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Version 3
4.3.1999
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# The Coda Mirror

## 1. Introduction[1]

In early Generative Phonology, the disjunctive context "before a (heterosyllabic) consonant or word-finally" __{C,#}, which is recurrent in the description of a wide range of phonological processes from genetically unrelated languages, has played a major role. It was argued that phonological theory must be able to refer to both sites as a phonologically unique object if no generalisation is to be missed[2]. This view led to the (re)introduction of Codas and hence syllable structure into the hitherto linear theory.

In this paper, we would like to draw attention to the existence of phonological processes that occur in the exact mirror-context, that is "after a (heterosyllabic) consonant and word-initially" {C,#}__. We refer to objects in this position as occurring in the Coda Mirror. Both synchronic and diachronic evidence from various genetically unrelated languages are reviewed, namely Siever's Law (Indo-European), the synchronic distribution of stops in Somali (Cushitic) and Tiberian Hebrew, the evolution of Latin sonorants in Ibero-Romance and that of Latin obstruents in French, and the so-called 2nd or High German Consonant Shift.

Having established the phonological relevance of the Coda Mirror context on the empirical grounds mentioned, we evaluate its consequences for phonological theory. We will show that analyses that resort to orthodox syllabic constituents (Onset, Rhyme, Nucleus, Coda) are unable to characterise the Coda Mirror as a natural class, let alone to give a clue for the explanation of the phonological phenomena involved. Indeed, the syllabic identity that is commonly assigned to consonants occurring after Codas and word-initially is that of an Onset. Onsets, however, also dominate intervocalic consonants that are systematically excluded from the processes that we will show to take place in the Coda Mirror. Syllable structure as currently assumed is unable to refer to the context at stake as a unique phonological object.

For the sake of the same arguments that have led to the reintroduction of Codas and syllabic structure, we propose to approach the Coda Mirror with the maximally simplified syllabic inventory defined in Lowenstamm (1996). In this view, syllable structure is reduced to a sequence of non-branching Onsets and non-branching Nuclei. We will refer to this proposal as the CVCV model. Instead of being interpreted as consequences of syllabic arborescence, syntagmatic relations holding among segments are handled by mechanisms such as Government and Licensing, as defined in Government Phonology (Kaye et al. 1985,1990, Charette 1991, Harris 1994). We show that this theory of syllabic structure offers

[1] We are grateful to Joaquim Brandão de Carvalho for supply of data and valuable discussion. We also would like to thank Patricia Cabredo-Hofherr.
[2] See the orthodox textbook-evidence given in, among others, Carr (1993:198ff), Roca (1994:134f), Goldsmith (1990:103ff), Lass (1984:250ff), Blevins (1995:209). This issue was first carried into generative discussion by Kahn (1976:20ff).

a straightforward way to properly discriminate Coda Mirror contexts from their complement set.

Codas notoriously illustrate the relative "weakness" of consonants. Given its opposite distribution, it comes as no surprise that the salient property of consonants occurring in Coda Mirror positions is "strength". We show that this fact is a natural consequence of the lateral relations obtaining for Codas and Coda Mirrors. In doing this we are able to give a more insightful definition of the two kinds of syntagmatic relations that are commonly assumed to hold among segments, namely Government and Licensing. Indeed, they turn out to be antipodal forces, the former damaging, the latter backing up segmental expression.

We aim at showing that the CVCV model combined with the devices familiar from Government Phonology achieves both descriptive and explanatory adequacy. Under the assumptions of the CVCV model, and granting the possibility for a Nucleus to be empty, a consonant may occur in four and only four configurations: 1) vCv, that is intervocalically, 2) vCø in Coda position, and 3) øCv, which we show to be the Coda Mirror. The fourth logical possibility, øCø, is ruled out by the Empty Category Principle (cf. below section 4.2) because two empty Nuclei occur in a row. The three configurations shown thus exhaust the syllabic configurations a consonant may universally appear in. Note that they are directly linked to the distribution of empty Nuclei, which is an object of crucial importance in a CVCV grammar. We aim at showing that one of the three situations evidenced, to the exclusion of all others, characterises all syllable-based phonological processes that may affect a consonant.

Section 2 sets out with the presentation of the relevant data. In section 3, we show that the traditional syllabic inventory is unable to account for them. In section 4, the theoretical tools of Government Phonology that are necessary for an alternative account are introduced. In the two final sections, we present our analysis using the CVCV model.

