Dental stops in Latin: a special class

Giovanna Marotta

This paper analyses a number of phonological processes all involving the dental stops in the Latin language. In comparison with other segments, these consonants appear to be more prone to articulatory weakening, producing deletion, assimilation or even substitution. On the other hand, coronals show a specific distribution even in consonant clusters, not only in Latin, but also in other languages. In order to explain this special behaviour, traditional phonological notions can be used, like phonetic constraints, syllable structure, contrast between lenition and fortition. However, more complex theories such as Underspecification Theory and Government Phonology appear to be more suitable in the global interpretation of the linguistic data, as they can account for almost all the phenomena within their specific theoretical pattern.*

1. Introduction.

In the history of the Latin language it is possible to identify a wide range of phonological changes involving dental obstruents. Starting with reconstructed Indo-European forms, through Ancient Latin, and up to Late Latin and the Romance languages, we recognise different processes where segments marked [+ coronal] come out as unstable elements, subject to more alterations than other consonants. The context may differ, but the dental element is constant.

The dynamic processes we are going to present do not share the same phonological value, since the function carried out by each change is different. Therefore, we should explain them in the light of different trends working in the phonological system. These trends may refer to theoretical notions such as syllable as well as to feature spreading or underspecification. In any case, the point of interest is that all the changes involve somehow a reduction of the coronal obstruents which has no direct parallel with the other points of articulation. The 'instability'—or weakness—of segments

marked [+ coronal] becomes then the real puzzle which the theory has to address.

Recently, the debate on the special status of the so-called Place-Node Coronal has become particularly rich both in terms of proposals as well as in producing interesting data relative to various languages. It is sufficient to mention the recent volume edited by Paradis & Prunet (1991a) totally dedicated to the special status of coronal segments. The present study is intended as a contribution to this current of research, by showing that the behaviour of Latin dental obstruents confirms the special status of coronals as the unmarked class. In order to explain this special status, some general considerations are needed, before analysing in detail the data we are going to present.

2. General preliminaries.

To begin with, it must be emphasised that coronal segments are normally claimed to be the most frequent among the consonants of a natural language.[1] Since frequency is an ambiguous term, given its wide scope, for the sake of clarity we prefer to keep the possible meanings of this notion distinct, and discuss them analytically. We first consider frequency from a typological point of view, that is in relation to a possible universal inventory of segments. In the UPSID statistical sample analysed by Maddieson (1984), all of the 317 languages have at least some coronal consonants,[2] and only one (Hawaiian) lacks any coronal obstruent. Among the fricatives, /s/ is attested in 266 languages, /ʃ/ in 146, /f/ in 135 and /x/ appears in 45 languages. For plosives, on the basis of the data sample, Maddieson (1984:40) proposes an implicational scale of frequency where /t > k > p/; as for nasals, the occurrence in the sample is the following: /n/ in 316 languages, /m/ in 299, and /ŋ/ in 167. Furthermore, when a language has four places of articulation (instead of the three usually present), two are normally coronal. Even the ideally universal modal inventory proposed by Maddieson reflects the asymmetry well, as it consists of twenty consonants, ten of which are coronals. This higher typological frequency is incidentally confirmed also by the IPA system, in which the symbols for coronal segments outnumber greatly those for labials or velars.

[1] Henceforth when we use the term 'coronal', we refer normally to its unmarked value, i.e. dental or alveolar, whereas marked coronals such as interdentals, palato-alveolars or palatals will be specifically termed.

[2] Actually, we have to note that Maddieson (1984) does not make use of the term 'coronal'. Nevertheless, of the ten primary places of articulation he considers, five (dental, alveolar, palato-alveolar, palatal and retroflex) can be easily classified as coronals, following the common phonological literature; thus, the coronal mark involves half of this inventory constructed for classifying the sounds of the 317 languages which form the sample.

Also the inventory frequency shows clearly the special status of the coronal point of articulation, since the number of consonants marked [+ coronal] in the consonant system of a given language is found to be higher than that relative to the other places in the same inventory. Consider for instance Italian: we have 14 coronal consonants (9 of which are dental), but only 5 labials and 2 velars. English and French show similar distributional ratios (see Paradis & Prunet 1991a:11). As for Latin, we may suppose a system with 6 dental consonants, alongside 4 labials and 3 velars.[3] This relatively higher occurrence of coronal segments stems from the greater number of contrasts which are possible for this articulatory class in relation to the other classes. For instance, the coronal consonants may often contrast for manner: stop/liquid/affricate/nasal, while for the other places of articulation the contrast is normally restricted to stop/nasal. Take the case of Latin: for the labial place we have two stops (p,b), one fricative (f), and one nasal (m), whereas for the dental point of articulation there are again two stops (t,d), one fricative (s), and one nasal (n), but also two liquids (l,r).

In Italian the proportion is even more unbalanced, since in the two places marked [+ coronal], i.e. alveolar and palatal, the affricate type also contrasts for manner. As Keating (1991:30) noticed, the reason why coronals are special in phonetic terms is probably to be found in their greater variety, as they can be produced in so many ways. In fact, their basic articulator, the tongue blade, not only has at its disposal a wider articulatory space, but also is itself relatively more available to movement than are other speech articulators.

Finally, there is the frequency of coronals in linguistic texts; for some languages the statistical analysis of a corpus has shown an occurrence of coronal consonants (normally dental) much greater than for other places.[4] Förstermann (1852; 1853) noticed long ago the higher frequency of dentals in Latin texts, as well as of the liquidae above the mutae.[5] Similar results can be found in the statistical analysis conducted by Zipf & Rogers (1939), while more recently, the data of Devine & Stephens (1977) and Giannini & Marotta (1989), based on a wide corpus of classical texts, confirmed the high frequency of dentals, especially of r and t. On the other hand, if we compare the occurrence ratio in relation to the position taken by the consonant in a word, in the quantitative data presented by Devine & Stephens (1977:177, table VI), we find that the dental voiceless plosive

[3] Here we give the list of the segments: /t d s n r l/ (dentals), /p b f m/ (labials), /k g ŋ/ (velars). For the analysis of the phonological inventory of Latin, see Brandenstein (1951), Muljačić (1965).

[4] Paradis & Prunet (1991a:11) quote data relative to English and Argentine Spanish.

[5] The studies of Förstermann (1852; 1853) were comparative, since he analysed the frequency distribution of sounds not only in Latin, but also in Greek, Sanskrit and Gothic. What is interesting is that in all the languages considered he noted the greater frequency of dental consonants as compared to the other plosives.

is much more attested than the other corresponding plosives in medial and final position, whereas in initial position both *p* and *k* are more frequent than *t*. If the dental stop was weaker than the other two consonants, it might more suitably occupy a weak position inside the word, such as the intervocalic one or the syllable coda, rather than a strong one, such as the onset of the word initial syllable. However, morphological considerations must also be taken into account. Thus, in word final position, only *-t* (not *-p* nor *-c*) has morphemic status in Latin, namely in verbal inflection, as third person marker (e.g. *amat, amabat, amabit; amant, amabant, amabunt*).[6] In word medial position, too, the voiceless dental stop is part of verbal morphemes, i.e. the second plural person and the past participle (e.g. *amatis, amabatis, amabitis; amatus, laudatus*, as in *captus, lectus*). The interaction with morphology may then explain, at least in part, the distributional asymmetry found in Latin texts for voiceless stops, since segments having a double status, i.e. belonging to the phonological system as well as to the morphological structure of the language, are naturally predicted to occur more frequently in a corpus.[7]

In the phonological literature it is easy to find many studies showing that coronal consonants are more prone than others to processes involving a weakening in articulation. Among these, assimilation of segments marked [+ coronal] seems to be a relatively frequent process occurring in different languages; see Avery & Rice (1989), Cho (1991), Paradis & Prunet (1991a). Kiparsky (1985:97) discussed the case of nasal assimilation in Catalan, claiming that 'the coronal nasals, being unmarked, are underspecified for place of articulation'. Furthermore, coronal consonants are often reported as transparent in vowel harmonies. For instance, Paradis & Prunet (1989; 1990) analysed a number of West African languages where harmony can occur only across coronals. In the Romance domain, Marotta & Savoia (1991) observed a similar transparency effect in some dialects of Southern Italy. Even consonant harmony involves coronals more than the other segments; as Shaw (1991) has demonstrated, coronal harmony is the most frequent type of such a process.

But the different places of articulation appear to show asymmetric behaviour even in performance. Stemberger (1991) analysed a wide set of induced slips of the tongue relative to English speakers; by assuming that the error rate is—at least in part—a function of the similarity between the two segments involved in the process (target/produced), he demonstrated

[6] As for the nominal class, the occurrence of a final voiceless stop is restricted to a few lexical items (*caput, lac, allec, volup*), whereas in other morphological categories (Pronoun, Adverb, Conjunction) both *-t* and *-c* are rather frequent word final segments (e.g. *sicut, aut, post, at, ut, velut, ac, hic, hoc, nunc, tunc*).
[7] It is evident that only a specific analysis of the data, keeping distinct the occurrences of the segments in relation to the possible grammatical function, would clarify the scope of such an interaction between morphological and phonological structures.

that [coronal], as a predictable feature, has only a small effect on the rates of error in comparison with the other Places, [dorsal] and [labial], which are fully specified. The quantitative data presented by Stemberger, even if not always perspicuous, indicate that between two obstruents sharing the same point of articulation, labials and velars are involved in error more often that alveolars, suggesting that underspecified features do not count in determining degree of similarity between segments.[8] Furthermore, in their study on child and adult speech errors, Stemberger & Stoel-Gammon (1991) found that coronals are involved more than other segments in all the basic processes related to slips of the tongue, i.e. substitution, harmony, exchange and fusion; the quantitative analysis carried out on English data clearly shows the relative weakness of alveolar consonants, as they tend to be replaced or assimilated by the other places of articulation. The authors rightly observe that to account for such a behaviour in simple terms of frequency is not possible: if a trend towards less frequent phonemes were at work, we would expect that the same should be manifested in language acquisition; but, as is well known, alveolars and labials are acquired by the child almost at the same time. On the other hand, Locke (1983) has reported that alveolars are more common than labials or velars in babbling, again indicating the place [coronal] as phonologically unmarked.

Evidence from aphasic speech also suggests that coronals are special with respect to other points of articulation. The recent study by Béland & Favreau (1991) on a large corpus of speech errors produced by French-speaking aphasics shows that coronals are deleted, replaced or inserted more than are labials and velars.[9] Even in this case the inventory frequency cannot account for such performance behaviour, since a statistical analysis conducted by the authors on their data in order to compensate for such an influence of the frequency on the results confirms the same trends. This again indicates coronal as the unmarked place of articulation not only in phonological competence, but also in performance.

3. *Latin data.*

We will now present the set of data we consider relevant to this discussion. It has to be emphasised that there is no boundary in the time axis for selecting the phonological processes analysed: for instance, clusters

[8] In Stemberger's view, not only [coronal], but also [-voiced], [-cont] and [-nasal] are considered underspecified for English; even for these features, the trend which emerges from the data is the same, i.e. error rate decreases in case of slip between two segments having no full specification; see Stemberger (1991: *passim*).
[9] It might be of interest to note that Béland & Favreau (1991:218) distinguish between fricative coronals and non fricative coronals (for French /s z ʃ ʒ/ on one hand and /t d n l r/ on the other), since only the latter subclass of segments shows more clearly the trend towards assimilation as well as insertion.

never attested in Latin, but only reconstructed for the Indo-European language, are listed close to synchronic alternations belonging to Classical or Vulgar Latin. In our opinion, this 'flat' arrangement does not constitute a methodological objection, but rather it is necessary, since it allows us to underline the special status of dental stops throughout the history of Latin.

The changes involving dental stops are here classified with relation to the basic kind of process which the segments are subject to, i.e. deletion, substitution, assimilation. The data, well known to all Latin students, are taken basically from the classical handbooks of Sommer (1914), Niedermann (1931) and Leumann (1977). The asterisk marks a non-attested form, normally an Indo European reconstruction.

a) *Deletion:*

(1) *tl-, *dl- > l-; e.g. la:tus < *tla:tos, longus < *dlonghos versus kl, pl, gl, bl unchanged;

(2) *dj > j; ex. Iovis < *djou+es, peior < *ped-jo:s;

(3) -t, -d > ø / C_##; e.g. lac < lact; cor < cord;

(4) -d > ø / V:_##; e.g. pron. me: < me:d, te: < te:d, se: < se:d;[10] abl. praeda: < praida:d, merito: < merito:d; fut. imper. dato: < dato:d, sunto: < sunto:d (C.I.L. I² 366).

b) *Substitution:*

(5) *-tl- > -cl-; cf. i.e. instrum. suffix *-tlom, -tla: > -clum, -cla:, with further vocalic epenthesis; e.g.: *po:-tlom > poc(u)lum, *saetlom > saec(u)lum;[11] furthermore, lexical borrowing ancla:re < Gr. ἀντλεῖν, exancla:re, cf. Plaut. St. 273 exanclavit; Serg. ad loc.: exantlavit;[12]

(6) *tw- > p-, e.g. paries, cf. lit. tveriù, tvorà, pa:rus < *twanknos, cf. lit. tvinkti;[13]

(7) *dw- > b-; e.g. duenos > bonus, duellom > bellum, *dvis > bis (cf. duo), dividens > bidens;[14]

[10] On the other hand, in *haud* the final -d does not drop, even if it occurs after a diphthong. Niedermann (1931: § 44) tries to explain this special treatment with reference to the proclitic status of *haud*, which could preserve the final plosive; but this opinion does not persuade us. However, we have to observe that after a short vowel -d is not deleted (for instance, *id, quid, ad, apud*. In these cases, we are dealing with morphemes consisting of one or two syllables, not belonging to the verbal or nominal classes; probably, in real production, since these elements could not be realized alone or with a following pause, this final -d was anyway subject to deletion or even assimilation to the following initial consonant, while it could stay if followed by a vowel; thus, for instance, *aliud tempus > aliut:empus, quid facis > quif:acis* (see Italian *che fai* [,ke'fai] 'what do you do?', with the so-called Syntactic Doubling); but *ad astera, sed altud*. We should observe that this change has touched Osco-Umbrian dialects too; e.g. Lat. *pia:c(u)lam*, Umbrian *pihaklu*; Oscan *sakaraklúm*, Lat. *sacra:culum*; see von Planta (1892:388-389), Sommer (1914:228), Leumann (1977:153). However, it seems that the change did not happen after s, since *postulare* < *por(k)s(k)-tlom, cf. *posco*; see Leumann (1977:208).

[12] Quint. *inst.* 1.6,40 puts this among the words *ab ultimis et iam obliteratis repetita temporibus*. As for the comparison with the Gr. ἀντλεῖν, see Paul. Fest. 10, 16.

[13] Cf. Sommer (1914:221). However, not all the scholars agree upon considering this process as certain, also because in word internal position *tw* remains unchanged, cf. *mortuos, quattuor*; for instance, Leumann (1977:132) considers the correspondences quoted in (6) as "unsichere Etymologien."

