguous; i.e. a segment in a given chain may be one or the other. Second, a syllable boundary may fall in the middle of a segment (which is then ambisyllabic). This concerns, above all, geminate consonants; but similar arguments have been advanced for other sorts of consonants. To approach a solution of this problem, the concept of an interlude[6] may be useful, which is a part of the phonological string that bridges two adjacent syllables, comprises at least the pre-initial and the postcoda and may be a constituent – if constituent structure we require – of either or both or neither of the neighboring syllables. The idea is illustrated by Latin *extra* 'outside' in S5, which deliberately leaves some aspects in the dark.

S5. *The interlude*

syllable		syllable		
…	postcoda	pre-initial		…
		interlude		
e k		s		t r a

The second kind of problems associated with syllable constituency concerns the internal structure of the rhyme and stems from the fact that the structure of the syllable is both symmetric and asymmetric. The basic symmetry lies in the wave form of S1 and is resumed in S4 in the sequence of the sonority values corresponding to syllable constituents. The basic asymmetry stems from the nature of the two halves of the syllable: the rhyme, based on a vowel, can represent the syllable; the onset, based on a consonant, cannot. In consequence of this ambivalence, alternative constituencies have been proposed for the syllable. One of them makes use of the notion of the nucleus as part of a ternary structure. The nucleus of a syllable is the part between the onset and any coda consonants. It contains the peak, which is that one segment that has highest sonority. The nucleus is not a proper constituent of the binary structure S4, as it comprises the peak and the first part of what is the coda in S4. The nucleus may consist of a long vowel or a diphthong whose first half is the peak and whose second half is part of the coda s.l. (sensu lato). This is shown in S6, illustrating with Latin *pēs* 'foot' and *aut* 'or':

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[6] proposed in Hockett 1955:52, taken up in Vincent 1986:316f

S6. *Constituency of peak and nucleus*

binary	onset	peak		coda s.l.
	p	e	e	s
		a	u	t
ternary	onset	nucleus		coda s.s.

The kinds of phenomena that are apt to blur the boundary between peak and coda concern segments of intermediate sonority in the rhyme and include the following:

- There are languages such as Cantonese (see Vincent 1986:313f) and Yucatec Maya, in which sonorants and semivowels in the rhyme consistently pattern with coda consonants and are therefore best regarded as part of the coda s.s. (sensu stricto).[7]
- In other languages such as Proto-Indo-European and Vedic, the combination of a vowel and a sonorant in the syllable rhyme forms a syllable nucleus.
- In English (Vincent 1986:314), sonorants may either be part of the nucleus or of the coda s.s.

We have to keep in mind that we are talking about discrete phonological structures erected over a phonetic continuum; S4 shows the constituency of the syllable in one particular language. The major constituent break between onset and rhyme may be universal.[8] However, the richer the structure becomes, the more there is variation among languages. In this and some other respects, S4 is less of a constituent structure in the strict sense and more a nomenclature for the parts of a syllable.

4. Syllable complexity

4.1. The optimal syllable

The paradigmatic side of phonological distinctness is opposition, its syntagmatic side is contrast. The chief domain of phonological contrast is the syllable. In consonance with the basic asymmetry of the syllable stated in section 3.2, its structure is governed by a principle of maximum contrast that may be stated as in P1:[9]

P1. *Contrast maximization*

The optimal syllable maximizes the contrast between onset and peak.

P1 hides some dialectic complexity, as it appears to require maximum contrast within one syllable. What actually matters, however, is the contrast between the peak of a syllable and the onset of the following syllable.

P1 entails that those peaks are best that are highest in sonority. Thus, every language has vocalic syllable peaks. It equally entails that those onsets are best that are lowest in sonority. Thus, every language has syllable onsets constituted by stops (cf. Jakobson 1941). This

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[7] Cser 2001 argues that the second part of a Latin diphthong is part of the coda s.s. Hence, the *u* of *aut* would not occupy the same constituent structure slot as the second part of the vowel of *pēs*, as in S6. This, however, renders an account of monophthongization more difficult.

[8] There is also a proposal for a binary structure consisting of body and coda, with the major break after the peak.

[9] Most of the following principles correspond to preference laws of Vennemann 1988.

amounts to the well-known empirical fact that the syllable structure CV is universal.[10] P2 is a consequence of P1.

P2. *The optimal syllable*

The optimal syllable has the structure CV.