## 2. Phonological phenomena occurring in the Coda-Mirror

### 2.1. French obstruents

Throughout the evolution from Latin to French, obstruents are lenited intervocalically and in Codas, but remain unaltered word-initially and after Codas. Illustration is given below.[3]

(1)

| | a. #__ | | b. Coda__ | | c. Coda | | | | d. V__V | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | __C | | __# | | | |
| p | **p**orta | **p**orte | tal**p**a | tau**p**e | ru**p**ta | route | lu**p**(u) | [lu] | ri**p**a | ri**v**e |
| b | **b**ene | **b**ien | her**b**a | her**b**e | cu**b**(i)tu | coude | u**b**(i) | où | fa**b**a | fè**v**e |
| t | **t**ela | **t**oile | can**t**are | chan**t**er | pla**t**(a)nu | plane | mari**t**(u) | mari | vi**t**a | vie |
| d | **d**ente | **d**ent | ar**d**ore | ar**d**eur | a**d**venire | avenir | nu**d**(u) | nu | co**d**a | queue |
| k | **c**or | **c**œur | ran**c**ore | ran**c**œur | fa**c**ta | faite | *vera**c**(u) | vrai | lactu**c**a | laitue |
| g | **g**ula | **g**ueule | an**g**ustia | an**g**oisse | ri**g**(i)du | raide | | | *a**g**ustu | août |
| f | **f**ame | **f**aim | in**f**ernu | en**f**er | ste**ph**(a)nu | Etienne | | | de**f**oris | dehors |
| s | **s**erpente | **s**erpent | ver**s**are | ver**s**er | mu**s**ca | mouche | no**s** | [nu] | cau**s**a | cho**s**e [z] |

[3] Vowels that are lost in the course of evolution are given in brackets, those bearing stress are underscored. Words are spelled. Latin and French spelled <c> is [k], Latin <ph> is [f]. In each column, the Latin forms precede their French cognates.
Glosses for table (1), [p]: "door, mole, road, wolf, shore"; [b]: "well, grass, elbow, where, broad bean"; [t]: "canvas, sing, plane (tree, dialectal), husband, life"; [d]: "tooth, ardour, future, naked, tail"; [k]: "heart, rancour, done, true, lettuce"; [g]: "face, fear, rigid, August"; [f]: "hunger, hell, Stephen, outside"; [s]: "snake, pour, flee, we, thing".

Let us first consider the behaviour of obstruents in intervocalic position as under (1d). All of them undergo lenition, that is labial stops spirantise, dental and velar stops as well as [f] disappear, and [s] becomes voiced.[4]

In contexts under (1c), before a (heterosyllabic) consonant and word-finally, Latin obstruents are lost.[5] The identical behaviour of consonants in this disjunctive context __{C,#} is to be construed as reflecting their common syllabic status: they all occur in Codas.

The fate of Latin obstruents in intervocalic and Coda position is different. Even though [t,d] are lost in both types of contexts, voicing and spirantisation obtain in intervocalic position, while no such process is observed in Codas. However, both intervocalic and Coda-contexts share the feature of damaging consonants.

Let us now turn to obstruents that occur in word-initial position (1a) and after a Coda (1b). The first thing to observe is that consonants behave in exactly the same way in both environments. The disjunctive context {C,#}__ that emerges here is the one under focus in this paper, i.e. the Coda Mirror.

Second, consonants occurring in the Coda Mirror remain stable from Latin to French[6]. That is, the Coda Mirror contrasts maximally with intervocalic and Coda positions. Damage or preservation of Latin obstruents crucially depends on the syllabic configuration they occur in.

For this reason, the contexts we refer to as the Coda Mirror have been traditionally described as "the Strong Position" in the Romance literature.[7]

In the next section, we turn to another process in Romance that makes reference to this position.