[14] Cf. Sommer (1914:222 f.), Niedermann (1914:222 f.), Leumann (1977:131). In word internal

a) *Deletion:*

(8) *db- > f-; e.g. fumus < *dhu:mos; facio < *dhe-;[15]

(9) *-db- > -b-, -d- e.g. verbum < *werdb-; cf. i.e. suff. *-dhlom, -dbla: > -bulum, -bula; e.g. stabulum < *stablom < i.e. *stadhlom versus sta-tum, sistere, pa:bulum vs. pa:sco; mandibulae vs. mandere; medius < *medhjos, vidua < *widh-;[16]

(10) d > l; e.g. Arch. Lat. dacruma > Class. Lat. lacrima; dautia > lautia, dingua > lingua; odor/olere; sedeo/solium; udus/uligo;[17]

(11) pref. d > r / _-f,v in Arch. Lat.; e.g. arvorsum, arvorsario, arfuerunt, arfuise (C.I.L. I², 401, 581 and 583):

(12) d > r / V_ V in Vulg. Lat.; e.g. peres = pedes Consent. V, 392,15, eritor = editor C.I.L. X 6565.

c) *Assimilation:*

(13) *-dl- > -ll-; cf. sella < *sed-la:; lapillus < *lapid-los (but after a diphthong, -dl- > -l-; e.g. cae-lum < kaid-lom); in verbal derivation, allicio, alligo;

(14) *-ts-, *-ds- > -ss- (-s-);[18] e.g. possum < pot-sum, percussi ~ percutio; mi:si ~ mitto; ars < artis; ri:si ~ rideo; arsi < ardsi ~ ardeo (but carpsi, dixi);

(15) *-tc- > -cc-; e.g. siccus ~ sitis versus lactis, octo;[19]

(16) *-dc- > *-tc- > -cc-: cf. boc < bocc < *hod-ce, quicquam;

(17) *-dp- > *-tp- > -pp-, cf. quippe, quippiam, topper < tod-per versus rup-tus, captus;

(18) *-tn- > -nn-; e.g. annus < *at-nos; penna < *pet-sna, vannus < *vat-nos ~ vatillum, pannus < *pat-nos;[20]

(19) -dn- > -nn-, e.g. mercenna:rius < merced(i)na:rius; in verbal derivation, adnuo (cf. annoto ~ adnoto, annecto ~ adnecto); is often in alternation with ann- (cf. annoto ~ adnoto, annecto ~ adnecto);

(20) -nm- > -mm-, cf. derivation with prefix in-: immolo, immemor, immerito.

position, -dw->-w-; e.g. suavis < *suad-wis. This change has often been attributed to an influence of Italic dialects, although there seem to be no secure evidence for such an hypothesis (see von Planta 1892:413 ff.).

[15] This process presupposes the following intermediate steps: db > th > θ > f (see Leumann 1977:167).

In the framework of IE reconstruction, the class of voiced stops, both simple and aspirates, has often been questioned in recent years; see Gamkrelidze & Ivanov (1973), Hopper (1973), Normier (1977) and recently Zamboni (1986, 1987), Vennemann (1989). Since we cannot address such a complex topic here, we have chosen to present the picture normally assumed in the traditional handbooks (e.g. Sommer 1914:177-178; Leumann 1977:163 ff.). However, we should observe that even if we accept the hypothesis of murmured consonants as belonging to the proto-language instead of *bh,dh,gh, we can postulate the correspondence reported in the text, by simple substitution of db with a voiced murmured dental.

[16] Even in this case, the final output comes from a dental fricative θ (> d), then changed to a labial one (θ > f > b). As for the alternation b/d, see § 6.

[17] The last three cases are partially different from the former ones, since here we are dealing with different words belonging to the same root and showing the alternation d/l.

[18] The reduction to simple -s- depends on syllable structure; see later in the text (§ 10).

[19] Recall that in word initial position -s- depends... e.g. Hebrew kłto:met > *ktunica > tunica, Gr. χιτών, Gr. πτισάνη > lat. tisana, Gr. πτελέα > tilia; see Leumann (1977:186).

[20] Another possible output from -tn-, -dn-, is -nd-, with metathesis; e.g. fundus < *bhudhnos, unda < *udna (Leumann 1977:200-201); recently this change has been dealt with by Poultney (1980), with specific reference to the Latin gerundive in -nd-.

The voiceless plosive is replaced by a velar one (see (5)), whereas the voiced one is assimilated to the following lateral (see (13)).[22]

Assimilation and, to an even greater extend, deletion represent lenition processes, while in the case of a replacement of the coronal obstruent with another consonant we encounter a strengthening process, as has already been pointed out by Dressler (1980) and Nyman (1982). In Latin, in the same internal context, the voiced plosive becomes assimilated, increasing ease of articulation, while the voiceless one, intrinsically stronger, not only holds its manner of articulation, but even optimises the perception by changing [t] into [k] before the coronal lateral.

But -cl- is not the only result from -tl-. In fact, in a series of papers Nyman (1979; 1982; 1984) has claimed that *-tl- became -ll- in some lexemes (*capillus, pullus, culleus*) because of the interconsonantal morpheme boundary, which determined the heterosyllabic status of the cluster. The hypothesis is interesting, since it allows the prediction of the different results with relation to the distinction between weak (= final) position and strong (= initial) position in the syllable: in weak position we find lenition (*t$l > ll), while in strong position, fortition (*$tl > cl, where $ stands for syllable boundary).

Another change which can be interpreted as a 'critical contact' between linear segments is the reduction of *dj to j (cf. (2)). In fact, in the original cluster both elements share the same place of articulation, given the well-known parallelism between front vowels (or glides) and dental consonants (recall the Jakobsonian feature [acute] working on both sides). The conflict between the two palatal segments is solved in favour of the glide, though an obstruent is normally stronger than a glide. Once again, the dental stop, and in particular the voiced one, is confirmed as the weakest segment in the Latin inventory. What is interesting to observe is that the same trend towards removal of the *dj* sequence goes on during the entire evolution of the language up to the Romance languages (see Lausberg 1969, § 456), since secondary *dj* clusters (coming from *d + i,e*) undergo palatalisation through reduction to the glide, as happened in ancient Latin.

Even the reduction of *-ts- and *-ds- to -ss- (see (14)) is compatible with the picture we have outlined so far. First, in these clusters both segments are obstruents and they also share the same point of articulation, [coronal]; second, even this combination seems to be rather unstable in natural languages. On the other hand, a sequence like [ts] could be easily produced and perceived by the speaker as a dental affricate; but the

[22] Other types of change for these clusters are available, such as metathesis or anaptyxis. As instance of metathesis we can consider the change which occurred in the development of Spanish: pre-Old Spanish *tidle > Old Spanish *tidle* "title", *espadla > espalda* "back" (see Hock 1986:115). As for anaptyxis, Hock (1986:125) quotes the English substandard pronunciation of words like *athlete* [æθli:t] > [æθəli:t].

63

The heterogeneous picture we have outlined in this list of diachronic processes may be interpreted in various ways, depending on the theoretical framework and on the nature of the process itself. Thus, the same trend working in the system may be manifested by different surface results (e.g. deletion or assimilation as instances of simplification of the syllable 'coda'); on the other hand, a single phenomenon may receive different interpretations with relation to the theoretical notion which is adopted. In the analysis of the above-mentioned processes, as a first step we would like to interpret and possibly explain them in the light of general principles of phonological theory. Every process will then be discussed in detail with reference to the theoretical notion which seems to be most suitable for descriptive and possibly explicative goals, sometimes by using distinct, but never contrasting, modules of the theory.

Though we are able to interpret all the changes with reference to notions belonging to general phonetic theory or to specific phonological constraints, the crucial point still hinges on the fact that such a complex set of data shows one feature in common, i.e. [+ coronal]. Thus, it can be asked whether it is just the coronal specification which plays a role, or even the basic role, in triggering off these processes. In order to try to answer such a question, in the final part of this work we will analyse all the data with reference to two different theoretical frameworks, underspecification theory and government phonology, trying to point out whether and how both these models could explain the phenomena discussed here.

4. Critical contact.

Starting with the segmental sequences which may be considered intrinsically problematic, as sharing the same place of articulation, in our list there are some processes which may easily be interpreted as simplification of clusters in order to avoid a 'critical' segmental contact. We consider first the clusters *tl, dl*: it is well-known that such segmental combinations show no sufficient spectral modulations; their acoustic and auditory parameters are not different enough to be used with phonological function, i.e. to create lexical contrasts (see Ohala & Kawasaki 1984:122 ff.). From a typological point of view, it seems that natural languages in general lack such clusters (Maddieson 1984); for they are cross-linguistically problematic sequences, languages tend to avoid them through various mechanisms.[21] Latin shows different processes depending on the context: in word initial position we find the deletion of the stop (see (11)); in word internal position,

[21] However, there are languages which have [tl, dl], normally as affricates, and not as real consonantal clusters.

62

phonological system of Latin—at least Classical Latin—did not allow affricates, and therefore the assimilation process was more easily actualised.

The relevance of place of articulation in triggering the assimilation is demonstrated by the fact that clusters composed of *voiceless stop + sibilant* were permitted in Latin when the stop was not coronal: cf. *concussi, possum, rexi, iunxi, scripsi, carpsi*; the same holds for word final position: *ars, mens*, but *arx, stirps*. Further reduction of the geminate sibilant to a simple short segment (as in *arsi, mi:si, ars*) depends on constraints imposed by the syllable structure (see § 10). However, it is interesting to note that in word initial position even the clusters *ps- and *ks- were subject to loss of the stop; for instance, *sabulum < *psaflom, Gr. ψάμμος; seresco (Lucr.), serenum < *ks-, Gr. ξερός.[23] This fact can easily be related to the hetero-syllabic status of these structures: internally, where the first segment could be associated with the preceding syllable, the segment was preserved, whereas initially, with no such association possible, the stop was deleted.

The changes involving the segmental combinations we have discussed so far (*tl, dl, ts, dj*) may be interpreted from a non linear point of view as induced by the *Obligatory Contour Principle*, i.e. the constraint which prevents a sequence of homorganic segments on the same autosegmental tier.[24] An objection to the application of this constraint comes however from the occurrence in Latin of other homorganic sequences, such as *nd, nt, st, mb, rl*; but if we suppose that in these latter combinations the two consonants are heterosyllabic, while *tl, dl, dj* and *ts* were tautosyllabic, we could propose that OCP works in the domain of the same syllabic constituent, in this case the onset. However, the well-formedness of *tr* as onset (where both the segments are [+ coronal]) does not agree with such a proposal.

5. *The case of* *-tt- > -ss-.*

In the handbooks of the Latin language, besides the process *-ts- > -ss-, we find another phonetic change resulting in a long sibilant, i.e. *-tt- > -ss-.[25] Although this change is traditionally recognised by the literature through the intermediate steps of *-tst- > *-st-, we believe that there is no clear evidence for justifying it. First of all, in Latin a long, geminate *t* was always allowed, as in *gutta, blatta, mitto, muttio, sagitta*; second, its frequency in the lexicon was not lower than that of the other

[23] See Leumann (1977:186). The cluster *ps* can occur in word initial position only in a few borrowings from Greek, like *psallo, psittacus, Psyche*.
[24] See Goldsmith (1990), Paradis & Prunet (1989:330 ff.).
[25] See Sommer (1914:241), Niedermann (1931:§ 90), Leumann (1977:197). The same change is attested for Celtic and Germanic, while the other i.e. languages show normally the *st* cluster (cf. Leumann 1977:197).

voiceless stops.[26] Furthermore, *st* cluster, which is assumed as intermediate between *-tt- and -ss-, is well attested in the Latin language in all its history, without any trend towards change.[27] Finally, from a general point of view, a process like this one, *-tt- > -ss-, does not seem to be natural. The anomalous nature of the change phonologically argues strongly for a morphological explanation, which puts the process inside the relevant paradigm.

An important point is that the instances of such a change are all relative to the past participle of some verbs (e.g. *missus, fissus, passus, quassus, cessus, divi:sus, ra:sus*, etc.). This morphological constraint is in our opinion the key for interpreting the phenomenon, i.e. the occurrence of a sibilant in spite of the original dental stop. As a matter of fact, in verbal inflexion, *-s- is a specific morphological marker for the so-called 'parfait sigmatique'.[28] This kind of perfect is frequent in Latin, especially in the case of verbs belonging to the third conjugation. However, the adjunction of the sibilant to the verbal root (or stem) was not always without phonetic consequences; thus, when the stem ended with a velar or a labial consonant, the resulting cluster was well formed and then preserved (e.g. *dico/dixi; duco/duxi; fingo/finxi; carpo/carpsi; nubo/nupsi; scribo/scripsi*, etc.); whereas in the case of a stem ending with a dental segment, since the resulting cluster was not allowed by Latin phonology, it was subject to the backwards assimilation we have already analysed for the change (14) of our list: *-ds-, -ts- > -ss-* (e.g. *cedo/cessi; concutio/concussi; suadeo/suasi; sentio/sensi; rado/ra:si*, etc.).[29]

We think that in the past participle the occurrence of *-ss-* or *-s-* in spite of *-tt-* or *-t-* may be due to the influence of the perfect; though the original suffix was *-tos*, in the paradigms which have already introduced the sibilant in the formation of the perfect, a new allomorph for the past participle was available, i.e. *-sus*. Such a natural trend could be stronger in this case, given the strict relations holding between the perfect on the one hand and the supine on the other, and supine is the basic reference for the formation of the past participle in Latin. The introduction of a new form for the participle within the verbal morphology, though increasing the phonological opacity, was not critical, since in the same verbal paradigm two stems at least normally occur, one for the present (e.g. *amo, ago, video, as ce:do,*

[26] For a quantitative analysis of geminate consonants carried out on Latin lexicon, we refer the reader to Giannini & Marotta (1989:233 ff.; *passim*).
[27] As de Saussure (1877 = 1922:373) wrote, 'le groupe *st* n'a jamais été redouté de la langue latine. Partout où on peut dire à coup sûr qu'il a existé, il existe encore. Il devient par conséquent inexplicable que la transformation de *tt* ne se soit pas arrêtée à l'étage supposé *st*; et, pour choisir un exemple caractéristique, que *pastus de patior* soit devenu *passus* quand *pastus de pascor* demeurait tel quel.'
[28] This formation is an old aoriste (as *-s-* indicates), with the endings of the perfect; see Ernout (1953:197 ff.); Leumann (1977: § 436).
[29] We may add the verbs ending with *-cto*, where *-t-* is a suffix: e.g. *flecto/flexi; necto/nexi; plecto/plexi*, etc.); see Ernout (1953:202).

percutio, mitto), the other for the past (*ama:vi, e:gi, vi:di*, as *cessi, percussi, mi:si*). The new allomorph of the participle used precisely one of these stems.

Assuming a paradigmatic influence of the perfect, it thus becomes possible to explain the occurrence of -ss- even in the past participle without postulating the phonetic process normally assumed: *-tt- > *-tst- > *-st- > -ss-. Forms like *cessus, percussus, missus, ra:sus*, will be directly interpreted in the light of paradigmatic analogy with the stem of the perfect. The same interpretation holds for verbs with the root ending with a sonorant: we have *pressus, mansus, alsum, mersus* because of *pressi, mansi, alsi, mersi*. On the other hand, forms like *fossus, fissus, versus, pransus*, which have no parallel form with the sibilant in the perfect (*fo:di, fidi, verti, prandi*), might be explained with indirect analogy, i.e. with reference to other participles where the sigmatic form was justified by the perfect.[30] In the light of this analogical trend it is also possible to interpret nominal forms like *messis, messor*, which derive from a root ending in a dental (cf. *meto*): even in this case the stem for the derivation is that of the supine of the verb, i.e. *mess-*, although the suffix has an initial dental stop, respectively -*ti*, -*tor*.

6. *Substitution as strengthening.*

The changes listed above in (5), (6), (7) deserve special attention, since they manifest the special weakness of the coronal articulation, which invites substitution: in (5) the voiceless dental stop is replaced by the corresponding velar, while in (6) and (7) the initial sequence composed of a dental stop + [w] is reduced to a single labial stop. Although with different specific outcomes, the common result is the loss of the coronal specification in favour of articulations marked by the Jakobsonian feature [+ grave].

The substitution of tautosyllabic *-tl- with a cluster improving syllable contact, i.e. -cl-, has already been analysed in the preceding paragraph. We would now like to remind the reader that the same change outlined in (5) is observed in the evolution from Latin to Romance; e.g. Lat. *vet(u)lus* > Italian *vecchio*, French *vieil*; *sit(u)la* > It. *secchia*, Fr. *seille*, as in *oc(u)lus* > It. *occhio*, Fr. *oeil* (cf. Lausberg 1969). Therefore, it seems legitimate to suppose that syncope of the postonic vowel as well as the consequent change -tl- > -cl- already belonged to so-called Vulgar Latin, or even to the substandard pronunciation of the language in the Classical Age.[31] From

[30] It is also possible that in informal, low registers analogical perfects with the sibilant were produced, such as *pransi*, or *versi*. We cannot exclude that even morphological constraints prevented a geminate like -*tt*- for some contexts (e.g. past part.), maybe in order not to increase morphological opacity.