Quite a few languages are like Hua in only allowing the optimal syllable, or like Cayuvava and Hawaiian in tolerating, besides the optimal syllable, only its onsetless variant, the pure vowel.

One might wish to say that the optimal syllable is the minimal syllable. This would not be true in a literal sense, because obviously the minimal syllable consists of one segment, normally a vowel. Such a syllable is not optimal. However, if we presuppose that a syllable consists of onset and rhyme, then the optimal syllable has a minimal onset and a minimal rhyme.

4.2. The rhyme

As we have seen, the relationship between the onset and the rhyme is basically asymmetric. The rhyme is more prominent than the onset, and it gives prominence to the syllable as a whole. Wherever there is, at any linguistic level, a syntagmatic contrast in prominence, preference in diversification and elaboration is given to the prominent part, to the detriment of the backgrounded part. This is the foundation for P3.

P3. *Complexity asymmetry in the syllable*

Complexity in the onset presupposes complexity in the rhyme.

As long as a syllable only consists of two segments, the major constituent break between onset and rhyme suffices to describe syllable structure. As soon as the syllable contains more than two segments, the next constituent structure break, the one between peak and coda, is implemented. This takes precedence over any subconstituency inside the onset, as expressed in S7. This hierarchy and those to follow are interpreted in the way of Jakobson's (1941) unilateral foundation of marked structures: If a language possesses a structure at a given position of the hierarchy, then it also possesses all the structures to the left of that position. Conversely, if complexity is gradually built up in a language, this follows the corresponding hierarchy from left to right.

S7. *Syllable complexity hierarchy*

•CV• > •CVX• > •CXV•

'•' represents the syllable boundary and X means 'any segment'. In CVX, X represents the coda s.l.

Since it is the function of the rhyme to give prominence to the syllable, further elaboration of the rhyme gives preference to segments of high sonority in the coda, while consonants of lower sonority are more marked. This leads to the hierarchy shown in S8, where V_iV_i means 'long vowel' and VW means 'falling diphthong' (regardless of whether this particular

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[10] or almost universal. Sommer 1970 reports on a group of languages on Cape York peninsula, North Queensland, that have CV syllable structure only as a conditioned variant of basic VC structure. Blevins 1995:230f refutes Sommer's analysis.

segmental composition turns out to be the appropriate analysis for long vowels and diph-
thongs in every case) : [11]

S8. *Rhyme complexity hierarchy*

V• > V_iV_i• > VW• > VN• > VL• > VC•

Examples for constraints on the coda follow:
*   In Axininca Campa, the only consonantal segment permitted is N, homorganic to the fol-
    lowing onset.
*   In Mandarin Chinese, the only consonantal segments allowed are the sonorants /n ŋ ɹ/.
*   In Japanese, codas must be homorganic to the following onset.
*   In Italian, codas are sonorants or homorganic to the following onset (Vincent 1986:315);
    or (postcodaic?) /s/.
*   In Yucatec Maya, one consonant is allowed.
    It should be noted that the right end of S8 is not an extreme pole in any sense. I have just
broken off elaboration of the rhyme at that point, because from there on, we may distinguish
between elaboration of the nucleus and elaboration of the coda s.s., as we shall do in what
follows. It is therefore no great feat that Latin covers the full range of S8.

4.3. The nucleus

Syllable peaks are formed in accordance with P4:

P4. *The optimal peak*

If a language admits a segment class of a given degree of sonority (of S2) as a syllable peak,
then it also admits all segment classes with higher sonority.

Latin is like many other languages in being maximally restrictive about P4, i.e. in allowing
only vowels as syllable peak. Other languages admit sonorants, nasals and even fricatives.
    The simplest nucleus consists just of a short vowel. S9 takes up the initial segment of S8
and presents the complexity hierarchy for nuclei.

S9. *Nucleus complexity hierarchy*

V > V_iV_i > VW > WV > WVW

Many languages are like Yucatec Maya in only reaching the second position of S9. The se-
quence VW does exist, but appears only before syllable boundary, besides such rhymes as
VC. Here the semivowel is part of the coda s.s. rather than of the nucleus. On the other hand,
Mandarin Chinese may be mentioned as a language that allows nuclei of maximum complex-
ity.
    Latin reaches down to the position 'VW' on the hierarchy of S9; there are no rising diph-
thongs. Throughout the history of the Latin language from Proto-Indo-European down to
Proto-Romance, the complexity of the nucleus gets reduced. While Old Latin had inherited a
large set of diphthongs from Proto-Italic, it monophthongized one after the other until, by 100
AD, none of them (except the insignificant /ew/) was left. Moreover, vowel length was
dephonologized before 200 AD. Insofar, only simple syllable nuclei remained in Proto-
Romance.