## 2.2. Ibero-Romance sonorants

In Occidental Ibero-Romance (Portuguese and Galician), Latin sonorants remain stable word-

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[4] In some cases, namely when none of the flanking vowels is rounded, Latin [f] undergoes voicing and appears as [v] in Modern French, cf. Lat *malifatius* > Mod. French *mauvais*.
The details of intervocalic velars are more complex: they are lost without trace when occurring in [{o,u}__ a] and [__ {a,u}] (*locare* > *louer, ruga* > *rue, securu* > Old Fr *sëur, legumen* > Old Fr *lëun*), but produce a palatal glide in [{a,e,i}__] (*necare* > *noyer*, *paganu* > *païen*). Finally in [__{e, i}] contexts, the reflex of Latin [g] is a palatal element, which combines with the preceding vowel (*flagellu* > Old Fr *flaiel,* Mod Fr *fléau*). In the same context, Latin [k] results in a palatal element that combines whith the preceding vowel as before, and a sibilant, which is further voiced to [z] because of its intervocalic position (l*ucere* > Old Fr *luisir, racemu* > *raisin*). Whatever their detailed evolution, it holds true that all velars weaken in intervocalic position in some way, just as other consonants do. See Bourciez (1926:130ff), Pope (1952:294,302,333,341), La Chaussée, (1974:46ff, 54ff) on this issue.

[5] Velars disappear in Codas, but give rise to a palatal element (or a labio-velar in the case of [g] before [m]) which then combines with the preceding vowel, cf. *facta* > *faite, rig(i)da* > *raide. sagma* > *(bête de) somme*.

[6] Throughout Gallo-Romance, stops are affected by various palatalisations. Latin [j] triggers palatalisation for all stops, and [k,g] moreover move when followed by [i,e,a]. Latin [pj], [bj] are discussed in more detail in section 2.6. For all stops that undergo palatalisation, the contrast between strong (=Coda Mirror) and weak position (=V__V, Coda) is preserved. In these cases, Modern French shows fricatives ([s,ʃ,ʒ], from Old French affricates [t͡s,t͡ʃ,d͡ʒ]) in strong positions, and a palatal glide (or zero) in weak position. Compare the development of [k] in ***c**aru, ar**c**a* > ***ch**er* [ʃɛʁ], *ar**ch**e* [aχʃ] vs. *pa**c**are* > *pa**y**er* [pɛ**j**e], [d] in ***d**iurnu* > ***j**our* [ʒuχ], *or**d**iu* > *or**g**e* [ɔʁʒ] vs. *mo**d**iolu* > *moyeu* [mwa**j**ø].
In short, palatalisations affect stops in all positions, but the results respect the difference between strong and weak positions.

[7] This fact is striking enough to lead Pope (1952:96) to call both contexts "initial": "consonants are said to be *initial* : (i) when they stand at the beginning of a word, (ii) when they stand at the beginning of a syllable, *if preceded immediately by a consonant,* e.g. in the word **p**or**t**are both **p** and **t** are termed *initial*". Bourciez (1926:147) writes: "Pour une consonne, la *position la plus forte* consiste à se trouver soit à l'initiale du mot, soit à l'intérieur derrière une autre consonne". On the other hand, Pope (1952:97f) states that "final consonants were in a weak position", and "single consonants in intervocalic position [...] were [...] in a weak position".

initially and after Codas, while they undergo various changes syllable-finally and in intervocalic position. For each context in (2), Latin forms are given first, followed by their Portuguese/ Galician reflexes.[8]

(2)

| | a. #__ | | b. Coda__ | | c. Coda | | | | d. V__V | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | __C | | __# | | | |
| n | **n**octe | **n**ojtə | cor**n**u | koɾ**n**u | te**n**(e)ru | tẽ$^{\mathbf{n}}$ru | pa**n**(e) | pɐ̃w̃ | lu**n**a | luɐ |
| | | | as(i)**n**u | aʒ**n**u | u**n**da | õ$^{\mathbf{n}}$dɐ | no**n** | nɐ̃w̃ | | |
| | | | an**n**u | ɐ**n**u | | | ratio**n**(e) | rɐzɐ̃w̃ | | |
| l | **l**una | **l**uɐ | gal**l**u | ga**l**u | ca**l**(i)du | kaɫdu | me**l** | mɛɫ | vo**l**are | voaɾ |
| | | | | | sa**l**vare | saɫvaɾ | ta**l**(e) | taɫ | | |
| r | **r**ota | **r**ɔða | ten(e)**r**u | tẽ$^{n}$**r**u | po**r**ta | pɔɾta | ma**r**(e) | maɾ | ca**r**u | kaɾu |
| | | | is**r**ael | iʒ**r**aɛɫ | | | | | | |
| | | | car**r**u | ka**r**u | | | | | | |