[31] On the possible persistence of this process throughout the history of Latin, see Marin (1974) and, more recently, Zamboni (1986; 1987).

this perspective, Latin would show through the centuries not only a special dislike for *tl* cluster, but also the same trend towards the velarisation of the coronal obstruent.

As for the labial articulation of the new consonant which takes the place of the dental, in processes (6) and (7) it may be due to the following round glide of the original clusters (*tw-, dw-*): the outputs *p-* and *b-* appear to be the result of a fusion process, where the manner of the first segment is maintained, but the place is that of the following glide. From a theoretical point of view, if we accept the hypothesis that coronals lack the Place node (see Paradis & Prunet 1991b), we can easily account for all these substitution processes by simple association of a place specification (dorsal or labial) to the position linked to the dental segment.[32]

The same labial result can be recognised in other diachronic processes in the evolution from I.E. to Latin; in particular we are referring here to the changes involving the dental voiced aspirate (see (8) and (9)). In initial position, the voiced aspirate is replaced by a voiceless labial fricative, while internally the result may be a labial voiced stop as well as a dental one.[33] The alternation between -*d*- and -*b*- probably depends on the phonetic context: -*b*- is preferred in case of cooccurrence of /l, r/, since in Latin sequences like *dl, dr* are normally disallowed. We have already dealt with the impossibility of having *dl* in Latin. Regarding *dr*, in initial position this cluster is limited to a few loanwords, such as *dracuma* (< Gr. δραχμή), *draco, Drusus*; in medial position, it occurs in some borrowings (*Adria, Hadrianus*), but it is maintained in *quadrus*, in numerals (*quadraginta*) and in derivates (*quadriga, quadripes*) or may change into -*tr*- (e.g. *taetrus* vs. *taedet; uter, utris* < i.e. *udro-, cf. Gr. ὕδρία). This last change seems to be rather strange, because it would be the only case where the voiced coronal shows a strengthening and not a weakening of the articulation; the onset position here occupied by the dental stop could strengthen the segment with simple loss of the voice feature.

Even the changes relative to the voiced aspirate can therefore be considered as evidence of the special instability of dental articulation. Apart from the final result (velar or labial), that which is constant is the substitution of the dental point of articulation by another one in some way felt as stronger. It might be observed that even the other voiced aspirates normally reconstructed for IE are subject to change in Latin: *bh > f, *gh > b*; but only in the case of the dental, a point of articulation different from the original emerges as historical output.

[32] For such an hypothesis, see § 13.

[33] The opinion about this point is rather controversial with regard to the segment which has to be considered as the normal outcome of -*db*- (-*d*- or -*b*-); we refer the reader to Zamboni (1986:212-213 and footnote 10), where the question is briefly dealt with.

7. Language contact and diaphasic variation.

We pass now to consider the substitution of the voiced dental obstruent by a liquid segment (see processes (10), (11) and (12) in our list). We see that in this type of phonological change, the contexts where d > l are at least partially different from those in which d > r. In fact, the former change occurred before a vowel in a rather small set of lexical items, whereas the latter had two different contexts of application, i.e. intervocalic position and preceding f,v. But, even when the context is the same (i.e. the intervocalic position), the chronology is different, since d > l occurred in Archaic Latin, whereas d > r is attested for Vulgar Latin.

However, the basic difference lies in the sociolinguistic status of the processes: in Latin there was no real variation between lingua and dingua, as this latter form could be recognised only by the educated speaker, who knew it from ancient texts, while peres was easily identified by speakers as a popular, dialectal form, which coexisted with the standard form pedes, probably not only in Late Latin, but even in the classical age.[34] Other forms, such as arfuise, arvorsum, arfuerunt, should be considered from a similar perspective; as archaisms, they were no doubt felt by a speaker of the classical age to be especially formal, belonging to the high register of the language. Thus, they were no longer living forms, but only relics.

The traditional Latin handbooks try to explain the lexical forms showing the exchange d/l, whenever possible, as instances of so-called 'popular etymology'; thus, lingua < dingua by influence of lingere; lautia < dautia, because of lautus; lacruma < dacruma with probable reference to lacus or lacer; odor, but olere, since it recalls oleum; levir, due to laevus; uligo by paradigmatic analogy with caligo, and so on.[35] But the wide scope of the phenomenon seems to indicate that a real phonological process was at work, and it was not simply lexical conditioning.

The change involving the lateral as surface output from a more ancient d has often been considered in terms of language contact; Varro first spoke of Sabini as the authors of the change,[36] and from him the general interpretation of this variation refers to such a dialect.[37] Actually, other changes among those listed in the third paragraph of this work may be interpreted with reference to linguistic interference; for instance, the

---

[34] The vitality of the process is well attested in a number of southern dialects of Italy, where the weakening of -d- into -r- is generalized. See Rohlfs (1966:204): Northern Calabrian ròmere "to sleep", Neapolitan rendə "tooth", etc.

[35] Cf. Sommer (1914:176 f.), Niedermann (1931: § 43), Leumann (1977:155 f.).

[36] Cf. Varro, ling. V, 123: item dictae lepestae, quae etiam nunc in diebus sacris Sabinis vasa vinaria in mensa deorum sunt posita; apud antiquos scriptores graecos inveni appellari poculi genus δεπάστρυ: quare vel inde radices in agrum Sabinum et Romanum sunt profectae.

[37] In addition to the references already quoted in footnote 35, see von Planta (1892), Devoto (1931). Moreover, recall that direct evidence relative to the Sabin dialect is very poor, thus rendering it even more difficult to correctly identify the linguistic reality of such a label.

processes (5) (-tl- > -cl-), (7) (dw- > b-) and (14) (-ts- > -ss-) are common to all Italic dialects.[38] On the other hand, the confusion between d and l was normally attributed by grammarians to the antiqui.[39] Then, Sabini would have basically the same value as veteres or antiqui, indicating for a speaker of Classical Latin the pragmatic dimension of an educated, formal register of the language.[40] The alternation d/l has been interpreted by Giacomelli (1983:39 ff.) in the light of the diglossia existing between Greek and Latin, since Greek, and specially Aeolic, shows the same phenomenon; in the Latium vetus, for a Latin speaker who was also competent in the Greek language, the confusion d/l could easily be introduced in his original language too, probably through the 'sabinism', i.e. a diaphasic dimension of the language.[41]

Both the changes d > l and d > r may be interpreted with reference to language contact as far as their origin is concerned; but in the synchronic competence of a Latin speaker, especially in the classical age, their sociolinguistic value was not the same: in the first case, the phenomenon, as referring to the Sabini, was marked by the index of antiquitas; in the other one, the alternation, as reported to an Italic influence (Oscan?), was clear evidence of rusticitas. Thus, the diaphasic parameter associated with the two processes cannot be equal.[42]

8. Weakening or strengthening?

From a functional point of view, all the processes resulting in a liquid segment (see (10), (11) and (12) in our list) may be interpreted as a weakening of articulation, since liquids, as sonorants, are normally less strong than obstruents.[43] But it is rather problematic in this perspective that a dental

---

[38] We are referring to von Planta (1892:388).

[39] Cf. Mar. Victorin. VI,26,1 ff. K.: communionem enim habuit l littera cum d apud antiquos, ut dinguam et linguam, et dacrumis et lacrimis.

[40] An analogous perspective has been followed by Negri (1982), who tries usefully to identify the basic registers of Latin.

[41] Giacomelli (1983:42) believes that the reason for the alternation we are discussing has to be searched for in "una situazione di diglossia latino-greca in cui il sabino faceva da anello di congiunzione fra le due rispettive competenze linguistiche". In his work, Giacomelli (1983: passim) analyses other alternations which can be interpreted in the light of interference between the Italic dialects as well as between Greek and Latin (for ex. i/u, b/f, ae/e), showing how language contact was a real dimension of Latin, especially in the classical period.

[42] S. Giannini (personal communication) has pointed out to me that, in the tradition of Latin grammarians (however not belonging to the classical age), rusticitas is sometimes considered as an index of antiquitas; therefore, the judgement of Latin speakers could be different from that which we have hypothesised here.

[43] Given the great number of studies on consonantal strength hierarchy, let us quote here only the recent book by Murray (1988), who also discusses the previous proposals on this topic.

voiced stop could surface as l as well as r, while Latin does not show other instances of confusion between the two liquid segments. In other words, since the language normally kept /l/ distinct from /r/, how could these segments become different outputs of phonological processes starting from the same input?[44] It is also true that typologically there are many languages having only one liquid (see Maddieson 1984); furthermore, when a language has both l and r, a confusion between them is rather common. As for language acquisition, the child normally produces the two liquids in different times (see Locke 1983).[45]

As a general principle, we may suppose that context played a role in determining the final result. In fact, d > l occurs in a strong position, i.e. always in syllable onset, and often even at the beginning of the word, whereas d > r occurs in a weak position, namely between vowels (in Vulgar Latin) or in syllable coda (before f, w in Archaic Latin). Actually, some scholars have claimed recently that in ancient, prehistoric Latin the lateral would have been subject to articulatory strengthening, so that /l/ developed obstruence, marked as [- continuous], as opposed to /r/, which remained [+ continuous].[46] Evidence of such a Verschärfung of /l/ would be precisely the 'sabinism' mentioned above, i.e. the exchange d/l, which occurs in strong position. Reflexes of the phenomenon can also be found in the Romance domain; e.g. Lat. laxare > Spanish dejar, Port. and Catalan deixar, Calabrian dassare, Sicilian dassari. Although in the opposite direction (l > d, instead of d > l), this change demonstrates the persevering confusion between the two segments.

The specification of the lateral as [- cont] would take it distinct from the other liquid present in the phonological system of Latin, i.e. /r/, marked [+ cont]. Given such feature specifications, only d > r would be interpreted as a weakening of articulation, while d > l would be an instance of strengthening. But such an hypothesis seems to be rather problematic, since the lateral is normally marked as continuous in any feature theory. In fact, Leonard (1980:47) thinks that "in the early preliterary period N. Italic *l/l and *d/d were so similar phonetically as to be in some danger of merger.

according to Murray (1988:104 and passim), the Consonantal Strength scale should have the following format:

i	u	r	l	N	F [+ voice]	F[-voice] /P [+ voice]	P [-voice]
1	2	3	4	5	6	7	8

weak → strong

where N = nasals; F = fricatives; P = stops. We will return to the topic, in particular to the relative strength of stops with reference to the point of articulation, in § 12.

[44] Latin does not know for instance the rhotacism l > r in intervocalic position, which is typical of many Romance idioms; e.g. Rumanian, Ligurian, etc. See Lausberg (1966: § 385).

[45] As Benveniste (1939:34) already observed, "la coexistence de r et l n'est ni universelle, ni nécessaire, ni même, là où elle se constate, absolument stable."

[46] See Leonard (1980) and Zamboni (1986:218 ff.).

Since *d/ was an obstruent (...) and certainly no lateral, it seems best to assume that *l/l had become an obstruent too and that it was no longer a lateral". But, in this case, how is it possible to explain the regression of such an obstruent-like sound to a lateral liquid as that which is found in literary Latin?[47] Therefore, at present, there seems to be no well-founded evidence supporting such an obstruentisation of the lateral.

From the phonetic point of view, an articulatory weakening starting from a voiced dental stop would easily lead to a fricative segment or even to an approximant, always voiced,[48] which, as a further step, could surface as a flap or even as a trill, but never as a lateral.[49] The change d > l, on the other hand, does not involve an intermediate step consisting of a voiced dental fricative, but is rather direct, since it basically modifies the manner of articulation in the segment.[50] Therefore, it is right to maintain distinct the two processes involving the liquid segments (d > l on one hand, and d > r on the other), keeping in mind not only their different pragmatic value (see § 7), but also the phonetic correlates of the two processes: if the change d > r has to be undoubtedly considered as a weakening process, the other one (d > l), as different, is not necessarily an instance of strengthening.

Even the well-known phenomenon of rhotacism can be viewed as a weakening process, since the resulting liquid is more sonorous and less strong than the original sibilant. The process implies a sonorisation of the sibilant occurring between two vowels; only after this step the liquid could surface: *-s- > *-z- > -r-.[51] It is normally assumed that the change was completed

[47] Awareness of the problem leads Leonard to suggest the influence of Etruscan, as a means for solving the impasse; but in this way, as Leonard (1980:49) himself recognizes, we are arguing ignotum per ignotius. A more complex picture is presented in Zamboni (1986: 1987), where the topic relative to the evolution of the liquids, marginal in that work, is connected with the alternating processes of weakening (spirantisation) and strengthening which affect the obstruent system throughout the history of Latin.

[48] Zamboni (1986) discussed in detail the possible allophones of the fricative coming from /d/ in intervocalic position; it could be a voiced interdental (or dental) fricative [ð] (or [ð̞]) as well as an alveolar approximant [ɹ] or even a flap like [ɾ]. Of course, since it is no longer possible to control the actual pronunciation of Latin, these segments may be considered arbitrarily supposed; but in our opinion what is important is to identify all phonetic segments which witness the weakening of the original stop articulation.

[49] Keeping in mind that in many dialects of the Center and South of Italy a voiced dental fricative coming from lat. d is well attested, the hypothesis seems to be more reasonable and consistent with the data. We refer the reader to the classic work of Rohlfs (1966:203 ff.); e.g. Lucanian ðómməðə "(he) sleeps", Apulian ðénðə "tooth", Calabrian ðiku "(I) say", etc.

[50] Within the feature geometry model, Rice & Avery (1991) have recently proposed a special node Lateral, depending on the Spontaneous Voice node, which also organises the other sonorant feature, i.e. Nasal; the specification of Coronal comes to the lateral by default, given the underspecified status of this latter Place node in the phonological representations. The association of the lateral with the Spontaneous Voice node has also been assumed by Palmada & Serra (1991) for the analysis of Hispanic data. For further details, see also § 13 of the present work.

[51] Rhotacism taking place in intervocalic position is a common phenomenon in Indo-European and non Indo-European languages. It has been recently addressed in phonetic terms by Solé

by about the middle of the fourth century B.C.[52] Although we cannot address such a complex question here, we would like to focus at least a few points relevant to our work. First, it is reasonable to suppose that when rhotacism took place, /r/ was a flap more than a trill, i.e. a continuous dental fricative or even an approximant. Second, rhotacism has touched Italic dialects too, at least Umbrian and Faliscan, whereas in Oscan the process seems to be limited to the sonorisation of the original sibilant (see Leumann 1977:178); e.g. Latin -arum, Umbrian -aru, Oscan -azum, -asum (depending on the alphabet used). Finally, as Leonard (1980) and Zamboni (1986) have already recognised, it is very probable that rhotacism has to be inserted within the dynamic situation involving the relations among the dental voiced plosive and the liquids in the Italic dialects. Recall that in Umbrian /d/ and sometimes also /l/ change in a vibrant-like sound, normally written in the earlier inscriptions with a special R letter of the Etruscan alphabet and with the digraph RS of Latin alphabet in the later ones.[53]

As far as the economy of this work is concerned, the most important point is, however, the fact that in rhotacism too the two segments involved are coronals, again indicating this segmental class as the one most prone to phonological change.

9. Phonetic change at the morpheme boundary.

We now analyse the exchange d/r before f or v. Zamboni (1986:220) supposes that in the period when the phenomenon occurred, f and v in conventional orthography stand respectively for [β] and [w]. As labial fricatives, these segments were marked [+ voiced] and [+ continuous]; thus, this context could be related to that of intervocalic position, as the rule changing d to r would have the same format for all the contexts, applying whenever the voiced dental occurs between segments marked as both [+ voiced] and [+ continuous], i.e. in intervocalic position (e.g. pedes > peres)

(1992), who demonstrates on experimental grounds that speakers can substitute [z] with a non-sibilant segment only referring to an r-sound.