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[11] In this respect, the present analysis deviates from the one proposed in Blevins 1995:218f.

On the other hand, sequences of high vowel plus lower vowel underwent synizesis in Vulgar Latin and Proto-Romance (s. Kiss 1971:93-96), so that Latin quadrisyllabic *ratione* yields Italian trisyllabic *ragione*, Latin trisyllabic *facio* yields Italian bisyllabic *faccio*. At some point, this introduced rising diphthongs into the language, whose subsystem was expanded in some of the modern Romance languages from other sources (Italian /uo/ etc.).

4.4. The syllable margins

In comparing the development of complexity in the syllable margins, we have to keep in mind the ambiguity of syllable structure (cf. section 3.2):

- The asymmetry between onset and rhyme gives the rhyme a lead in the development of complexity.
- The symmetry between onset and coda s.s. is responsible for equal complexity of the margins.

We will repeatedly meet this ambivalence below.

The optimal syllable has a consonant at the start and no consonant in the end. To this extent, the onset has the lead in the elaboration of consonantal complexity. It is guided by the principle P5, which we will meet again in syllabication.

P5. *Restricted onset maximization*

The onset starts before that segment from which sonority increases steadily up to the syllable peak.

P5 is a direct consequence of P1 and P2: those onsets are best that are lowest in sonority; therefore a depression in the sonority undulation is the start of a new syllable, not the end of the preceding syllable. If two consonants become adjacent between two syllable peaks, there are three logical possibilities in terms of their respective sonority, as illustrated in the left-hand column of T2 (where i represents some degree of sonority). P5 syllabifies them as shown in the second column of T2.

T2. *Syllabication of consonant clusters*

group	syllabication	example
$C_i\,C_{i+1}$	$\bullet C_i\,C_{i+1}$	pa•tris
$C_{i+1}C_i$	$C_{i+1}\bullet C_i$	par•tis
$C_i\,C_i$	$C_i\bullet C_i$	par•ris

Thus, the syllable boundary will naturally fall between the two consonants except if the second is higher in sonority than the first, in which case the boundary precedes the consonant cluster. Applied to a sequence of /VCLV/ (muta cum liquida), P5 favors the syllabication /V•CLV/ over /VC•LV/. This is a force leading to relatively complex onsets as compared with codas s.s.; there are, however, counteracting forces, as we shall see.

A language may develop the onset or the coda in terms of complexity. In principle, these two parts are independent of each other; i.e. a language that complicates its onsets does not need to complicate its codas, too. However, since one syllable is adjacent to the next, asymmetry in the elaboration of either onset or coda will, at mid-term, be leveled out. For instance, a language might start developing complex onsets of the kind /pt/ etc., while still banning closed syllables. However, such a complex onset will ex hypothesi be preceded by an open

syllable, and P5 will syllabify a sequence /VCCV/ as /VC•CV/ rather than as /V•CCV/. The language will thus end up having syllables that end in /p/. By consequence, languages tend to have similar complexity in onsets and codas, as a reflex of the basic symmetry of the syllable.

On the other hand, constraints on onsets are more rigid than constraints on codas, because distinctness of consonants is more important in the onset. As a consequence, consonantal material that cannot be subsumed under a given onset in syllabication may accrue in the postcoda and even coda of the preceding syllable, being indulged there by phonotactic constraints and to be treated by phonological rules bound up with syllabication (see section 5). This may lead to the development of coda complexity at the phonotactic level which has no counterpart in the onset. Thus, Latin phonotaxis admits such syllables as the second one in *siremps* 'likewise', whose mirror image would contain an inadmissible onset.

4.5. The onset

The peak is the only universally obligatory part of the syllable. However, syllables that lack an onset are defective. Many languages, not only those confined to CV structure, disallow them. Languages lacking a syllable that only consists of a V also lack VC syllables. In other words, VC as a syllable is even worse than sheer V.

Latin allows onsetless syllables at the lexical level both word-initially (*ovum* 'egg') and word-medially (*mo•ne•as, Da•na•os*). In the latter case, glide formation probably created an onset (and removed the hiatus; Moralejo 1989).