As may be seen under (2a,b), Latin [n,l,r] appear as such both word-initially and when occurring after Codas.[9] Portuguese and/or Galician faithfully deliver the second member of a cluster of two Latin sonorants without any lenition. This behaviour is overt for Latin [rn,sn,nr,sr] clusters, as demonstrated in table (2). Latin geminates also follow this pattern, provided that they are analysed as heterosyllabic objects. In this view, which is classically held, their second part belongs to an Onset that is preceded by a Coda, and hence appears unlenited in modern forms.[10]

While they remain unaltered in Coda Mirror positions, the same sonorants undergo various lenition processes in Codas and intervocalically. In internal Codas, [n] nasalises the preceding vowel and is reduced to a consonantal trace (noted in superscript in traditional sources). In final Codas, it disappears, leaving various traces.[11] In both Coda contexts, internal and final, Latin [l] appears as velar, and [r] is flapped. These moves are traditionally viewed as lenition-trajectories (cf. English [l]-velarisation in Codas). In intervocalic position, [l] and [n] are lost with the latter leaving a trace on the preceding vowel, while [r] is flapped as before.[12]

The salient feature of the processes at stake is the stability of sonorants in Coda Mirror contexts, against their affection by various types of lenition in other environments. Again,

[8] Glosses (left-to-right, up-down): "night, horn, tender, bread, moon, donkey, wave, no, year, reason, moon, cock, clear soup, honey, fly, save, this, wheel, tender, door, sea, dear, Israel, carriage". The vowels in brackets disappeared early, so that the preceding consonants came to stand either in word-final, or in preconsonantal position.

[9] Secondary (partial) velarisation of initial and geminated Latin [l] has obscured the picture. Indeed, some speakers do pronounce slightly velarised [l] in [luɐ, galu]. Carvalho (1989a,b) shows that this process is secondary, and provides more discussion. In any event, Brazilian Portuguese witnesses the primitive contrast between geminated [ll] and [l] in Coda position. In this language, initial Latin [l] is [ɫ], Latin [l] in Coda position vocalises to [w], but the Latin geminate [ll] is [ɫ].

[10] The missing piece of evidence in the above table are Latin laterals preceded by another sonorant. This is due to an independent process of metathesis that affected Latin [rl]-sequences, cf. e.g. Carvalho (1989a). Thus, Latin *merulu*, **parlare* come out as [mɛɫru], [paɫraɾ] "blackbird, chat" in Portuguese. Note that, in line with the general pattern, the lateral is lenited to velar in Codas, against unlenited [r] in post-Coda position.

[11] Latin [n] in final Codas always nasalises the preceding vowel. In addition, it has a velar manifestation [w)] if preceded by Latin [a,o] as in *pan(e)*, *non* > [pɐ)w, nɐ)w)]. A palatal reflex obtains if it is preceded by Latin short [e] as in *bene* > [bɛ)j)]. See Carvalho (1989a,b), Teyssier (1980), Bec (1970) for discussion.

[12] In intervocalic position, Latin [n] is completely lost before the 12th century, cf. Teyssier (1980), Bec (1970). The thereby created hiatus has given rise to various subsequent processes. No reaction is observed in *luna* > [luɐ], *sinu* "breast" has become *se)u > [sɐ**j**u], an [n] has appeared in *vinu* "wine" > *vi)u > [vi**n**u], and a bilabial occurs in *una* "one" > *u)a > [u**m**ɐ].

there is no way of understanding the picture unless the Coda Mirror may be addressed as a unique syllabic object, which is different from any other.

## 2.3. Somali stops

Somali, a Cushitic language spoken in Somalia, Djibuti, Ethiopia and Kenia, also illustrates the relevance of the Coda Mirror. The distribution of Somali stops is such that plosives can be observed only word-initially and after heterosyllabic consonants, while lenited allophones thereof occur in other positions. Unlike for the data discussed so far, Somali stops adduce synchronic evidence in support of the Coda Mirror.

First note that Somali lacks branching Onsets altogether: words may not begin with more than one consonant, and word-internal clusters have maximally two members. The syllabic inventory is limited to CV(V) and CV(V)C. So in particular all word-internal clusters are heterosyllabic.