Another interesting question concerns the asymmetry of the process: the direction /z > r/ is well attested in the world's languages, while the opposite one (i.e. /r > z/) is unusual. In terms of phonetic features, Ohala (1985) pointed out that the sound which is subject to change is normally more complex than the sound which substitutes it. This general criterion is satisfied in the case of rhotacism, since the acoustic forms of [z] and of a continuant r-sound are quite similar: both segments show formant structure and periodic source, but only the sibilant has the frication feature. Thus, as Solé (1992:264-265) writes, "if this distinguishing feature is missed or masked when the sound is heard, then it (scil. [z]) might be interpreted as some type of r-sound. When an r-sound is heard, however, it is far less likely that this extra distinguishing feature will be accidentally introduced".

[52] See Leumann (1977:178), Touratier (1975), Leonard (1980).
[53] On the other hand, Oscan does not merge *ll with */d/ and does not have rhotacism; cf. von Planta (1892), Devoto (1931).

---

as well as between a vowel and a voiced fricative (e.g. adfuerunt > arfuerunt). Zamboni has in fact proposed just such a rule, but without considering that the change in question did not occur in all contexts involving segments marked [+ voiced, + cont]. In particular, after a rhotic or a nasal, having the same positive value for these two features, the process did not take place; consider, for instance, cardo, surdus, unda, pondus, never attested as *carro, *surrus or *unra, *porrus, then *urra, *porrus with regressive assimilation, in order to avoid the disallowed sequence *-nr-.[54]

In our opinion, the process changing d to r before f, v is different from the one working in intervocalic position, since its phonological status is different. In fact, only in the latter case do we have a process occurring at the lexical level, whereas in the former a morpheme boundary is needed between d and the following consonant. In other words, only ad as prefix or apud as preposition were able to trigger the change of the final d (e.g. arfuise, arvorsum, arventor, apur finem). Instances of the phenomenon at lexical level are restricted to arcessere and arbiter, but for both these words the etymology is unclear: arcessere could be derived from *ad-facesso (Leumann 1977:155), and thus, we would again have ad- as prefix before a labial fricative. Otherwise, it could be interpreted as the desiderative of arceo (see Ernout & Meillet 1979⁴:44). In this case, the liquid would be present already in the input form. As for arbiter, Martino (1986) has recently demonstrated the unreliability of the traditional etymology from ad and baetere, instead relating the word to a Semitic root. Therefore, we believe that the process d > r in front of f, v was not merely phonological, but rather, morphophonological, as it was triggered by specific morphemes.

On the other hand, if we consider what normally happens in Classical Latin in the context of the ad prefix before the segments f and v, we observe a clear trend towards assimilation before f, but not before v (e.g. afficio, affigo, but adverto, advenio). The change of d to r occurring in Archaic Latin can be interpreted as an intermediate step of the weakening which leads to the total assimilation of the dental voiced stop in the ad prefix before another obstruent. In the case of a following v, it seems reasonable to suppose that this segment in Archaic Latin was pronounced more as a fricative. Thus, as an obstruent, probably [β], it could trigger the process just like f, later, when it became more a labial approximant, i.e. a [w] glide, it was no longer involved in the weakening process of d before the obstruent consonants. Therefore, in this context, the dental could not be assimilated to the following [w], since Latin (like many other languages) did not allow

[54] To this last context, we could add the lateral (for instance, valde > valre > *varre), but this segment has to be ruled out, for Zamboni believes that it was marked [-cont], in opposition to /r/ [+ cont]; see the preceding paragraph.

A way for saving Zamboni's rule could be to add the specification of syllabic position occupied by the dental plosive changing into r, i.e. the coda; but then the rule would not apply in the intervocalic context (e.g. pedes > peres), where d is in onset position.

[ww] sequence, nor could it be deleted, to avoid a possible merger with other lexemes (for instance, if *adverto* > *$averto*, it would be confused with *a:verto* < *abverto*). Finally, we should remember that in assimilation processes taking place at morpheme boundary between the final consonant of a prefix and the initial consonant of a stem, *ad* is the most prone to assimilation, again confirming the special status of the voiced dental stop as the weakest segment.[55]

10. *Coda weakening.*

A number of the above-mentioned changes seem to be due to the trend towards simplification of syllabic structure, in particular of the 'coda' constituent. This trend has already been recognised in phonological studies on Latin[56] as a phenomenon of wide dimensions, involving not only the class of the coronal consonants, but more generally all the obstruents which could occupy the coda position.

Latin syllable structure, in fact, allows heavy rhymes, composed of V: as well as of VC, but dislikes hyperheavy combinations such as V:C or VC_1C_2. As for V:C rhymes where C belongs to a geminate consonant, such structures are found in a few lexical items with C: = [l] (e.g. *mi:lle*, *coro:lla*, *vi:lla*, *ste:lla*) or in some marginal verbal morphemes (i.e. perf. infinitive -*a:sse*, -*i:sse*; plusperf. subj. -*a:ssem*, -*i:ssem*; inchoat. suffix -*a:sco*, -*e:sco*). A rather strong constraint holds in rhymes of the structure $V:C_1$$C_2$,[57] since C_1 is normally a sonorant (e.g. *fo:rma*, *o:rdo*, *o:rno*, *pu:rgo*, *qua:rtus*, *nu:ntus*, *qui:nque*, *ve:ndo*). Other contexts escaping this trend are Lachmann's Law (e.g. *le:ctus*, *a:ctus*) and perfects like *du:xi*, *nu:psi*, *scri:psi*, *vi:xi* (see Porzio Gernia 1973:835).[58] In final position, on the other hand, a long vowel is allowed in a closed syllable only before the sibilant, given the high morphological functional load carried both by the quantity feature and by this consonant in Latin. Consider for instance alternations like *rosa/rosa:* or *manus/manu:s*.

As for the VC_1C_2 tautosyllabic structures, in word medial position they are present normally before a morpheme boundary: e.g. *ex-trahere*, *sanc-tus*, *trans-ferre*, *carp-si*, *emp-tum*, *emp-si*.[59] While in *extrahere*, *transferre*, the

55 The topic relative to the different degrees of strength in assimilation of the Latin prefixes will be dealt with in another work, which is still in progress.
56 See Kiss (1972), Porzio Gernia (1977), Steriade (1987a), Giannini & Marotta (1989).
57 Henceforth, as in § 4, $ stands for syllable boundary.
58 Furthermore, if we consider the *s* + C clusters as heterosyllabic in Latin, we have to add in the occurrences of a long vowel followed by the sibilant, as in *fa:stus*, *fe:stus*, *po:sca*, *e:sca*, *be:stia*, etc.
59 More difficult is the interpretation of *sextus*, *iuxta*, *extra*: is a morpheme boundary present here too? Normally, medial clusters like these lose their first member: e.g. *$sekscenti > sescenti*, *$Opsci > Osci*. It may be possible, as Niedermann (1931) argues, that pronunciation with [kst(r)] was limited to the literary language; but, even if marginal, the examples still remain problematic.

boundary between the prefix and the verb was clearly strong enough to preserve the syllable constituency, in the case of *sanctus* or even *carpsi*, *emptum*, we may ask whether the speaker was aware of the morphological structure, therefore recognising -*tus* or -*si* as specific verbal endings, marked by the preceding syllable boundary. This is a rather complex question we cannot tackle here; however, even without assigning a role to morphemes, we think that evidence against a syllabification like *san$ctus*, *car$psi* is available. First, general phonological principles connected with the strength hierarchy do not admit a syllable contact like -*n$ct*-, given the same degree of strength in such a complex onset; on the other hand, *$ps* is allowed only as marginal, because of the low sonority distance between the two tautosyllabic segments.[60] Second, but strictly based on the above mentioned principles, in sequences like VctV, VptV, VksV, VpsV, the syllable boundary falls without any doubt between the two consonants (e.g. *dic$tus*, *scrip$tus*, *dik$si*, *scrip$si*), and not before the cluster. Finally, in word initial position, these clusters were not allowed by Latin, and thus they were reduced to the second element.[61] Therefore, even if we admit the influence of Greek, which has such initial clusters, this does not necessarily mean that in the syllable structure of Latin a change occurred which was so radical as to admit complex onsets composed of two obstruents.

In final position, sequences of two consonants are more frequent, by virtue of the morphosyntactic function carried out in Latin by this position. Not by chance in these contexts is the last consonant of the word either the sibilant as nominal morpheme (e.g. *ars*, *mens*, *inops*, *audax*)[62] or the voiceless dental stop as part of the verbal morpheme -*nt* (e.g. *amant*, *dicunt*).[63]

The analysis of the diachronic processes of Latin phonology clearly shows the trend towards reduction of the coda constituent.[64] Dental consonants do not escape this general trend, but by virtue of their special status they became the elements most exposed to the weakening. As a matter of fact, in our list we have instances of such a drift. In the processes described in (3) and (4) the deletion of the word final coronal consonant allows the reduction of marked heavy weight structures to normal heavy rimes: VC_1C_2 >

60 See Hooper (1976), Steriade (1982), Vennemann (1988).
61 We have already analysed this reduction in § 3 of this work, especially in footnote 19.
62 With a final -*s*, -*ns* is frequent in the present participle (e.g. *amans*, *dicens*, *videns*). Furthermore, remember that in Latin also $VC_1C_2C_3$ structures are possible, where C_3 is always the sibilant: e.g. *stirps*, *arx*, *calx*, *falx*, *lanx*. Here again a morpheme boundary between the stop and the final -*s* can be recognised. Benveniste (1939:29) claimed that "dans *stirps*, *falx*, *arx*, on percevait un morphème -*s*, marque de nominatif"; therefore, in this case, we are dealing with "combinations dues à des nécessités morphologiques" and no longer with "véritable groupes consonantiques".
63 We can add the case of some monosyllabic verbal forms like *fert*, *vult*, *est*, and the preposition *post*. As for *st*, Devine & Stephens (1977:131) observe that this is the only cluster which can occupy all the positions in the word; cf. *stare*, *vestis*, *est*.
64 It is sufficient to again refer the reader to the classical handbooks of Niedermann (1931), Sommer (1914), Leumann (1977) as well as to the work of Kiss (1972).

VC₁ in (3) and $V{:}C > V{:}$ in (4). The simplification of geminates which come from the assimilation of a coronal obstruent should be interpreted from the same perspective: in the context of a preceding long vowel or diphthong, the long consonant would give too much weight to an already heavy structure; therefore, reduction to a single, heterosyllabic element is needed. Thus, we have, for instance, *kaid-lom > *kaillom > caelum (cf. (13)) or *mi:tsi: > *mi:ssi: > mi:si: (cf. (14)).

11. Assimilation.

Even the assimilation processes well attested for dental consonants may be interpreted in the light of the same trend towards simplification of the coda constituent. Given the normal direction of the assimilation, from right to left, the segment which plays the role of target is the one in coda position.[65] Although in this case the syllable weight remains constant, since the position linked to the assimilated segment is still present, the original segment has lost all feature content, so that the skeletal slot on the timing tier becomes associated with the features of the following segment. In our view, assimilation is then not a process going against the general trend of 'coda weakening', but it is a special manifestation of this same trend. In fact, although the skeleton is not changed, the position connected with the coda constituent becomes no more than a simple skeletal point, since its feature content is now totally percolated by the following position.

After an assimilation takes place, the original consonant is no longer recoverable in terms of a specific segment; only its structural position remains, first associated with the consonant which undergoes the process, and then filled by the feature matrix of the onset position. In other words, the segmental structure is different, but the prosodic structure is the same. We could say that assimilation is the most natural and simple way for preserving syllable weight and at the same time for allowing coda weakening. As Vennemann (1988:39-40) observes, syllable offsets "may weaken to the point where they are little more than an indistinct mora bearer. To fill this mora with a copy of the following onset appears to be a natural strategy". As a weakening process, assimilation easily involves the coronal segments, which, ceteris paribus, have in the system a less marked status. In fact, as clearly results from the contexts listed above under the label of assimilation, there are a number of instances of such a process involving dental plosives.

In a non-linear framework, in particular within autosegmental phonology,

[65] The reason why C₁ is normally assimilated to C₂, while the reverse process is rarely found, has recently been investigated by Ohala (1990) in the light of experimental phonetics; he believes that the source of this asymmetry "is to be found in the acoustic-auditory domain, not in the articulatory" (Ohala 1990:265).

assimilation may be viewed as spreading of the feature content of the onset to the preceding coda position. Because the target of the process loses its melodic properties, preserving only its structural and metrical position, we claim that assimilation of the dental segment is a weakening process, when compared to substitution; at the same time, it also looks like a partial strengthening in comparison with deletion. In other terms, if substitution may be considered as strengthening and deletion as weakening, assimilation would stay in the middle.

As is well known, the trend towards reduction of the coda is present throughout the Romance domain. In Italian, where the process often shows the special face of gemination as product of an assimilation, it is widespread and works independently from the place of articulation; therefore, not only the dentals (as in Classical Latin), but also the other stops, are affected by the assimilation: e.g. Lat. scriptus > It. scritto, octo > otto, scripsi > scrissi, dixi > dissi, etc. In Vulgar Latin, and much more so in the formation of the Romance languages, coda reduction becomes no longer dependent on the relative weakness of the consonant, while it assumes the value of a general syllabic drift, taking various aspects in the different Romance languages, but moving in the same direction.

The recognition in the history of Latin of the vitality of assimilation does not contradict the supposed weakness of the dental stops; rather, the special behaviour shown by these segments leads to positing a specific hierarchy in the diachronic processes, by putting just the coronal consonants as the first phonological class which triggers the phenomenon. In other words, if we consider an extensive enough temporal axis, starting from ancient, prehistoric Latin up to the Romance languages, and in particular to Italian, the dental plosives appear to make a breach in the wall of clusters, through which all the other obstruents were able to pass step by step. For instance, the final result of such a drift is an increase in geminate consonants, while in other systems, even if assimilation has taken place, normally there are no geminates as a final result.

Among the processes listed under the label of assimilation, those involving a nasal appear to be particularly interesting. In fact, the analysis of the clusters composed of stop + nasal shows a general weakening of the first articulation. If the segments of the cluster share the same point of articulation, we find a total assimilation: *-tn-, *-dn- > -nn- (see (18), (19)) like *-pn-, *-bn- > -mm- (e.g. summus < *sup-mos; in verbal derivation, summitto, summoveo).[66]

If the segments are of different place, in the case of *-pn-, *-bn-, a partial assimilation of nasality takes place, saving the point of articulation for both segments (for instance, *sop-nos > somnus, *scab-num > scamnum

[66] See Sommer (1914:229 ff.), Niedermann (1931), Leumann (1977).

vs. *scabilum*, **Sab-nio-* > *Samnium* vs. *Sabini*).[67] With velars, **-kn-*, **-gn-*, the result was probably a velar nasal (graphically, <gn>), which, as such, again preserved the manner of the second segment, but the point of the first one (e.g. **dek-nos* > *dignus*; **leg-nom* > *lignum*).[68] As far as dentals are concerned, only the example of *caementum* < **caementum* < **caid-men-tom* (cf. *caedere*) is reported in the traditional literature:[69] here again a total assimilation of the dental plosive occurs. A partial assimilation was not possible (i.e. **-dm-* > **-mm-*, like in **-bn-* > *-mm-*), since the sequence **-nm-* is not allowed by Latin. In fact, among the clusters composed of two nasals, only *-mn-* was preserved (e.g. *amnis, contemno, omnis, damnum*),[70] whereas the opposite **-nm-* was again prone to regressive assimilation, though the instances are all relative to derivation, e.g. **in-mortalis* > *immortalis, in-mineo* > *immineo*. The analysis of the clusters with nasal as second element shows, therefore, that a syllabic contact where a segment marked [+ coronal] occupies the first place is unstable and subject to change. We shall return to this topic in the next paragraph.