Because of P1, the absolute onset should be a stop. In order to be distinct, it must explode, i.e. it must initiate a movement towards higher sonority. A segment between the absolute onset and the absolute peak of a syllable tends to be of intermediate sonority and consequently constitutes a transition between them. Postinitials with low sonority are more marked than those with high sonority. This may be formulated as in S10, a simplified version of a complete onset complexity hierarchy (cf. Greenberg 1965).

S10. *Onset complexity hierarchy*

•C > •CW > •CL > •CN > •C_iC_j

Here are some examples of languages that stick to different positions on S10:
- Hua, Hawaiian, Yucatec Maya, Turkish and many other languages abide by position 1 of S10.
- Japanese is at position 2.
- Spanish allows the CL cluster in onsets.
- German allows CN in addition, plus an optional pre-initial /s/.
- Ancient Greek reaches the last position of S10, with words like *Ptolemaîos*.

Latin occupies a middle position on S10. It does allow CW (*suavis*)[12] and CL (*clam*) clusters, but bans CN clusters and those further to the right of S10. Moreover, the pre-initial /s/ may precede a subset of the admissible binary clusters. We will see in section 5 that the pre-initial is not, in fact, well integrated with these initial clusters.

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[12] /kw/ and /gw/ in Latin are consonant clusters that may constitute onsets (s. Lehmann 2002, section 3.3.5).

During the development from Latin to Romance, constraints on onset complexity increase:[13]

- While syllable- (i.e. word-)initial consonant groups introduced by /s/ are admissible in Latin and only removed by resyllabication in sandhi, they are disallowed in Ibero-Romance, in Old French and in several Italian dialects, being broken up by vowel prothesis.
- The group muta cum liquida was an unproblematic onset in Latin. There appears to have been a tendency in the spoken language to break such a group up in syllabication, so that /'te•ne•brae/ and /te•'neb•rae/ 'darkness', /'in•te•grum/ and /in•'teg•rum/ 'whole' would be alternatives. The tendency to simplify the onset prevails in the Spanish forms *tinieblas, entero*.

In the second case, simplification of the onset is achieved at the cost of complication of the rhyme of the preceding syllable.

4.6. The coda

P6 is a phonetically-based phonotactic principle that constrains contrasts in the coda:

P6. *Coda backgrounding*

No release of a constriction (in particular, no explosion) in the rhyme.

P6 is not a universal inviolable principle, but a constraint on optimal syllables. It is in consonance with the maxim that sonority should be lowest at the left syllable boundary, because release of a constriction is a move towards higher sonority and would thus tend to start a new syllable. If there is, at some stage of a language, a tendency to syncopate the vowel between a stop and another consonant, then the same tendency would require leaving the stop unreleased, thus assigning it to the preceding syllable, while its release would tend to reintroduce the syllable just syncopated. Consequently, stops in the coda tend not to be released. However, since it is the release – rather than the closure – that makes for the identity of a stop, this reduction seriously damages the stop. Consequently, many languages ban stops from syllable codas altogether. The principle of coda backgrounding does not affect segments of higher sonority, as their identity gains nothing from the release of their constriction.

Both the constraints on the syllabication of consonant clusters (T2) and the principle of coda backgrounding (P6) have the consequence that the first segments to be admitted into the coda are those of high sonority, while consonants of lower sonority are more marked. This is what we already saw in S8. If the syllable rhyme is further expanded, non-vowels of relatively high sonority – semivowels and sonorants – will tend to associate with the nucleus, while obstruents remain in the coda s.s. or even constitute a postcoda.

S11 is a prolongation of S8 with regard to coda (s.s.) complexity:

S11. *Coda complexity hierarchy*

C• > LC• > NC• > CC• > LCC• > …

Examples for constraints on the non-nuclear part of the coda follow:
- In Yucatec Maya, one consonant is allowed.
- In French and Spanish, one consonant plus the postcoda /s/ is allowed (cf. T4 below).

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[13] On this and some further Latin-Romance developments, see Kiss 1971, ch. III.

- In Turkish, two consonants are allowed.

As some of these examples already show, some languages reach postnuclear complexity by introducing a further constituent structure break, the one between coda and postcoda. Some languages, including German, are notorious for allowing extremely complex combinations of coda and postcoda, as in the monosyllabon *schrumpfst* /šrumpfst/ '(you) shrink'.