The stops under concern are /b,t,d,k,g/.[13] Let us first consider the distribution of the voiced subset, as under (3).[14]

(3)

| | a. #__ | b. Coda__ | | c. Coda | | | |
|---|---|---|---|---|---|---|---|
| | | | | __C | __# | | |
| | sg indef | 1°sg | | sg def | sg indef | pl | gloss |
| b | **b**eer | gar**b-**o | pl | gara**b˺-**ta<br>da**b˺**-ka | gara**b˺**<br>da**b˺** | da**β-**ab˺ | field<br>shoulder<br>fire |
| d | **d**ile | heb˺**d-**aj | he became tame | heβe**d˺**-ka<br>gee**d˺**-ka | heβe**d˺**<br>gee**d˺** | gee**ð-**ad˺ | killer<br>tame animal<br>tree |
| g | **g**af | nir**g-**o | pl | niri**g˺**-ta<br>ɖe**g˺-**ta | niri**g˺**<br>ɖe**g˺** | ɖe**ɣ-**o | error<br>young fem camel<br>ear |

As may be seen, the only context in which /b,d,g/ appear as such on the surface is the Coda Mirror, i.e. word-initially (3a) and after a Coda (3b). In any other environment, allophones thereof occur, that is the spirantised versions [β,ð,ɣ] intervocalically as under (3d), and unreleased plosives in Codas as under (3c).[15]

The alternations shown are based on suffixation that triggers a zero in the place of the second vowel in bisyllabic stems of the $CV_1CV_1C$ kind whenever the suffix is vowel-initial. For example /nirig/ "young female camel" appears as [nirøg-] when the plural morpheme *–o* is added, but surfaces as [nirig-] with the sg definite-markers *–ka* (masc) and *–ta* (fem), and if the marker is zero as for the sg indefinite. In the former, but not in the latter case, the stem-final consonant comes to stand in a position adjacent to its root-medial neighbour, hence after a Coda.

The case of voiceless stops, while following the same pattern, is slightly more complex. Table (4) shows their distribution.

[13] [ʔ] and [d͡ʒ] are not mentioned since they are only partially involved in the regularity at hand. More information on the retroflex [ɖ] and the uvular [q] is given in note 17. There is no [p] in Somali.

[14] Unless otherwise specified, the gloss provides the lexical meaning of the various grammatical forms for every line given.

[15] See Orwin (1990), Armstrong (1934) for a detailed phonetic characterisation of the Coda-allophones.

(4)

| | a. #__ | | c. Coda | | d. V__V | |
|---|---|---|---|---|---|---|
| | | | __C | __# | | |
| | sg indef | 1° sg | 1° pl | imperative 2°sg | sg def | gloss |
| t | **t**uug˺ | | | | | thief |
| | | | | | /mindi-ta/ = [mindi-**ð**a] | knife |
| | | gun**t**-aa | gunu**d˺**-naa | gunu**d˺** ! | | tie a knot |
| | | sun**t**-aa | suma**d˺**-naa | suma**d˺** ! | | brand |
| k | **k**al | | | | | pestle |
| | | | | | /kursi-ka/ = [kursi-ɣa] | chair |
| | | ar**k**-aa | ara**g˺**-naa | ara**g˺** ! | | see |
| | | dur**k**-aa | duru**g˺**-naa | duru**g˺** ! | | move |

Again, the only opportunity to observe /t,k/ on the surface is when they appear in a Coda Mirror position as under (4a,b).[16] In all other contexts, the same allophones as before occur, i.e. unreleased stops in Codas, and fricatives intervocalically. In addition, allophones of /t,k/ are always voiced. The underlying identity of the root-final consonant of the verbs meaning "tie a knot, brand, see, move" is evidenced when occurring after a Coda, as under (4b). (4c) shows that it surfaces as an unreleased voiced stop in Codas. Underlying voiceless plosives spirantise and voice when occurring intervocalically. This process is demonstrated under (4d). The morphemes that mark the singular definite value for a noun /-ta/ (feminine) and /-ka/ (masculine), which we have already come across, surface as [V-ða], [V-ɣa], respectively.

The allophonic variation of Somali stops may be summarized as follows. Stops occur in Coda Mirror positions, spirants intervocalically and unreleased stops in Codas.[17] Unless the two contexts __{C,#} that we call the Coda Mirror are addressed as a single phonological object, this distributional situation cannot be accounted for.