Another factor has to be taken into account with regard to assimilation, i.e. the morphological structure of the word. In all the assimilatory processes we have considered so far a morpheme boundary occurred between the two original consonants; e.g. **sed-la*, **pot-sum*, **sit-cus*, **bod-ce*, etc. The case of the cluster **tl* is particularly interesting in this respect; it shows two different results depending on the syllabic and morphemic context: if this cluster was tautomorphemic (as in the **tlom* suffix), no assimilation occurred, but instead the dental plosive was substituted by the velar one; if the original cluster was heteromorphemic (as in **capit-los*), assimilation did occur. Now, since assimilation is a phonological process always taking place between two segments belonging to different but adjacent syllables, it seems evident that in these cases the morpheme boundary was strong enough to preserve the original syllable boundary, thus triggering the assimilation.[71]

[67] Remember also that in epigraphic sources it is possible to find *amm-* for *abn-* (e.g. *amnegaverit* C.I.L. VI, 14672).

[68] See Sommer (1914:233), Niedermann (1931), Leumann (1977:201). Niedermann (1931: § 74) claimed that *gn* would represent the combination of a palatal nasal followed by a dental one; but this opinion seems to us rather strange, since Latin does not have palatal consonants at all. For a phonetic and phonemic interpretation of *gn*, see also the recent article by Giannini (1987).

[69] In the manuscripts, we find rather frequent instances of *amm-* for *adm-*, clearly indicating the total assimilation of the dental stop to the following labial nasal.

[70] For a disputable origin of *-mn-* from *-pn-* in *omnis* and *damnum*, see Leumann (1977:201).

[71] In all the processes we have considered, we are dealing with regressive assimilation. Although Latin had progressive assimilation too, the regressive form is undoubtedly much more frequent. For an explanation of such an asymmetry in acoustic terms, we would like, to quote to the recent article by Ohala (1990).

An interesting question concerns the criteria for determining the direction of the process. Although such it is not possible to explore the question here, we would like, however, to quote Vennemann's opinion in this regard: "where the syllable boundary coincides with a morphological boundary, the direction of the assimilation may be determined by a desire to protect the integrity

12. Strength hierarchies and asymmetric distribution.

A possible statement recognising the weakness of dental consonants does not find general agreement in the literature devoted to strength hierarchies. In particular, strength values associated with the different places of articulation can differ from one scholar to another.[72] For instance, with reference to data relative to Fula and Finnish on the one hand and Icelandic on the other, Skousen (1972a; 1972b:86) and Vennemann (1972:6) claimed that precisely the dental voiceless stop has to be considered as the strongest segment. However, Schane (1973) proposed *t* as the least marked consonant, starting from French data. In his classic works on the topic, Foley (1970:90; 1977:28 ff., 90 ff.) posited a scale for obstruents where labials are the strongest series, but dentals are stronger than velars; the basic evidence was constituted by the intervocalic deletion of stops in Spanish and French. Following Foley's approach, Escure (1977) proposed a hierarchy of 'cavity features' where the velar series was thought to be weaker than those of labials and coronals; as she writes (p. 61), "back consonants (velars) are more likely to undergo deletion than front consonants (labials and dentals)".[73] New reflections on the topic come out from the work by Cravens

of a stem or affix" (Vennemann (1988:39). In Latin, progressive assimilation always seems to preserve the stem (e.g. **vel-se* > *velle*; **col-nis* > *collis*), whereas the regressive one sometimes saves the affix (e.g. **sed-la* > *sella*, **lapid-los* > *lapillus*; **coron-la* > *corolla*) and in other cases the stem (normally in verbal derivation, e.g. *afficio, oppono, occido* as *possum* < *potis sum*). In both directions taken by the process of assimilation at morpheme boundary, there is morphological transparency on one side, but increasing opacity on the other; for instance, in *velle* or *oppono* the verbal stem is preserved, while the affix is modified; in *sella* or *lapillus* the affix is unchanged, but the stem reaches a greater degree of opacity.

The direction of the assimilation processes we observe in Latin could also be phonologically governed. Some of the preference laws proposed by Murray (1988) and Vennemann (1988) may be used in such a perspective; we are thinking in particular of the laws of 'Contact' and of 'Strength Assimilation'. Future research specifically devoted to the question would shed more light on such a complex topic.

[72] Given the large number of studies devoted to this topic, we will refer here only to the contributions which are considered relevant for the matter we are analysing, therefore specially those which assign different strength values to obstruents in relation to the point of articulation. As a matter of fact, while different degrees of consonantal strength are uncontroversially assumed in the literature with reference to the manner of articulation (for instance, liquids are weaker than obstruents), the same cannot be said for articulatory place.

For a more exhaustive picture of strength hierarchies within phonological theory, the reader can be referred to the book by Murray (1988), which critically discusses all the studies published until that date; more recently, the topic has again been addressed by Dogil & Luschützky (1990), where traditional unidimensional scales of relative segmental strength are substituted by multidimensional scales of different parameters, largely based on phonetic criteria. In any case, neither Murray (1988) nor Dogil & Luschützky (1990) pose specific differences of strength among the places of articulation.

[73] According to Escure (1977), consonantal strength hierarchies should be constructed with reference not only to manner and place of articulation, but also to the environment where the segment is located, i.e. word initial, word final, intervocalic. This study presents some aspects of interest even now, for it tries to take into account a number of factors which can interact with an abstract strength scale in real linguistic behaviour, like the relation between word and syllable, or the occurrence of stress.

(1984a; 1984b), with the introduction of implicational strength scales, capable of relating the units of the system with the classes of units; for Tuscan stops, he proposes the hierarchy $p > t > k$,[74] but with the clear awareness that strength hierarchies are language-specific (cf. Cravens 1987:170; 1988:92). More recently, Murray (1987; 1988) has once again approached the topic from the theoretical pattern based on preference laws for syllabification. As for the Romance languages, he proposes the view traditional since Foley which assigns to the labial stops a higher degree of strength as compared with the other stops, concluding that "sound change typically does not affect all the members of a particular class but rather only a subsection of the class, with subsequent generalization to other members" (Murray 1987:116). Finally, a rather critical perspective is assumed by Harris-Northall (1990:51), who analysed the historical processes involving weakening in Spanish consonants, concluding that "a strength hierarchy makes no sense unless it is applied with reference to the position of the segment in question".

In the generative framework, the theory of markedness proposed by Chomsky & Halle (1968) gave the labial stop a higher markedness value with respect to the other stops, without keeping the dental stop distinct from the velar one, since both had the same degree of markedness. But Kean's theory (1975:48) clearly recognised the universally unmarked status of /t/ as compared to both /p/ and /k/. The subsequent debate on markedness values and on underspecification of the coronal class has undoubtedly found its roots in Kean's thesis.

In the absence of an uncontroversial opinion among those who have used the strength hierarchy notion with specific reference to the place of articulation, two theoretical possibilities are available: either to postulate a universal hierarchy of consonantal strength or to propose relatively different scales which, given some general principles,[75] are subject to language parametrisation. This second approach is more suitable in our opinion, since linguistic data do not confirm that certain places are universally weaker than others, whereas the degrees of weakness or strength may vary from language to language and in relation to the diachronic axis of a same language. As Lass (1984:183) claims, "if at a given time a language has a weakening process, there is a strong tendency for certain place categories to be weak and others strong, in a given position." This is precisely our case for dental plosives in Latin: for a fairly long time, such segments were weaker than others, especially in coda position, and therefore became subject to the different phonological processes we have analysed so far.

74 The symbol > here means "stronger than".
75 A general principle could be, for instance, the greater strength of voiceless obstruents in comparison with the voiced ones, or even the relative weakness of liquids and nasals with respect to obstruents.

Thus, even without admitting a universal perspective, we can assume that, in Latin, dental stops form a special class.[76] To the set of processes listed and analysed above, let us now add the evidence relative to the composition of consonant clusters.

To begin with, we consider the clusters which are composed of two voiceless plosives: a clear asymmetry emerges from the data, since the coronal segment can occupy the second position, but never the first one, whereas the labial and velar segments are found in first position, but never in the second one; e.g. *captus, septem, factum, octo*, but *-tc-, *-tp-, *-cp-, *-pc-*.[77] The same asymmetry holds for *stop + sibilant* clusters: *-ps-, -ks-* were possible (e.g. *scripsi, rexi*), but *-ts-* was not (see the phonological process under (14)). Even in the case of clusters composed of two nasals, the coronal can occupy only the second place; as we have already seen, *-mn-* is well-formed (e.g. *omnis, amnis*), while *nm* is not.

As a first approach, we might interpret this particular distribution with reference to the syllable constituents: given a lower value of strength for the dental stop, when it occupies a weak position in the syllable, such as the coda, it could not easily preserve its articulation; on the opposite, a strong position like syllable onset would grant the segment the means for maintaining its phonetic properties. In fact, in the historical evolution of the language, we have seen that a dental stop in the coda normally becomes assimilated to the following obstruent. This can explain why we no longer find *-tp-, *-tc-* in Latin. But what is responsible for the absence of *pc, *cp clusters?

What is striking is that the same asymmetries seem to exist in other languages too. As discussed in Clements (1990), Kaye (1990:328) and elsewhere, in French and English *pt* and *kt* occur (e.g. Fr. *adopter, dictée;* Eng. *chapter, actor*), while the opposite sequences do not; again, in *stop + sibilant* clusters, *ks, ps* occur (e.g. Fr. *fixer, taxe, rapsodie;* Eng. *axis, Pepsi*), but *ts* not. However, we think that some other factors should be taken into account before claiming a structural asymmetry in the stop distribution for these two languages. As a matter of fact, the instances of clusters composed of stops in French are normally relative to learned lexemes, not belonging to the popular lexicon of the language: since Latin had only *pt* and *ct*, the same and not other sequences of stops were reintroduced into the educated language. Through borrowing from French, these clusters later entered into English; again, the asymmetric distribution in clusters is not structural, but depends on the primary root of the words

76 The relative weakness of the coronal stops in Latin was already observed by Steriade (1982:98) who gave *t, d* a different and higher degree of sonority with comparison to *p, b, c, g*, although without discussing this hierarchy.
77 See Devine & Stephens (1977), who present an exhaustive list of Latin clusters, but do not discuss the above mentioned gaps. Even Steriade (1987a) explicitly keeps the [coronal] feature distinct in her classification of the consonant sequences, without trying to explain this treatment.

showing the sequences under question, i.e. Latin, *via* French. Furthermore, English is different, since not only *pt* and *kt* occur (e.g. *actor, chapter, adopt, fact*), but also *tp* and *tk*, at least in some contexts, i.e. at morpheme boundary, even with variable degrees of cohesion between the two morphemes; in fact, we meet such clusters not only when a strong morpheme boundary occurs inside the consonant sequence (e.g. *outcome, outpace*), but even in words where the original morpheme boundary is probably less perceived as such by the speaker (e.g. *output, outsider*).

More interesting appears to be Classical Greek, which admits clusters composed of two stops, both voiceless and voiced, as well as by *stop + sibilant* in word initial position too, but never with a coronal occurring at the first place in the sequence.[78] A form like τίχτω 'I procreate' is particularly significative in this respect: the verbal root was in fact *tek-, as is demonstrated by the coronal consonant in the first syllable because of the doubling occurring in the stem of the present; moreover, the aorist of the verb was ἔτεχον, and a nominal derivate is τόχος "son". Thus, τίχτω was originally *τιτχω; but a cluster like *-tk- was not allowed in Greek; thus, given its ill-formedness, metathesis occurred.

We might wonder whether the asymmetry holding in Latin and Greek for stop clusters is accidental or if it obeys general, possibly universal constraints on the order of segments in the speech chain. Bailey (1970: 348) claimed that sequences of *non apicals + apicals* are unmarked clusters. He found evidence for such a claim in metathesis occurring in Ancient Greek when apicals occurred before non apicals (e.g. *φανιω > φαῖνω, *μορια > μοῖρα) and in assimilations taking place across morpheme or word boundaries in English in the case of rapid speech (e.g. *good-bye > goob-bye; good boy > goob boy; right corner > righb corner;* but not *keet track < keep track*). Actually, there could be physiological reasons why coronals are preferred at the end of consonantal clusters, for the kind of articulatory gesture involved for dentals is different with respect to that for labials or velars: rapid movement of the tongue tip on one hand, but slower and reduced movement of jaw and lips (labials) or of the body tongue with change in the state of the cavity (velars). The most stable articulations seem then to be preferred before the speedy ones rather than *viceversa*. But to recognise such a preference trend does not imply, in our opinion, that it is then assigned to Universal Grammar; the case of Classical Greek does confirm

[78] An exaustive picture of the clusters admitted by Greek may be found in Lupaş (1972). In an old article, Benveniste (1939:31) noticed the 'défauts de symétrie' concerning the position of the dental in clusters. Recall that the Greek alphabet uses two special characters for *ps* and *ks*, clearly indicating not only their tautosyllabic status, but also their integration in the phonological system. The same asymmetries seem to hold for Modern Greek too; for instance, *pleko* 'I knit' / *pleksi* 'knit'; *strefo* 'I turn' / *strepsi* 'turned'; but *plito* 'I am bored' / *pliksi* 'bored', with a substitution of the coronal stop with a velar one (these data are taken from Kaye *et alii* 1990:229, footnote 27).

such a weak interpretation of distributional constraint: if *τιτχω > τιχτω, *φανιω > φαῖνω, however ῥυθμός, ἀτλητής, τλητός, still remain unchanged, although a coronal segment occupies the first position in the cluster.

13. *The special status of coronals and underspecification.*

Diachronic processes involving the coronal point of articulation have been discussed so far with reference to notions and constraints belonging to general phonetic and phonological theory, without assuming a specific and exclusive point of view. We would like now to see how the special status of dental consonants as emerging from the Latin data can be represented according to two recent theoretical frameworks, *Government Phonology* and *Underspecification Theory*. Our corpus will therefore become a kind of data set where we can test the capacity of such theories to explain in a consistent manner different phonological processes bound to each other for coronal specification. The choice of these two particular theoretical frameworks is justified because not only are they intrinsically stimulating, but also because these approaches are still very much in a developmental character.

We start with the theoretical approach related to the notion of underspecification, which seems to be very promising in the interpretation of Latin data. Actually, it is not accidental that the special behaviour of coronal segments has been particularly well developed and profitably studied in the theory of feature hierarchy, integrated with underspecification. If we assume that coronals lack Place specification, we are able to derive their particular weakness directly from the phonological structure, giving at the same time an explanation for all the processes attested for Latin dentals stops (i.e. assimilation, deletion, substitution).

13.1. *Radical or contrastive underspecification?*

Underspecification derives from the theoretical assumption that not all feature specifications are present in underlying representation, but that some of these are filled in during the derivation. Thus, to say that a feature is underspecified in the tree structure of a segment means that the value (+ or-) for such a feature is predictable. But such predictability can be related either to Universal Grammar or to constraints holding in particular phonological systems. In other words, whereas underspecification is normally assumed in any hierarchical model of feature geometry, its scope is controversial.

There are two basic interpretations of underspecification: radical or contrastive. Assuming radical underspecification, only the unpredictable value of the features is present in the underlying representation, whereas

predictable values are filled in during derivation by Redundancy Rules; a universal theory of markedness determines which values have to be considered as unpredictable. In contrastive underspecification, the occurrence of feature values in the underlying representation depends on the phonemic contrasts holding in the language; universal grammar thus plays a more reduced role in the specification of the pertinent values. As Paradis & Prunet (1991b:5) observe, "radical underspecification is essentially a theory of markedness (...), while contrastive specification is essentially a theory of redundancy".

The contrastive approach to underspecification seems to us more productive than the radical one. The value of a feature specification can vary according to different specific systems. To assign markedness values equally defined for all the natural languages is in our opinion too powerful: the real linguistic data may not correspond to the assigned indexes. Once again, we believe that Universal Grammar should contain only a few general principles, which are subject to language specific constraints.