Latin, too, approaches the right pole of S11 only by adding a postcoda:

- Two-consonant codas have the form 'L/N C' (sonorant plus voiceless stop), as in *sanc•tus* 'saint', *carp•si* '(I) plucked'.
- /s/ may follow a one-consonant or a two-consonant coda (*ex* 'out', *stirps* 'root').
- A consonant cluster cannot follow a long vowel or diphthong. This is additional evidence for S4, where the second half of the diphthong or long vowel starts the coda s.l.
- Most of the consonants may end a word, but /f g h / cannot.

The diachronic trend in this domain is clearly towards simplification, as the Romance phenomena mentioned above already indicate.

4.7. Differential treatment of syllables

Syllables commonly have different prominence in the chain. This prominence stems from various sources: the distinction between lexical (root) morphemes and grammatical morphemes is a grammatical determinant; word-accent is a phonological one. The segmental phonology of a language may ignore this kind of prominence in its treatment of syllables, or it may be sensitive to it, limiting diversity of less prominent syllables. Hungarian, for instance, treats all syllables alike, having as much variety of vowels and consonants in unstressed as in stressed syllables. German, Russian and English, on the other hand, reduce the vowel system in unstressed syllables.

Latin steers a middle course in this regard. Complexity is essentially the same in accented and unaccented syllables, or, putting it the other way around, any type of syllable may be accented or unaccented (cf. Kiss 1971:14). Complex onsets and diphthongs except /ae/ are absent from grammatical affixes. However, apart from a process of vowel reduction that took place in linguistic prehistory, all vowels may appear in all positions and all kinds of morphemes. This liberality is, however, reduced in the development towards Romance. Syncope becomes pervasive, deleting non-prominent vowels. Italian and the Ibero-Romance languages, for instance, have constraints on vowels in suffixes.

5. Syllabication

5.1. Elementary notions

Syllabication is a phonological process that may apply at intermediate levels during the mapping of a lexical phonological structure onto a phonetic structure. In models that provide for cyclic application of phonological processes, syllabication may first apply at some lower level of T1 and then cyclically work up to the cursus. (Naturally, syllabication cannot apply across pauses.) Syllabication may be thought of as an algorithm that applies a template to the input string. In a first step, a syllable peak is identified, and in a further step, the left boundary of this syllable is located. The output of the algorithm is a string that is completely analyzed in

terms of syllable constituent structure as in S4 (Lehmann 2002 presents such an algorithm for Latin).

The input string for syllabication is composed of word forms with their grammatical – syntactic and morphological – boundaries. The lexical syllabic structure of a word form may be changed by syllabication. In particular, an initial consonant group may be split up so that its first segment becomes part of the last syllable of the preceding word; and similarly, a final consonant group may be split up so that its last segment becomes part of the onset of the next word. Former studies of syllabic phonotaxis often concentrated on isolated word forms and even morphemes and insofar failed to reveal the structure of the syllable in the spoken chain. The lexical syllable structure appears chiefly in syllables located at the edges of the cursus, as no resyllabication is possible there.

Thus, languages have constraints on complexity in syllable margins at the two levels shown in the left column of T3. Methodologically, the constraints may be seen operative in the corresponding two positions shown in the right-hand column of T3.

T3. *Two levels of phonotactic constraints on syllables*

level of representation	diagnostic position of syllable
lexical	edge of cursus
derived after syllabication	word-internal

Constraints on syllabified strings may be stricter or looser than constraints on lexical syllabic structure. T4 shows which consonants and consonant clusters occur in Spanish syllable codas; capitals represent archiphonemes (cf. Alarcos Llorach 1965, cap. V).

T4. *Consonantal codas in Spanish*

syllable-position coda composition	word-internal	word-final
consonants	/B, D, G, θ, s, N, L, R/	/d, θ, s, χ, n, l, ɾ/
consonant clusters	/rs, ns, (ks, ps)/	-

For example, the coda /ns/ occurs in a word such as *constante*, but there is no word, and consequently no cursus, ending in this group. The consonants and consonant clusters permitted in word-final position in Spanish are thus a proper subset of those appearing in medial position, which means constraints on syllabification are looser than lexical constraints.