## 2.4. Tiberian Hebrew

The allophonic variation of stops and fricatives that occurs in Tiberian Hebrew is well known (e.g. Joüon 1923, Kenstowicz 1994:410ff, Lambdin 1973:XIX). It instantiates another synchronic case of the Coda Mirror. Each underlying stop /p,b,t,d,k,g/ may appear as either plosive [p,b,t,d,k,g] or spirantised [ɸ,β,θ,ð,x,ɣ]. The distribution of both allophonic variants is commonly referred to as a function of vocalic contexts: fricatives appear post-vocalically, stops elsewhere. This statement is correct. However, the following description capitalising on the complement context is strictly equivalent: plosives are found in initial position and after a consonant, fricatives occur elsewhere.[18]

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[16] Somali does display intervocalic [t] and [k]. However, on the basis of (i) morphological evidence, (ii) inhibition of regular vowel-zero alternations and (iii) resistance to intervocalic voicing, it can be shown that all of these cases in fact are underlying geminates. Compare for instance [joog˺sa**d**aj] "I ceased" = /joog-sa**t**-ø-aj/ = /root + affix + personal marker + preterite/ and [joog˺sa**t**aj] "you (sg) ceased" = /joog-sa**t-t**-aj/. See Barillot & Ségéral (forth.), Ségéral (forth.) for a more detailed demonstration. Significantly, [t] and [k] never appear in Codas (Orwin 1990:253) where, of course, geminates do not occur.

[17] This generalisation also holds for [ɖ]. Except in Northern dialects, the retroflex is realised as a flap [ɾ] in intervocalic contexts, and as [r] in Codas. The opposition between /ɖ/ and /r/ is thereby neutralised everywhere but in the Coda Mirror. Illustration thereof is [gab˺**ɖ-**o] "girl pl" vs. [gaßa**r**] "girl sg indef", [gaßa**r-**ta] "girl sg def"; [baa**r**] "search! inperative 2°sg", [baa**ɾ-**a] "search! imperative 2°pl".

The voiceless uvular stop /q/ appears as such in the Coda Mirror, against mostly fricative (or at least affricate) realisation in Codas and intervocalic contexts.

[18] Assuming either description, a special case must be made for geminates. Indeed, the first part of a geminate, although residing in a Coda, is not affected by spirantisation, as can be seen in intensive forms: the relevant binyan *piʕel* is [yə-C$_1$aC$_2$C$_2$əC$_3$-uu] in ipf 3m pl, which produces [yə-βaSSər-uu, yə-ʃabbər-uu, yə-βattəβ-uu], respectively, for the three verbs examined under (5). This behaviour illustrates the well known phenomenon of

For instance, consider the behaviour of /b/ shown under (5), where it occurs as first, second and third radical, respectively.

(5)

| | | *qal* = simple | | | |
|---|---|---|---|---|---|
| | | pf. 3m sg | ipf 3 m pl | imperative 2f | |
| root | pattern | $C_1aaC_2aC_3$ | yi-$C_1C_2$ə$C_3$-uu | $C_1iC_2C_3$-ii | |
| √bSr | | **b**aaSar | yi-**β**Sər-uu | **b**iSr-ii | "cut off" |
| √ʃbr | | ʃaa**β**ar | yi-ʃ**b**ər-uu | ʃi**β**r-ii | "break" |
| √ktb | | kaaθa**β** | yi-**β**təb-uu | kiθ**b**-ii | "write" |

If /b/ is the first radical of a verb like in √bSr "cut off", it appears as [b] in initial position [**b**aaSar, **b**iSrii], while the spirant allophone [β] is observed when the same object comes to stand in an internal Coda [yi**β**Səruu] or in intervocalic position in intensive forms [yə**β**aSSəruu] (cf. note 18). The roots √ʃbr and √ktb demonstrate the same behaviour. In addition, they show that /b/ surfaces as [b] in post-Coda position [yiʃ**b**Xruu, kiθ**b**ii], while it appears as [β] word-finally [kaaθa**β**].

The general picture that may be drawn from these alternations thus shows "strong" plosive allophones in the context {#, C}__ that we refer to as the Coda Mirror, while "weak" fricative variants are found in Codas and intervocalically. Table (6) sums up this situation for all six Tiberian Hebrew plosives. The behaviour of those plosives that have not been examined is identical to the one observed for /b/.