13.2. Different degrees of unmarkedness.

Apart from the divergence about the kind of underspecification (radical/contrastive), the phonological theory based on hierarchical feature organisation normally recognises a special status for the segments marked [+ coronal]. The relevant hypothesis is that coronals, unlike the other segments, lack Place specification. The corresponding geometry is the following:

(21)
```
        SLN
         /
        SVN
       /   \
      PN   /   \
     / \  [lat] [lnas]
    /  (Cor)
  PerN
   / \
 Lab  Dors
```
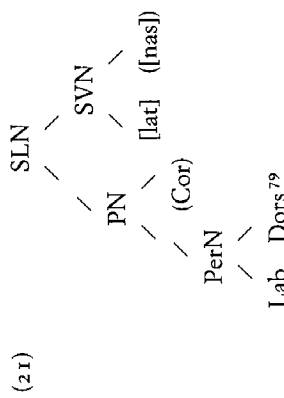
In such a representation, the Coronal articulator is the default value for the Place Node, i.e. Coronal is underspecified at the underlying level. To assume the unspecified value of Coronal for Place is equivalent to saying

---

[79] In this schema, as well as in the following ones, SLN = Supralaryngeal Node; SVN = Spontaneous Voice Node; PN = Place Node; PerN = Peripheral Node; lat = lateral; nas = nasal; cor = coronal; lab = labial; dors = dorsal; nodes in brackets are default nodes. The Spontaneous Voice Node is active for sonorants; of the two sister nodes dominated by SVN, [nasal] is the unspecified one, while [lateral] is underlyingly specified. See Rice & Avery (1991) and relevant comments in Paradis & Prunet (1991a:15-16).

---

that coronals are the unmarked obstruents; it becomes directly possible to interpret all the phonological processes we have observed in Latin. We start by considering deletion. In feature geometry, deletion is represented as delinking of the root node as well as of the lower nodes.[80] If coronals are underspecified for Place in underlying representation, their segmental content is reduced; thus, their deletion becomes simpler than that of noncoronal consonants.

It is important to recall that the deletion we have observed in Latin always concerns dental stops; for instance, in initial sequences composed of *stop + lateral*, both marked [+ coronal], the stop is deleted, while the lateral is preserved. The same asymmetry within the class of coronal segments is observed for the other kinds of processes we have considered, i.e. substitution and assimilation: dental stops are always the prime targets, whereas other coronal consonants appear sometimes as surface output of the process. Take again the case of *tl; we have seen that this prehistorical input can give rise to three different historical outputs, depending on syllabic constraints (see § 10): a) *l-* (e.g. *latus*); b) *-cl-* (e.g. *baculum*); c) *-ll-* (e.g. *capillus*). Even when the structural position originally associated with the dental stop has been preserved, it has been filled in by another stop (-cl-) or by the segment content of the following lateral. In this respect, the substitution of the voiced dental stop with a liquid segment (see the processes listed under (10), (11) and (12)) appears to be especially instructive, since input and output of the process share in common the crucial mark of coronality.

Another dental consonant which shows in Latin a treatment similar to that of stops is the nasal; remember that in a cluster of nasals, the coronal one undergoes assimilation if it occupies the first position in the sequence (cf. *immineo < in-m-; immerito < in-m-,* but *omnis, amnis*). More complex is the status of the sibilant: as far as rhotacism is concerned, it seems to behave like a stop; but the distributional properties of this segment do not indicate that /s/ is underspecified as /t/: /s/, unlike /t/ or /d/, can occupy any position in clusters (e.g. *status, spargo; scripsi; recsi; strincsi; est, ars, mens*). Even in the diachronic evolution of the language this segment appears to be rather stable in Romance languages.[81] As for liquids, they seem to behave differently from stops. The changes of the voiced plosive to a liquid (see the processes listed under (10), (11), (12)) indicate that an unmarked consonant (= d) is substituted by a more marked one, in the representation of which even the Spontaneous Voice Node is filled in.

In order to account for the linguistic data, it seems therefore that to

---

[80] Rice & Avery (1991:106) make a more restrictive use of delinking, defined as "a neutralization process that delinks content nodes in neutralizing positions such as morpheme-final or syllable-final".
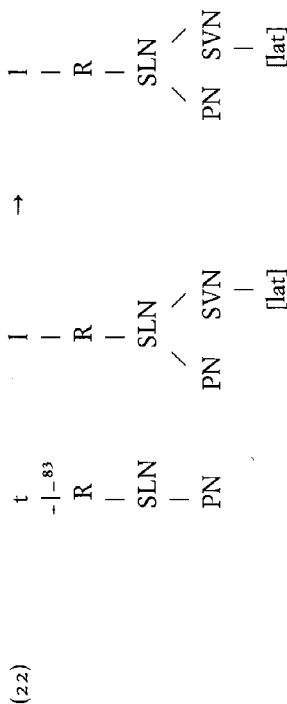
[81] See Lausberg (1969: § 306; 353 ff.); recall however that in Eastern Romania the change s > i occurs, but only in word final position (see Lausberg: § 534 ff., Rohlfs 1949: § 308).

assume underspecification for the class of coronals as a whole is not sufficient, because within this class, segments marked with different manners of articulation do not show the same behaviour; typically, only coronal stops (and perhaps the nasal one too) appear to be unmarked and thus more prone to the phonological processes involving deletion or weakening of the consonant.

The same difference in the degree of markedness within the class of coronals is confirmed by the data relative to performance. In the study of Béland & Favreau (1991), French aphasic speakers show a clear trend towards assimilation as well as insertion in the case of [t, d, n, l, r], but not for [s, z, ʃ, ʒ]. Even the data relative to speech errors reported by Stemberger (1991) and Stemberger & Stoel-Gammon (1991) clearly indicate not only that coronals are more often involved in the typical processes related to slips of the tongue, but also that the stops in particular are affected by these processes.[82]
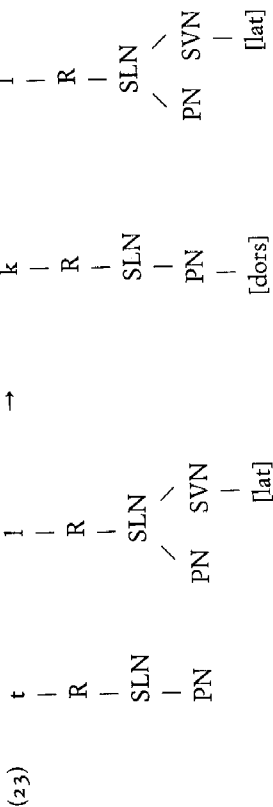
13.3. *Representation of phonological processes.*

We have already said that deletion is represented in *UT* (= Underspecification Theory) as delinking of the Root node; for instance, in the case of *tl-* > *l-*, we have formally:

(22)
```
      t           l
      -|-[83]      |      →
      R           R
      |           |
      SLN         SLN
      |    \      |    \
      PN   SVN    PN   SVN
           |           |
          [lat]       [lat]
```

It is important to observe that we agree with the recent proposal advanced by Rice & Avery (1991) assuming [lateral] as a specification dominated by the Spontaneous Voice node, and not by the Place node. It this way, the difference in behaviour between [l] on the one hand and dental stops on the other is directly reflected in the more complex representation of the lateral.
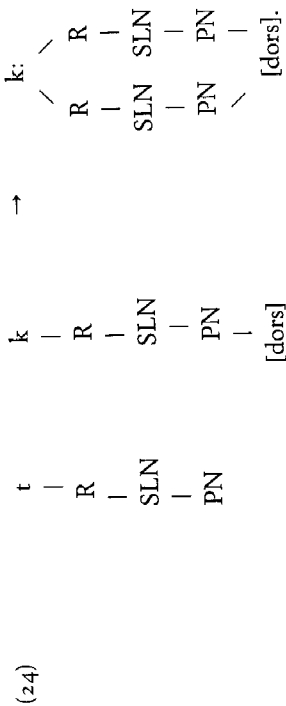
Substitution can be represented in *UT* as a new linking of the original coronal segment, which becomes marked for Place; for instance, taking the case of *-tl-* > *-cl-*, the formal representation of the phonological process will be the following:

82 For a discussion of these studies, we refer to § 2 of the present work.
83 With the -|- symbol, we indicate the process of delinking.

(23)
```
      t             l      ↑          k
      -|-           |                 -|-
      R             R                 R
      |             |                 |
      SLN           SLN               SLN
      |     \       |    \            |
      PN    SVN     PN   SVN          PN
            |            |            |
          [lat]        [lat]        [dors]
```

The feature geometry mirrors the more complex representation of the output of the process. Since the *Obligatory Contour Principle*[84] is recognised by *UT*, it is also probable that this principle plays a role in triggering the process, given the sharing of the same unmarked place for the original segments.

As for assimilation, spreading is the formal operation accounting for it. A general constraint holding in feature hierarchy is that a feature or node can spread only to an empty position.[85] This constraint applies in case of assimilations involving dental stops in Latin: given the assumption that coronals are unmarked for place, the Place Node is empty and thus becomes filled in precisely by the spreading of the following Place specification; for *-tc-* > *-cc-* we have then the representation in (24):

(24)
```
      t       k              t       k:
      -|-     -|-            -|-      -|-
      R       R        →     R        R
      |       |              |        |
      SLN     SLN            SLN      SLN
      |       |              |        |
      PN      PN             PN       PN
              |                       |
            [dors]                  [dors]
```

We can therefore conclude this section by recognising for *UT* a rather high descriptive power in relation to the phenomena under examination. To assign coronal stops in Latin an unmarked status allows us to interpret consistently and simply all the processes analysed, with simple operations like linking (substitution), delinking (deletion) and spreading (assimilation).

84 On OCP, see Paradis & Prunet (1989), Goldsmith (1990: *passim*).
85 See Archangeli (1988), Avery & Rice (1989), Paradis & Prunet (1991a); Rice & Avery (1991:106).

14. Charm and Government Theory.

We now consider the theory of *Charm and Government* proposed by Kaye, Lowenstamm & Vergnaud (1985; 1990).[86] This theoretical framework provides for three syllabic constituents: Onset, Nucleus and Rhyme, which are maximally binary and left-headed. Each phonetic segment is represented as the result of a fusion operation holding onto the phonological elements which compose it. Phonological elements are the primes of the representation; they have a charm value and correspond to a matrix of features totally specified and with one marked feature. *Element* is then a technical term, indicating the ultimate constituent of the segments. Underspecification and redundancy are therefore not admitted to this theory. The crucial notion of *Government* involves a local relation between a head and a governee in its domain; the government relation is universally left-headed in the constituent domain, but right-headed in the interconstituent domain.[87]

14.1. Complexity.

Let us see now how *CGT* is able to represent with descriptive and explicative adequacy the special properties presented by the class of coronal stops in Latin. Taking into account the considerable instability of these segments as is manifested by the processes encountered (deletion, substitution and assimilation), we may suppose that the special status is somehow related to the markedness degree: coronals should be less marked than segments with a different place of articulation. Within the *CGT* framework, the degree of markedness of a segment is determined by its composition. The technical notion used is that of *complexity*, which is computable in relation to the number of elements which characterise a segment (see Harris 1990). Thus, a segment is considered less complex than another one when it is composed of fewer phonological elements; taking vowels for instance, [e] will be more complex than [a], since $[\varepsilon] = (A^+ \cdot \underline{I}^\circ)$, while $[a] = (v^\circ \cdot \underline{A}^+)$.[88] If we now analyse the composition of plosives occurring in Latin, we get the following picture:

(25)

$$[p] = (H^- \cdot (h^\circ \cdot (P^\circ \cdot \underline{U}^\circ)^\circ)^\circ)\text{-} \qquad [b] = (L^- \cdot (h^\circ \cdot (P^\circ \cdot \underline{U}^\circ)^\circ)^\circ)\text{-}$$
$$[t] = (H^- \cdot (h^\circ \cdot (P^\circ \cdot \underline{R}^\circ)^\circ)^\circ)\text{-} \qquad [d] = (L^- \cdot (h^\circ \cdot (P^\circ \cdot \underline{R}^\circ)^\circ)^\circ)\text{-}$$
$$[p] = (H^- \cdot (h^\circ \cdot (P^\circ \cdot \underline{v}^\circ)^\circ)^\circ)\text{-} \qquad [g] = (L^- \cdot (h^\circ \cdot (P^\circ \cdot \underline{v}^\circ)^\circ)^\circ)\text{-}\text{89}$$

86 Henceforth, *CGT* will be used instead of *Charm and Government Theory*, and KLV instead of Kaye, Lowenstamm & Vergnaud.

87 The theory provides for another government relation too, i.e. the one holding between syllabic nuclei; in this case, the direction of the government is not universally fixed, but is language dependent.

88 See KLV (1985), Harris (1990), Charette (1991:14); the underlined element indicates the head of the segment.

89 In these expressions, P° is the element of occlusion, h° is that of noise, U° and R° are the elements corresponding to the place of articulation, respectively for labiality and coronality

---

In such a scenario, coronals do not appear to be less complex than the other stops; they have, on the one hand, the same complexity as labials, and, on the other, a higher complexity than velars.[90] With reference to the *Complexity Condition*, preventing a governed position from being more complex than its governor,[91] we expect that, given two segments with different degrees of complexity, the most complex will govern the less complex one, while in the case of two segments having the same complexity, no special restriction on government obtains, at least with relation to complexity.[92]

If we apply this constraint on Latin clusters composed of plosives, we are able to explain why the heterosyllabic cluster *ct* is well-formed, whereas the opposite is not (*tk*): since in an interconstituent government relation the governor cannot be less complex than the governee, [t] – which is more complex than [k] – can only occupy the onset position.[93]

However, in Latin we find the same asymmetry with labials too: *pt* (e.g. *captus*), but *tp*, while there seems to be no intrinsic reason why the coronal can occupy the onset position, but the labial cannot, given the same complexity value shared by both these plosive segments.[94] The lack of *tp beside *pt* appears to be a first critical point challenging the government theory in explaining the distributional gaps we have brought to light.

(for palatality, I° is used), v° is the so-called 'cold' element, while H⁻ and L⁻ are the elements referring to the status of the vocal cords: H⁻ stays for high tone and for [-voice], while L⁻ for low tone and [+voice]. See Harris (1990:263-264); Charette (1991:15). Each element is marked for charm, as charmless (°) or charmed (either negatively ⁻ or positively ⁺).

We are here following the proposal of Harris (1990), by assigning the noise element to plosives too, and not only to fricatives, as is proposed within the same theoretical framework by KLV (1990) and Charette (1991). We prefer Harris's proposal because it represents plosives as more complex than fricatives, thus explaining lenition processes, like spirantisation from an original stop, by simple depletion of the occlusion element. From the other perspective, plosives and fricatives would have the same complexity degree, since they do not share the elements P° and h°.

90 Both coronals and labials have a specified element for place of articulation (U° = labial; R° = coronal), whereas in the composition of the velar the cold element, which is unmarked, is filling up this tier.

91 Harris (1990:274) defines the *Complexity Condition* as follows: "Let α and β be segments occupying the positions A and B respectively. Then, if A governs B, β must be no more complex than α".

92 Actually, as we will see further, charm requirements play a role too in constraining the interconstituent government.

93 Recall that in the interconstituent domain, like the one holding between the onset and the rhymal complement (= the coda), the direction of the government is universally from right to left (see KLV 1985; 1990, Harris 1990).

94 On the other hand, we should remember that Harris (1990:297) observes that "coronals appear to be the 'weakest' series in English", even if its analysis does not seem to account for such a claim. Kaye (1990:328) not only notices the same asymmetry (*pt*, but *tp), in English as well as in other languages too, but he is also aware that in clusters composed of two plosives the charm requirements are not satisfied, since there could be no real government relation between two segments both having a negative charm. In fact, the governee has to be neutrally charmed. For the discussion about the charm values, see the next paragraph.

14.2. Charm values.

Moreover, the government relation has to obey not only the complexity condition, but charm requirements too. Now, as far as charm is concerned, the theory predicts that charmed segments (i.e. σ⁺, σ⁻) may govern, while charmless segments (σ°) may be governed (cf. KLV 1990:202; Harris 1990:273). Since the obstruents have a negative charm value (see (25)), a potential governor role is assigned them by default. In clusters like *pt* or *kt*, however, a negatively charmed stop comes to occupy not only the governing position (= onset), but also the governed one (= coda), thus apparently challenging the charm requirements. Although government relation has a central and not disputable role inside the theory, KLV (1990:216) admit that "there exists a series of stops that are governable", given the heterosyllabic status of these clusters. How can a stop become governable? By lacking one or more elements in its composition, crucially lacking the element which gives negative charm to the segment.