In Klamath (Blevins 1995:223), onsets consisting of C_1C_2 occur exclusively at the start of a cursus; internally, all but the last consonant of a cluster are incorporated in the coda of the preceding syllable. Similarly in Cairene Arabic, C_1C_2 only occur at the end of a cursus; internally, they are split by syllable boundaries. In these languages, thus, constraints on syllabified strings are stricter than constraints on lexical representations.

Some languages apply the same constraints to cursus-marginal syllables as to internal syllables. Thus, if a cluster is left at the edge of a cursus that would be taken apart by syllabication if it occurred internally, then consonants jutting out are apocopated (by 'stray deletion'). This applies, for instance, to the final /n/ of English *damn* that appears in *damnation*, or to the /t/ that appears in Greek *onómatos* but not in *ónoma*.

Pre-initials and post-codas are assigned to an adjacent word in syllabication whenever possible. In some sense, these positions are outside syllable constituency proper, as is re-

flected in their names. In contemporary phonological theories, such material is also dubbed 'extraprosodical' or 'extrasyllabic'.

5.2. Latin syllabication

Grammatical boundaries, in particular word and morpheme boundaries, may in principle be relevant for syllabication. In a language like German, a word boundary or a stem boundary in a compound is always a syllable boundary. In the Romance languages, including Latin, this is not so. However, grammatical boundaries do play a role in syllabication. Latin obeys the following principles:

P7. *Grammatical boundary in consonant-vowel sequences*

Syllabication ignores a grammatical boundary in a CV sequence (C#V). That is, such a sequence will always belong to one syllable (by liaison).

As for sequences of two vowels, Latin allows them only across morpheme boundary:

P8. *Morpheme boundary in vowel sequences*

A sequence of two vowels that contains a morpheme boundary (V#V) is always separated by a syllable boundary (*re#i, re#um, me#am, tu#us* etc.).

If there is no morpheme boundary between two vowels, the sequence would be contracted into a diphthong, in other words, one of the two vowels would become a semivowel.

The boundary referred to by P8 does not cover the word boundary. In this respect, Classical Latin, and in particular its poetry, is rather remarkable, since if a vowel sequence is separated not by a morpheme, but a word boundary, then no syllable boundary is occasioned by the grammatical boundary, and synaloephe applies, as in *sata est* > /sa•tāst/.

P9. *Morpheme boundary in muta-cum-liquida sequences*

Syllabication of a sequence of muta cum liquida (and the same goes for the group 'muta cum semivocali') depends on the location of morpheme boundaries:
* If there is no morpheme boundary or the morpheme boundary follows the sequence (CL#), it is generally ignored in syllabication; in other words, the syllable boundary precedes the group (pa•tr#is, inte•gr#ō). In poetry, however, the group may be separated by a syllable boundary. Both variants are in consonance with P7.
* If the morpheme boundary precedes the sequence (#CL), the syllable boundary likewise precedes the group even in poetry (aurea• # prīma).
* If the morpheme boundary separates the sequence (C#L), the syllable boundary also separates it (ab• #rumpo, ferat• # regiō).

The generalization for muta cum liquida combinations is that P7 takes absolute priority; but otherwise the location of a grammatical boundary determines the syllable boundary.

Groups of obstruents are always separated before the last obstruent, regardless of the segmental context and of morpheme boundaries. This entails that if a word starts by an obstruent group, i.e. by /s/ plus stop, the syllable boundary falls after the initial obstruent. An example is nulla fu|gae rati|o, nul|la **sp**es, | omnia | muta (Cat. 64, 186).[14]

The rules applied in Latin syllabication may be summarized as in P10:

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[14] There are a couple of erratic exceptions to this in Virgil; see Lehmann 2002, §4.3.5.2.

P10. *Latin syllabication*

1.　Any vowel that does not directly follow another vowel is a peak.

2.a. Except at the start of the cursus, the onset must contain at least one segment. This implies that the determination of syllable boundaries ignores a grammatical boundary preceding a vowel.

　b. From there, the syllable boundary is successively displaced to the left up to that point where either sonority no longer decreases sufficiently (i.e. by one measure unit of the left column of S3) or there is a grammatical boundary.