(6)

| | a. #__ | b. Coda__ | c. Coda | | d. V__V |
|---|---|---|---|---|---|
| /p/ | [p] | [p] | [ɸ] | [ɸ] | [ɸ] |
| /b/ | [b] | [b] | [β] | [β] | [β] |
| /t/ | [t] | [t] | [θ] | [θ] | [θ] |
| /d/ | [d] | [d] | [ð] | [ð] | [ð] |
| /k/ | [k] | [k] | [x] | [x] | [x] |
| /g/ | [g] | [g] | [ɣ] | [ɣ] | [ɣ] |

In all instances of the Coda Mirror that have been considered so far, there was a contrast between the different weak positions: segments were subject to different phenomena in Codas and intervocalic position (and sometimes in internal and final Codas). Contrastingly in the Tiberian Hebrew case at hand, the same allophones appear in all weak contexts. This issue will be further discussed in section 6. For the time being, we only need to notice that Tiberian Hebrew spirantisation occurs in all contexts but in those that we call the Coda Mirror. Moreover, the alternation at hand is clearly connected with consonantal strength in a way that the strong variant appears in the Coda Mirror, while its weak counterpart is observed elsewhere.

As stated before, it is commonly assumed that Tiberian Hebrew spirantisation is triggered by the action of a vowel on the following consonant. This view was induced by the distributional situation that seemed to suggest that fricatives occur in a uniform context (postvocalically), while the environment of stops ({#,C}__) is heterogeneous. This approach implicitly denies the existence of a single phonological object "Coda Mirror". Or rather, it is the only way to express the generalisation observed in a theoretical environment that does not

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*geminate integrity* (e.g. MacCarthy 1986:226ff, Kenstowicz 1994:411ff, Perlmutter 1995:309f), which does not interfere with the purpose of this paper.

It has been noticed that in some cases, fricatives do occur after Codas, e.g. [malxee] construct state pl. from [melek̲] "king". These instances are due to a vowel syncope, cf. McCarthy (1986:234).

recognise the existence of the Coda Mirror. For all phenomena considered so far, as well as for the spirantisation at hand, we suggest that the relevant context provoking the different alternations is not the one in which weak variants occur, but the one in which their strong counterparts are observed. In other words, we claim that the key to syllabically driven segmental alternations may not be found in explaining weak, but in accounting for strong forms.

The following section discusses a phenomenon that provides positive evidence in disfavour of the view that Coda Mirror processes are induced by postvocalic contexts.

## 2.5. High German Consonant Shift

Two prominent features setting German apart from the other Germanic languages are the presence of affricates in certain positions and the well-known complementary distribution between [χ] "ach-Laut" and [ç] "ich-Laut". Both are the result of what is called the High German (or Second) Consonant Shift. Unrecorded Common Germanic voiceless stops [p,t,k] appear in Old High German (about A.D. 850-1050) as affricates [p͡f,t͡s,k͡χ] word-initially and after Codas, while fricative reflexes [f,s,χ/ç] are found in word-final position and intervocalically.[19]

The phenomenon can be appreciated when comparing English to German, the former giving direct access to Common Germanic voiceless plosives that have remained unaltered. Table (7) shows the English forms first, followed by their modern German cognates.[20]

(7)

| | a. #__ | | b. Coda__ | | c. Coda | | | d. V__V | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | __C | __# | | | |
| p | **p**ath | **Pf**ad | car**p** | Kar**pf**en | | shee**p** | Scha**f** | po**p**e | Pfa**ff**e |
| t | **t**en | **z**ehn | sal**t** | Sal**z** | | tha**t** | da**s** | ha**t**e | ha**ss**en |
| k | **c**orn | **k͡χ**orn | than**k** | dan**k͡χ**e | | strea**k** | Stri**ch** | ma**k**e | ma**ch**en |

The phenomenon illustrated parallels the processes discussed in the previous sections in that a complementary distribution obtains for the same input in Strong Positions vs. other contexts. However, there is an important difference between the German evidence and the other diachronic changes observed so far. In Romance, diachronic change does not harm the Latin inputs at all in strong positions: they appear completely unchanged in the modern languages. Only in Codas and intervocalically are the Latin consonants lenited. In German, however, consonants standing in the Coda Mirror as well as those occurring elsewhere are damaged. Nevertheless, the output is not the same: affricates in strong positions, fricatives elsewhere.