In the representations given in (25) relative to Latin stops, the element which imparts negative charm is that controlling the state of the vocal cords, i.e. H⁻ (stiff vocal cords) for the voiceless stops and L⁻ (slack vocal cords) for the voiced ones. A stop losing this distinctive laryngeal element is no longer negatively charmed, but charmless, and thus governable. Furthermore, the production of the same plosive is phonetically different with reference to the position occupied in syllable structure; for instance, [k] is a genuine plosive as characterised by a release phase in the articulation when it is in onset position (e.g. English *balcony*), while it is an unreleased and lax stop when it is not in such a position (e.g. Eng. *doctor*). This difference is reflected in the composition: a genuine plosive will be marked by h°, while the unreleased stop will lack it, because h° is the element which contributes aperiodic energy in the form of a noise burst to plosives (Harris 1990:263). Therefore, a stop associated with the governed position corresponding to the rhymal complement will lack two elements, that is not only the laryngeal, but also the noise one. The representation of a cluster like *-pt-* in terms of element configuration as well as of charm values will thus be the following:

```
(26)   R              O
        \            /
         \          /
     -- N --      -- 
     |    / \     |
     x   x   x    x
     |        |   |
    2°       2°  2°
     |            h°
    U°            R°
     |            H⁻
     V            t
     p
```

This representation is well-formed as far as all the theoretical requirements are concerned: the governee is charmless and less complex than the governor. However, distinguishing two underlying types of obstruents, on one hand those that can govern another obstruent, and on the other those that cannot, leads us to increase the segmental inventory of the language. Moreover, the acknowledgement of neutral obstruents is not yet able to explain why in Latin, as well as in English or French, [k] and [p] may become governees, while [t] may not. The only solution for such an asymmetry is to admit a parameter which specifies language by language which obstruents may become neutral.[95]

The asymmetric distribution of coronals in clusters has recently been dealt with by Rice (1992), who refers to the theoretical notions of underspecification and government. She accepts the hypothesis that coronals lack the Place specification, thus assigning them less Place structure as compared with the other places of articulation. But government assumes a different meaning in Rice's approach; as she writes, "A governs B if has more relevant structure than A" (Rice 1992:83), where the relevant structure is related with the sonority and the place of articulation of the segment. Therefore, for instance, in a cluster like *pt*, *t* can govern *p*, since *p* has more structure in terms of feature specifications, while a cluster like *tp* will be ill-formed, because *t* cannot be governed by a segment with more relevant structure. In such a perspective, the notion of government is no longer directly connected with the complexity of the segment: while in *CGT* as proposed by KLV (1990) and Harris (1990), the government relation between two constituents goes from the more complex (= the governor) to the less complex (= the governee), in Rice (1992) the governor has less structure than its governee.

In other words, Harris and Rice contrast: in Harris more sonority means less complexity in the representation; in Rice, greater sonority implies a greater complexity in the phonological structure. Although Rice's proposal seems to be rather original and distant—at least for some aspects—from the *opinio vulgata* in *CGT*, we must recognise that up to now this is the only approach that can account for the asymmetric distribution of coronals in clusters composed of two obstruents.

14.3. Assimilation and government.

The notion of phonological government is called upon to explain the direction of the assimilation processes we have observed for Latin. In fact,

⁹⁵ KLV (1990:216) compare French and English, which do not have governable coronal stops, with Korean, which possesses the full series of neutral stops: p° t° c° k°. Moreover, Kaye (1990: footnotes 7 and 20) observes that in English branching nuclei followed by coronal sequences are not shortened if final (e.g. *child/children; wild/wilderness*), whereas shortening always takes place in the case of non-coronal clusters (e.g. *leave/left; keep/kept*). The same Author admits that he has no solution for such a question, which is interesting for us because it concerns again coronals as special segments.

within this theoretical framework, a backward assimilation is expected by default, since a universal principle predicts that government goes from left to right in the domain of a constituent, but from right to left in the inter-constituent domain. This latter government relation permits the establishment of links generally holding in sequences Onset-Rhyme or Rhyme-Onset. Typical instances of the right-headed domains are onset palatalisation before front vowels (e.g. Ital. *amici* [a'mi:t∫i] "friends" / *amico* [a'mi:ko] "friend") as well as phenomena of assimilation in point of articulation (e.g. Ital. *banco* ['baŋko] "bench", *campo* ['kampo] "field"). In the case of total assimilation, the government relation manifests itself as particularly strong, since the governee, i.e. the consonant in rhyme position, loses those phonological elements which are not common with the ones present in the head segment, i.e. the consonant which occupies the onset position. Thus, assimilation can be interpreted as a process consisting of two stages: first, a depletion in the composition of the governed segment; second, the spreading of phonological elements from the head to the governee, obeying the two basic theoretical principles of locality and strict directionality. Spreading is dealt with as a mechanism of successive fusion operations and may be represented as follows:

(27)
```
      R      R    O
      N \         |
      x      x    x
      x      └────┘
```

Italian   d   e   t: o
        ['det.o] "said"   *versus*   ['di:ko]   "(I) say"

The element content of the governee is now totally controlled by the governor. Assimilation processes, taking place normally between heterosyllabic segments, are therefore interpreted in a suitable way within this theoretical framework.

Another interesting point where we can test the government approach is the one relative to the homorganic clusters which are subject to change in our corpus of data. From the perspective of *CGT*, homorganicity has to be interpreted as sharing of the element corresponding to the place of articulation. The clusters which are relevant in this respect are thus *tl, *dl, *ts, *tn.[96]

One basic aspect concerns the syllable constituency of these sequences: from an abstract point of view, they could belong to the same constituent or to different intersyllabic constituents. In the first hypothesis, we would

---

[96] In our data there is another cluster which could be traditionally classified as homorganic, i.e. *dj. But, in *CGT* these two segments do not share the same place of articulation, for the stop is marked by coronality element R°, while the front glide by the palatality element I°. Therefore, this cluster cannot be dealt with in the same manner as the other ones quoted in the text.

be faced with a complex onset. As is well known, natural languages normally possess branching onsets with a liquid (or even a nasal) as governed segment, but not of the format *tl, dl, tn*. In this case, *CGT* assumes that the two segments share in common too many phonological elements; in other terms, they are not different enough in order to make a phonological contrast.[97] This gap, which characterises not only Latin, but also many other languages, is captured by the principle that "segments within a branching onset can be bound for at most one element" (Harris 1990:278). Therefore, well-formed onsets are for instance *kr, pl*, because the segments have no element in common, as well as *tr, pn*, where the two structural positions corresponding to the segments are bound for only one element (R° in *tr*, ?° in *pn*);[98] whereas *tl, dl, tn* are ill-formed onsets, since the adjacent positions are bound for two elements, i.e. R° and ?°.[99]

The same compositional constraint accounts for the substitution of the voiceless dental stop with the velar one, i.e. *tl > cl* (see (5) in our list) occurring in Latin as well as in Romance languages. While *tl* is not allowed as tautosyllabic, since the segments are bound for two elements, in *cl* they are bound only for the element of occlusion; thus, the new sequence can constitute a well-formed onset.[100]
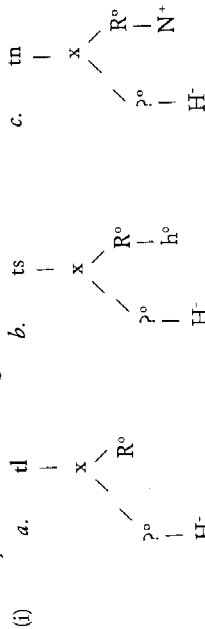
Once demonstrated that these structures cannot form branching onsets, we now have to consider the alternative interpretation, i.e. that they belong to different constituents in the syllable, namely the rhymal complement and the following onset. In this case, a right-to-left government relation should be holding between the two positions, with the second one as head.

---

[97] Recall what we have already noticed in § 4 with reference to the acoustic correlates of [tl, dl].

[98] R° is the charmless element for coronality, while ?° is the charmless element for occlusion; see KLV (1990), Harris (1990) and § 14.4. of the present work.

[99] With the same theoretical constraint, *a fortiori* geminates are ruled out as branching onsets; in fact, in this case there will be a complete identity in the element composition (see Harris 1990: *passim*).

[100] In languages where *tl, dl, tn, ts* are admitted as belonging to the same syllable, they have to be interpreted like contour segments, that is complex articulations associated with a structural position subject to the breaking of relevant tiers; their representation will be the following:

(i)
```
   a.  tl          b.  ts          c.  tn
       x               x               x
      / \             / \             / \
    ?°   R°         ?°   R°         ?°   R°
     |               |               |    \
    H-              h°              H-    N+
                     |
                    H-
```

In these representations, h° and ?° are the charmless elements for noise and occlusion, H- is the negatively charmed element for absence of sonority and N+ is the charmed element for nasality. As for the notion of breaking, see Harris (1990:229-230). Even KLV (1990:270 ff.). Even footnote 31) notice that *tl* is not a possible onset, since *t* and *l* are isomers, that is two segments with the same composition in terms of elements but organised in a different fashion".

However, sequences like those we are considering (*tl, dl, ts, tm*) cannot be licensed, since they would violate the *Complexity Condition* as well as the charm requirements. As we have already seen, the *Complexity Condition* prevents an inter-constituent government relation between positions when the head is less complex than its governee; in these structures, the stops staying in coda position are more complex than the following segments.[101]

As for charm values, stops are negatively charmed and thus cannot occupy a governed position, which is associated with charmless segments.[102] Therefore, sequences like *tl, dl, ts, tm* cannot even be heterosyllabic. Their ill-formedness accounts for assimilation taking place in Latin: a geminate consonant, the normal result of an assimilation process, is in fact well-formed both for complexity and for charm values.

14.4. *Coda weakening in CGT.*

CGT assumes the strict locality and strict directionality conditions on government relation (KLV 1985; 1990); binarity of syllabic constituents is derived from these structural constraints.[103] In particular, the strict locality condition will on principle exclude a structure like the following one, relative to a long vowel (or heavy diphthong) in a closed syllable:

```
(28)  *  R
         /
        N
       / \
      x   x
      |   |    x
      |   |    |
      σ₁  σ₂   σ₃
```
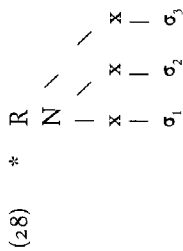
Technically, the head σ_1 is not adjacent to a member of the Rhyme constituent, i.e. σ_3. The relevant generalisation is therefore that branching nuclei are not allowed in a closed syllable.

As shown clearly by Latin data, 'coda' weakening is derived directly from the binarity constraint; in fact, a deletion of a final consonant like that found in the processes above listed under (4) (e.g. pron. *me:* < *me:d*,

[101] For the sake of clarity, we give here the element composition with the indication of charm values:

(ii) [t] = (H· (h°. (P°. R°)°)°;
    [d] = (L·. (h°. (P°. R°)°)°);
    [s] = (H·. (h°. R°)°);
    [l] = (P°. R°)°;
    [n] = (N⁺. (P°. R°)°)⁺.

[102] However, recall that a stop can lose its negative charm and become neutral in specific contexts; see the preceding paragraph.

[103] See KLV (1990:199): 'All syllabic constituents are maximally binary', with further comments and proofs.

abl. *praeda:* < *praida:d*) can be read as a means for avoiding a structure of the format in (28). The same structural constraint is valid for the other reductions of syllable weight we find in our corpus; e.g. *mi:si:* < *mi:ssi*; *caelum* < *caillom*, etc.

On the other hand, *CGT* does not recognise the coda as an autonomous syllable constituent. Since the position associated with the rhymal complement cannot branch, a heavy rhyme composed of a vowel plus two consonants in coda positon is thus ruled out. The final consonant in *lac* < **lact, cor* < **cord*) (see (3)) is lost because there is no structural position for its syllabification.

However, as we have already seen in § 10, Latin allowed hyperheavy rhymes of the format *V:C* or *VC₁C₂*: for instance, *mi:l\$le, fo:r\$ma, a:c\$tus; carp\$si, sanc\$tus*. The only way to interpret such structures within the *CGT* is to resort to an 'empty nucleus' (see KLV 1990; Yoshida 1990; Charette 1991). Following such a perspective, words like *fo:r\$ma* or *sanc\$tus* will be composed of three syllables, with an empty nucleus not phonetically realised and occurring at the place of the syllable boundary here indicated. In our opinion, the admittance of structural units not represented in the phonetic form of the word is an abstract way of capturing structures which cannot be otherwise represented by the theory. If in the case of *capsi* or *sanctus* the proposal of an empty nucleus might be in some way justified by the morphophonological alternations occurring in the paradigm (cf. *carpo, sancio*), for *mi:lle*, or *fo:rma* it appears to be rather arbitrary.

Actually, these structures are problematic within *CGT* because of the binarity constraint imposed on syllabic constituents. Exactly as in the metrical theory, constituents more than binary are not allowed by the prevalent generative theoretical patterns. But perhaps it is time to challenge the principle of *Strict Locality*, which is the root of binarity.

15. *Conclusions.*

In this work, we have analysed a number of phonological processes occurring in different historical stages of Latin, but all involving dental stops. A general weakening of the coronal segment has been pointed out; its manifestations range over loss of the segment (deletion) and change of articulation (substitution, assimilation).

The special status of dental stops comes out clearly from the linguistic data; in comparison with other stops occurring in Latin, the coronals appear to be more prone to change. Traditional phonological theory is able to describe almost exhaustively all the phenomena related to this special status. In particular, syllable theory seems to be very useful in the interpretation of the processes, although it cannot predict all the aspects of special behaviour shown by coronals.

The theoretical approach based on feature geometry incorporating the notion of *Underspecification* seems more productive. The starting point within such a framework is the assumption of [coronal] as the unmarked place of articulation for stops. Thus, the representation of all the processes involving dental stops occurring in the history of Latin becomes both possible and straightforward. Choosing a perspective based on contrastive underspecification, we may recognise that coronals were underspecified for Place in Latin, without assuming any radical position about Universal Grammar.

As far as *Charm and Government Theory* is concerned, most of the phenomena analysed here appear to be represented quite suitably in such a pattern. In particular, the theory makes correct predictions about assimilation, deletion as well as 'coda' weakening. Similarly, specific reasons, based on theoretical principles, are provided for the substitution of the dental stop with the velar one (*tl > cl*). However, there are some phenomena for which this theory cannot account, at least at the present stage of research. For instance, the distributional gaps in Latin clusters composed of two obstruents (e.g. *pt*, but *tp*, *cp*, *pc*) remain by chance. More complex seems to be the interpretation of superheavy rhymes, where CGT seems to touch a rather high level of abstraction.

Address of the Author:

Giovanna Marotta
Dipartimento di Filologia
Università di Siena
Via Roma, 47
I-53100 Siena
Italy

References

Archangeli, D. (1988), "Aspects of underspecification theory", *Phonology* 5:183-207.

Avery, P. & K. Rice (1989), "Segment structure and coronal underspecification", *Phonology* 6:179-200.

Bailey, C.-J.N. (1970), "Towards specifying constraints on phonological metathesis", *Linguistic Inquiry* 1:347-349.

Béland, R. & Y. Favreau (1991), "On the special status of coronals in aphasia", in Paradis & Prunet (1991b:201-221).

Benveniste, E. (1939), "Repartition des consonnes et phonologie du mot", *Travaux du Cercle Linguistique de Prague* 8:27-35.

Bertinetto, P.M. & M. Loporcaro, eds. (1988), *Certamen Phonologicum. Papers from the 1987 Cortona Phonology Meeting*, Torino, Rosenberg and Sellier.

Birdsong, D. & J. P. Montreuil, eds. (1987), *Advances in Romance Linguistics*, Dordrecht, Foris.