In terms of constraints on syllabified representations, Latin sides with those languages like Klamath and Arabic that have mercy on consonants that are left at the edge of the cursus. Thus, pre-initials and post-codas are allowed in lexical representations and at the edge of a cursus, but in the interior of a cursus, syllabication reassigns them. For instance, *spargo* 'sprinkle' starts with the group /sp/, and *crux* 'cross' ends in the group /ks/. But *a#spergo* is syllabified /as•per•go/, and *crux est* is syllabified /kruk•sest/. Similarly, empty onsets are allowed in lexical representations and at the start of a cursus, but in the interior of a cursus, syllabication creates an onset by liaison: *inscius aeui* (Verg. A. 8, 628) yields /ins•ki•u•s#ae•wī/. The onsets permitted in syllabified strings are thus a proper subset of those permitted in lexical representations and at the edge of a cursus.

　　Because of liaison and avoidance of pre-initials in syllabication, onsets produced by syllabication are more regular than the phonotaxis of consonant clusters at the beginning of words, because these obey simply the principle of increasing sonority from the boundary up to the syllable peak.

　　As for the role of grammar in syllabication, P10 implies that two phonological principles take precedence over consideration of grammatical boundaries:

•　A syllable should have an onset.
•　A syllable should have no pre-initial.

Once these conditions are fulfilled, the rest of the syllable boundaries are where the grammatical boundaries are.

　　There is a universal tendency to mark the left morpheme boundary of a stem as a syllable boundary, while the right stem boundary tends to get blurred by syllable structure. Latin (as well as Romance languages) may be characterized by going relatively far in blurring morphological boundaries, even left stem boundaries and, thus, word boundaries, by the two phonological principles mentioned.[15]

6. Syllable weight

The weight of a syllable is the property that is relevant for prosody, especially for accent and meter. It is measured in moras. The mora (μ) is the weight of the optimal syllable (cf. T5.a).

T5. *Syllable structure and weight*

a	b	c	d	e	f	g
σ	σ	σ	σ	σ	σ	σ
μ	μ	μ	μ ┊ μ	μ ┊ μ	μ ┊ μ	μ

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[15] Marotta 1999 claims that Latin may be characterized as a language whose syllable structure respects grammatical structure, but presents no thorough analysis, let alone a typological comparison.

CV	V	CCV	CV⋮V	CV⋮C	CV⋮C	CVC
ta	a	sta	tā	ta⋮l	ta⋮p	tap

The following principles hold universally (cf. Broselow 1995):

P11. *Syllable structure and weight*

- Only rhyme units bear moras; the presence or absence or complexity of the onset does not matter for syllable weight.[16] Cf. T5.a with b and c.
- Anything following the minimal rhyme (i.e. the peak) may constitute another mora. This is governed by the sonority hierarchy as follows:
  - Each vowel or semivowel in the rhyme weighs one mora. Cf. T5.a with d.
  - If a segment at a given position of the sonority hierarchy weighs a mora, then every segment higher up on the hierarchy also weighs a mora. Thus, both T5.f and g are possible; but in a given language, f implies e.[17]

Languages therefore differ in which kinds of coda (s.l.) segments they allow to bear a mora:

- any sonority degree: English, Arabic, Sierra Miwok, Hausa;
- from sonorant upwards: Lithuanian, Creek, Kwakwala;
- only vowels: Mongolian, Huastec, Hawaiian, Lardil.

Latin here sides with the languages of the first group, in which any kind of complexity in the rhyme raises its weight to two moras; i.e. T5.g does not occur.

The relevance of the phonological unit of the mora to Latin phonology derives from the fact that both the rules of poetic metrics and the rules of accent placement may be formulated most simply on the basis of moraic structure. P12 recalls the well-known Latin accentuation rule.

P12. *Latin word accentuation*

1. The weight of the last syllable is stipulated to be one mora.
2. Word accent falls on the third-last mora.
3. If the word is shorter, word accent falls on the first mora.

While this does not answer the question of whether the mora is a primitive or a derived unit of Latin phonology in the sense of section 2, the Latin facts are clear evidence for the major constituent break after the peak in S4.

7. Syllable structure processes

In many languages, the phonetic syllable is rather different from the lexical one. Older models of phonology used the concept of syllable structure processes, more contemporary ones reckon with constraints that are applied to phonetic syllables. In any case, the result of such phenomena is a change in syllable structure.

The function of some of these processes is an approximation to the optimal syllable. Among these belong vowel shortening in closed syllables. In Hausa, Yokuts and German, for instance, given an input sequence CV:C, all segments remain fine if the sequence can be syl-

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[16] Blevins 1995:214 mentions a couple of apparent exceptions to this.

[17] Blevins 1995:214f analyzes the distinctions relevant here in terms of different constituency of these segment classes in S4.

labified as CV: •C. If, however, it has to be syllabified CV:C•, then the vowel is shortened, as in North German *Gläser : Glas* 'glass.pl. vs. sg.'. Classical Latin phonology leaves complex syllables admirably intact, witness such words as *paullum*, with a diphthong followed by a geminate. Another process that may be seen as a byproduct of syllabification is epenthesis.[18] This, too, is not regularly productive in the phonology of Classical Latin.

The most important phonological process that raises complexity in terms of consonant clusters is syncope (cf. Kiss 1971:99-102). It does so both in the onset and in the coda:

- Given a word such as *o•cu•lus*, syncope leads to *o•clus* and, thus, to a consonant cluster in the onset.
- Given a word such as *ca•li•dus*, syncope with ensuing resyllabication leads to *cal•dus* and, thus, to a consonant ending the coda.

Syncope does appear in the history of Latin of all times and plays an important role in shaping the phonology of Proto-Romance. It is, however, not a regular process in the phonology of Classical Latin.

One must conclude that, apart from resyllabication, Latin phonology is relatively faithful to lexical representations, which means that a relatively high amount of phonotactic complexity surfaces in phonetic representations. All of the processes mentioned are typical of Vulgar Latin and Proto-Romance. Most of them conspire in the diachronic changes of syllable structure mentioned. Only syncope is antagonistic, because it creates new consonant clusters.

8. Summary

At the typological level, Latin syllable structure may be characterized, in very general terms, as follows:

- The syllable has a major structural break after the peak.
- The rhyme is further differentiated; anything that comes after the peak increases syllable weight by one mora.
- The formation of peaks is maximally constrained, as only vowels qualify.
- As for the nucleus, there is a diachronic drift from Proto-Indo-European up to Proto-Romance to reduce it or to assign relevant material to the coda s.s.
- The coda is relatively complex, with a postcoda on top. The diachronic tendency is towards simplification.
- As for the onset, onsetless syllables are allowed at the lexical level. At the phonetic level, onsets are created by syllabication word-initially and by glide formation word-medially. This remains stable in diachrony.
- Onset complexity is relatively low, but pre-initials are allowed at the lexical level. There is a diachronic drift that reduces this complexity further towards Proto-Romance.
- No great difference is made between syllables of different grammatical status and in different syntagmatic positions.
- Grammatical boundaries play a role in syllabication only after phonological well-formedness is satisfied.

As regards diachrony, Latin represents a stage in a movement that starts in Proto-Italic and ends in Proto-Romance (or, in some respects and some language, even later) and that

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[18] "epenthesis is a strategy for saving otherwise unsyllabifiable strings" (Blevins 1995:224)

leads to a simplification of syllable structure in all of its constituents. Thus, Latin keeps the golden middle both in typological and in diachronic variation.

Classical Latin is a snapshot of this diachronic development. It is a frozen snapshot, and moreover one that is not particularly representative of the language spoken at the time. It is a highly standardized language system, and in dealing with phonology, we always run the risk of putting too much faith in the standardized orthography. Despite such methodological strictures, we are sufficiently well informed about the phonology and phonetics of Classical Latin to be sure that we are dealing with a relatively stable and balanced phonological system. Thus, the question makes sense what this equilibrium, in the last resort: what the success story of this standardization is based on.

We have seen that Latin syllable structure avoids the extremes on most of the typological parameters we have reviewed. We have, however, identified three fields of scalar variation in which Latin keeps to a pole:

- Latin makes no compromises for syllable peaks, as these have to be vowels.
- Under no circumstances does syllabication tolerate (within its domain) a syllable without an onset.
- Latin does not commit itself to incorporating any coda material into the mora of the canonical syllable; whatever follows the peak constitutes a second mora.

These three constraints lend a very clearly articulated structure to the syllable. The second mora in particular is important not only as a structural unit corresponding to the coda s.l., but also in the very literal sense of the word 'mora': there is a special time slot reserved for the coda. This provides a firm framework within which the syllable is articulated and which saves it from much phonological and phonetic variation.

Inventory of symbols

V	vowel	N	nasal
W	semivowel	σ	syllable
C	consonant, esp. obstruent	•	syllable boundary
L	liquid	#	morpheme boundary
μ	mora		

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