Brandenstein, W. (1951), "Kurze Phonologie des Lateinischen", in appendix to F. Altheim, *Geschichte der lateinischen Sprache, von den Anfängen bis zum Beginn der Literatur*, Frankfurt am Main, Klostermann, 481-498.

Charette, M. (1991), *Conditions on phonological government*, Cambridge, CUP.

Cho, Y.M.Y. (1991), "On the universality of the coronal articulator", in Paradis & Prunet (1991b:159-179).

Chomsky, N. & M. Halle (1968), *The sound pattern of English*, New York, Harper and Row.

Clements, G.N. (1988), "Towards a substantive theory of feature specification", *NELS* 18:79-93.

Clements, G.N. (1990), "The role of the sonority cycle in core syllabification", in Kingston & Beckman (1990:283-333).

Clements, G.N. & S.J. Keyser (1983), *CV Phonology: A generative theory of the syllable*, Cambridge (Mass.), MIT Press.

Cravens, T.D. (1984a), "Intervocalic consonant weakening in a phonetic-based strength phonology: Foleyan hierarchies and the *gorgia toscana*", *Theoretical Linguistics* 11:269-310.

Cravens, T.D. (1984b), "Implicational phonology: Martinet, Foley, and beyond", in Manning et alii (1984:141-148).

Cravens, T.D. (1987), "The syllable and phonological strength: gradient loss of gemination in Corsican", in Giacalone Ramat et alii (1987:163-168).

Cravens, T.D. (1988), "Problems and solutions in diachronic phonology: historical correspondences and phonological evolution", in Bertinetto & Loporcaro (1988:77-102).

Davis, S. (1991), "Coronals and the phonotactics of nonadjacent consonants in English", in Paradis & Prunet (1991b:49-60).

De Mori, R. & C.Y. Suen, eds. (1985), *New systems and architectures for automatic speech recognition and synthesis*, Berlin, Springer.

Devine, A.M. & L.D. Stephens (1977), *Two studies in Latin Phonology*, Saratoga, Anma Libri.

Devoto, G. (1931), *Gli antichi Italici*, Firenze, Vallecchi.

Dogil, G. & H.C. Luschützky (1990), "Notes on sonority and segmental strength", *Rivista di Linguistica* 2:3-54.

Dressler, W.U. (1973), "Pour une stylistique phonologique du latin. A propos des styles négligents d'une langue morte", *Bulletin de la Société Linguistique de Paris* 68:129-145.

Dressler, W.U. (1980), "A semiotic model of diachronic process phonology", *Wiener Linguistische Gazette* 22:31-94.

Dressler, W.U., H.C. Luschützky & O.E. Pfeiffer, eds. (1992), *Phonologica 1988*, Cambridge, CUP.

Ernout, A. (1953), *Morphologie historique du latin*, Paris, Klinksieck.

Ernout, A. & A. Meillet (1979), Dictionnaire étymologique de la langue latine. Histoire des mots, Paris, 4ème édition, Klincksieck.

Escure, G. (1977), "Hierarchies and phonological weakening", Lingua 43: 55-64.

Foley, J. (1970), "Phonological distinctive features", Folia Linguistica 4: 87-92.

Foley, J. (1977), Foundations of theoretical phonology, Cambridge, CUP.

Förstemann, E. (1852), "Numerische Lautverhältnisse im Griechischen, Lateinischen und Deutschen", Kuhn Zeitschrift 1.1:163-179.

Förstemann, E. (1853), "Numerische Lautbeziehungen des Griech., Latein. und Deutschen zum Sanskrit", Kuhn Zeitschrift 2:35-44.

Gamkrelidze, T. & V. Ivanov (1973), "Sprachtypologie and die Rekonstruktion der gemeinindogermanischen Verschlüsse. Vorläufiger Bericht", Phonetica 27:150-156.

Giacalone Ramat, A., O. Carruba & G. Bernini, eds. (1987), Papers from the 7th International Conference on Historical Linguistics, Amsterdam, Benjamins.

Giacomelli, R. (1983), Graeca Italica, Brescia, Paideia.

Giannelli, L., N. Maraschio, T. Poggi Salani & M. Vedovelli, eds. (1991), Tra Rinascimento e strutture attuali, Atti del Primo Convegno Internazionale della Società Internazionale di Linguistica e Filologia Italiana, Torino, Rosenberg and Sellier.

Giannini, S. (1987), "Di alcuni nessi con nasale in latino", Studi e Saggi linguistici 27:189-209.

Giannini, S. & G. Marotta (1989), Fra grammatica e pragmatica: la geminazione consonantica in latino, Pisa, Giardini.

Goldsmith, J.A. (1990), Autosegmental and metrical phonology, Oxford, Blackwell.

Harris, J. (1990), "Segmental complexity and phonological government", Phonology 7:255-300.

Harris, J. & J. Kaye (1990), "A tale of two cities: London glottalling and New York City tapping", Working Papers in Linguistics and Phonetics 1:3-20.

Harris-Northall, R. (1990), Weakening processes in the history of Spanish consonants, London/New York, Routledge.

Hock, H.H. (1986), Principles of historical linguistics, Berlin/New York/Amsterdam, Mouton-de Gruyter.

Hooper, J.B. (1976), An introduction to Natural Generative Phonology, New York, Academic Press.

Hopper, P.J. (1973), "Glottalized and murmured occlusives in Indoeuropean", Glossa 7: 141-166.

Izzo, H.J., ed. (1980), Linguistic Studies in honor of E. Pulgram, Amsterdam, Benjamins.

Kaye, J. (1990), "'Coda' licensing", Phonology 7:301-330.

Kaye, J., J. Lowenstamm & J.R. Vergnaud (1985), "The internal structure of phonological elements: A theory of charm and government", Phonology Yearbook 2:305-328.

Kaye, J., J. Lowenstamm & J.J. Vergnaud (1990), "Constituent structure and government in phonology", Phonology 7:193-231.

Kean, M.L. (1975), The theory of markedness in generative grammar, Ph.D. Dissertation, MIT, Cambridge (Mass.); distributed (1980), Bloomington (Ind.), Indiana University Linguistics Club.

Keating, P.A. (1991), "Coronal places of articulation", in Paradis & Prunet (1991b:29-48).

Kingston, J. & M.E. Beckman, eds. (1990), Papers in Laboratory Phonology, I, Between grammar and physics of speech, Cambridge, CUP.

Kiparsky, P. (1985), "Some consequences of Lexical Phonology", Phonology Yearbook 2:83-138.

Kiss, S. (1972), Les transformations de la structure syllabique en latin tardif, Debrecen, University of Debrecen.

Lass, R. (1984), Phonology. An introduction to basic concepts, Cambridge, CUP.

Lausberg, H. (1969), Romanische Sprachwissenschaft, I, Einleitung und Vokalismus, II, Konsonantismus, Berlin, W. de Gruyter; Italian translation (1971), Linguistica romanza, I, Fonetica, Milano, Feltrinelli.

Leonard, C. (1980), "The role of */l/ in rhotacism", in Izzo (1980:43-52).

Leumann, M. (1977), Lateinische Laut- und Formenlehre, München, Beck.

Locke, J.L. (1983), Phonological acquisition and change, New York, Academic Press.

Lupaş, L. (1972), Phonologie du grec attique, The Hague/Paris, Mouton.

Maddieson, I. (1984), Patterns of sounds, Cambridge/London, CUP.

Magno Caldognetto, E. & P. Benincà, eds. (1991), L'interfaccia tra fonologia e fonetica, Padova, Unipress.

Manning, A., P. Martin & K. McCalla, eds. (1984), The Tenth Lacus Forum 1983, Columbia, Hornbeam Press.

Marin, D. (1974), "Latino arcaico e lingue neo-latine", Romanica 7:183-200.

Marotta, G., (1991), "Innovazione e continuità nella struttura sillabica: italiano e latino a confronto", in Giannelli et alii (1991:179-193).

Marotta, G. & L.M. Savoia (1991), "Diffusione vocalica in un dialetto calabrese. Alcuni parametri fonologici", in Magno Caldognetto & Benincà (1991:19-42).

Martino, P. (1986), Arbiter, Biblioteca di ricerche linguistiche e filologiche, 17, Roma, Herder.

Meyer-Lübke, W. (1890), Grammatik der romanischen Sprachen, I, Lautlehre, Leipzig, Fues's Verlag; reprinted (1972), Hildesheim/New York, G. Olms.

Muljačič, Ž. (1965), "Per un'analisi binaristica dei fonemi latini" in Omagiu lui A. Rosetti la 70 de ani, Bucuresti, 599-605; German translation: "Zu einer binarist lateinischen Phonemen", in Strunk (1973:32-46).

Murray, R.W. (1987), "Preference laws and gradient change: selected developments in Romance", Cananadian Journal of Linguistics 32:115-132.

Murray, R.W. (1988), Phonological strength and early Germanic syllable structure, München, Fink.

Negri, M. (1982), Latino arcaico, latino rustico e latino preromanzo, Milano, Unicopli.

Niedermann, M. (1931), Précis de phonétique historique du latin, Paris, Klincksieck.

Normier, R. (1977), "Idg. Konsonantismus, germ. 'Lautverschiebung' und Vernersches Gesetz", Kuhn Zeitschrift 91:171-218.

Nyman, M. (1979), "Morphotactic motivation in reconstructed words: Latin tranquillus", Indogermanische Forschungen 84:132-156.

Nyman, M. (1982), "Positing a Lautgesetz: latin capillus, pullus and kindred issues", Folia Linguistica Historica 3:87-108.

Nyman, M. (1984), "On evaluation, causation and validation: pre-latin *-tl-", Folia Linguistica Historica 5:185-191.

Ohala, J.J. (1985), "Linguistics and automatic processing of speech", in De Mori & Suen (1985:447-475).

Ohala, J.J. (1990), "The phonetics and phonology of aspects od assimilation", in Kingston & Beckman (1990: 258-275).

Ohala, J.J. & H. Kawasaki (1984), "Prosodic phonology and phonetics", *Phonology Yearbook* 1:113-127.

Palmada, B. & P. Serra (1991), "On the specification of coronals", *Catalan Working Papers in Linguistics* 1:181-199.

Paradis, C. & J.F. Prunet (1989), "On coronal transparency", *Phonology* 6:317-348.

Paradis, C. & J.F. Prunet (1990), "On explaining some OCP violations", *Linguistic Inquiry* 21:456-466.

Paradis, C. & J.F. Prunet (1991a), "Introduction: Asymmetry and visibility in consonant articulations", in Paradis & Prunet (1991b:1-28).

Paradis, C. & J.F. Prunet, eds. (1991b), *The special status of coronals: Internal and external evidence*, New York/London, Academic Press.

Planta, von R. (1892), *Grammatik der oskisch-umbrischen Dialekte, I, Einleitung und Lautlehre*, Strassburg, Trübner.

Poultney, J.W. (1980), "The phonology of *-nd-* and the Latin gerundive", in Izzo (1980:33-41).

Porzio Gernia, M.L. (1973), "Lo statuto fonologico del fonema /s/ in latino", *Rendiconti dell'Accademia dei Lincei* 28:829-840.

Porzio Gernia, M.L. (1976), "Tendenze strutturali della sillaba latina in età arcaica e classica", in Auctores Varii, *Studi in onore di G. Bonfante*, II, Brescia, Paideia, 757-779.

Porzio Gernia, M.L. (1977), "Interferenze tra struttura morfologica e struttura fonologica nella sillaba finale latina", *Studi Italiani di Linguistica Teorica ed Applicata* 3:113-140.

Rice, K.D. (1992), "On deriving sonority: a structural account of sonority relationships", *Phonology* 9:61-99.

Rice, K.D. & P. Avery (1991), "On the relationship between laterality and coronality", in Paradis & Prunet (1991b:101-124).

Rohlfs, G. (1949), *Historische Grammatik der italienischen Sprache und ihrer Mundarten, I, Lautlehre*, Bern, A. Francke; Italian translation (1966), *Grammatica storica della lingua italiana e dei suoi dialetti, I, Fonetica*, Torino, Einaudi.

Safarewicz, J. (1969), *Historische Lateinische Grammatik*, Halle, Niemeyer.

Sagey, E. (1986), *The representation of features and relations in non-linear phonology*, Ph.D. Thesis, MIT, Cambridge (Mass.).

Saussure, de F. (1877), "La trasformation latine de *tt* en *ss* suppose-t-elle un intermédiaire *st?*", in *Mémoires de la Société de Linguistique de Paris* 3: 293-298; reprinted in Saussure (1922:370-375).

Saussure, de F. (1922), *Recueil des publications scientifiques de F. de Saussure*, Genève, Payot.

Schane, S. (1973), *Generative phonology*, Englewood Cliffs (N.J.), Prentice-Hall.

Shaw, P.A. (1991), "Consonant harmony systems: The special status of coronal harmony", in Paradis & Prunet (1991b:125-157).

Skousen, R. (1972a), "On capturing regularities", *CLS* 8:567-577.

Skousen, R. (1972b), "Consonant alternation in Fula", *Studies in African Linguistics* 3:77-96.

Solé, M.J. (1992), "Experimental phonology: the case of rhotacism", in Dressler et alii (1992:259-271).

Sommer, F. (1914), *Handbuch der lateinischen Laut- und Formenlehre*, Heidelberg, Winter's.

Stemberger, J.P. (1991), "Radical underspecification in language production", *Phonology* 8:73-112.

Stemberger, J.P. & C. Stoel-Gammon (1991), "The underspecification of coronals: Evidence from language acquisition and performance errors", in Paradis & Prunet (1991b:181-199).

Steriade, D. (1982), *Greek prosodies and the nature of syllabification*, Ph.D. Dissertation, MIT, Cambridge (Mass.).

Steriade, D. (1987a), "Gemination and the Proto-Romance syllable shift", in Birdsong & Montreuil (1987:371-409).

Steriade, D. (1987b), "Redundant values", *CLS* 23/2:339-362.

Strunk, K. (1973), *Probleme der lateinischen Grammatik*, Darmstadt, Wissenschaftliche Buchgesellschaft.

Touratier, C. (1975), "Rhotacisme synchronique du latin classique et rhotacisme diachronique", *Glotta* 53:246-281.

Väänänen, V. (1963), *Introduction au latin vulgaire*, Paris, Klincksieck.

Vennemann, T. (1972), "On the theory of syllabic phonology", *Linguistische Berichte* 18:1-18.

Vennemann, T. (1988), *Preference laws for syllable structure and the explanation of sound change*, Berlin, Mouton-de Gruyter.

Vennemann, T., ed. (1989), *The new sounds of Indoeuropean: Essays in phonological reconstruction*, Berlin, Mouton-de Gruyter.

Vineis, E. (1984a), "Problemi di ricostruzione della fonologia del latino volgare", in Vineis (1984b:45-62).

Vineis, E., ed. (1984b), *Latino volgare, latino medioevale, lingue romanze*, Atti della Società Italiana di Glottologia, Pisa, Giardini.

Weinrich, H. (1958), *Phonologische Studien zur romanischen Sprachgeschichte*, Münster Westfalen, Aschendorff.

Yip, M. (1991), "Coronals, consonant clusters, and the coda condition", in Paradis & Prunet (1991b:61-78).

Yoshida, S. (1990), "A government-based analysis of the 'mora' in Japanese", *Phonology* 7:331-351.

Zamboni, A. (1986), "Tra latino e neolatino: l'evoluzione delle medie aspirate indoeuropee e le successive ristrutturazioni del consonantismo", I, *Indogermanische Forschungen* 91:205-235.

Zamboni, A. (1987), "Tra latino e neolatino: l'evoluzione delle medie aspirate indoeuropee e le successive ristrutturazioni del consonantismo", II, *Indogermanische Forschungen* 92:112-134.

Zipf, G.K. & F. Millet Rogers (1939), "Phonemes and variphones in four present-day Romance languages and Classical Latin from the viewpoint of dynamic philology", *Archives néerlandais de phonétique expérimentale* 15:11-147.

Zirin, R.A. (1970), *The phonological basis of Latin prosody*, The Hague, Mouton.