[19] The behaviour of Common Germanic stops in internal Codas (=before a heterosyllabic consonant) may not be controlled because all relevant configurations were affected by the First Consonant Shift (Grimm's Law), thus lat *ca**p**tus*, *no**c**tis*, *re**c**tus* = Old High German *ha**f**t*, *na**h**t*, *rë**h**t*. See Paul et al. (1989:124f).
The process is called High German because its origin is commonly sought in this particular geographical area (Austria, Bavaria), from which it spread out northwards. The more it progressed, the less it affected local dialects, to the effect that the basic subdivisions in the entire German dialectal space (Upper, Middle and Lower German) correspond to the fading progression of the High German Consonant Shift (e.g. Munich ***ich***, ***pf**und*, Cologne *i**ch***, ***p**und*, Hamburg *i**k***, ***p**und* "I, pound"). For general references regarding the High German Consonant Shift, see e.g. Paul et al. (1989:114ff), Braune & Ebbinghaus (1987:81ff), Hirt (1931:96ff), Schwarz (1950).

[20] Note that the fricative resulting of Common Germanic [k] is invariably noted "ch" in spelling, but has become subject to contextual influence subsequently to the process at issue here: "ch"=[χ] after [a,o,u], while [ç] occurs after front vowels. Spelled "z"=[t͡s]. The velar affricate [k͡χ] has survived in High-Alemannic (Switzerland) only. The simple stop has been restored elsewhere, thus [kɔrn] and [daŋkə] in standard German.

This difference is important. It shows that lenition processes in {V__#, V__V} environments cannot be attributed to the vowel preceding the affected consonant, as could be argued when looking at the Romance and Hebrew data. Under an analysis linking lenition of a consonant to a preceding vowel, strong positions remain unaffected simply because they lack the vocalic trigger to their left. This view is incompatible with the German facts because **all** consonants are affected, even those in Coda Mirror contexts where a vocalic trigger is missing. Rather, the correct generalisation covering all data discussed so far grants a *relative* stability to Strong Positions as compared to other contexts. Consonants in any position may be affected by lenition, but those in Coda Mirror contexts will be less vulnerable than others.

2.6. Fortition

So far, we have reviewed evidence showing that either stops occur in the Coda Mirror, while weakened versions thereof are found in other positions (Somali, Tiberian Hebrew), or stops weaken everywhere but in the Coda Mirror throughout diachronic change (French, Ibero-Romance, German).

Considering the diachronic data, it could be argued that nothing is to be explained when no process takes place. Rather, the interest should be focussed on positions in which segmental change does obtain. This, however, is a misguided line of argumentation simply because what is expected with the passing of time is **not** stability, but change. An object that does not change in time cannot be a human language. Hence, the abnormal situation that requires explanation is not change, but stability.

A similar point can be made for synchronic distributional facts of the Somali and Hebrew kind. If phonology is to account for allophonic variation, stability should not be in its focus. Here again, we believe that the absence of variation is of phonological relevance. Why should processes affect all kinds of segments in all kinds of positions except for a very specific subset, the Coda Mirror? Clearly, its phonological status makes this position immune to processes applying elsewhere. Hence, this status deserves further examination.

But even setting aside the question whether stability requires an explanation, the phonological reality of the Coda Mirror is evidenced by processes that do affect segments in this position. These processes are commonly referred to as *fortition*, *stengthening* or *hardening*. The relevant literature (e.g. Foley 1977:90ff, Lass 1984:177ff, Collinge 1985:93ff,243ff, Harris 1990, 1994:132f, 1996, Hock 1991:162ff, Kenstowicz 1994:35, Trask 1996:55ff) quotes various instances in a number of genetically unrelated languages. The focus is generally centered on the segmental variations that occur, rather than on the position in the string that may condition fortition. However, Kenstowicz (1994:35) summarises the relevant issue as follows: "Postvocalic context is the most typical environment for the change from stop to fricative [...] Many systems restrict weakening to contexts in which a vowel follows as well as precedes [...] Fortitions from fricative to stop tend to occur in the complementary set of contexts: postconsonantal and initial."

Kenstowicz's identification of the Coda Mirror as the typical site in which fortition takes place makes a number of predictions. Namely, we expect fortition to occur either in both initial and post-Coda position, or in one of these contexts only. The fact of being observed in half of the Coda Mirror only is not at odds with the existence of the Strong Position. If on the other hand fortition occurred intervocalically and/ or in Codas, to the exclusion of initial and post-Coda positions, this would cast doubt on the reality of the Coda Mirror. We are not aware of such a process, nor could we identify one single event of this kind in the literature.

We present in what follows a clear case of fortition in both initial and post-Coda position. From Indo-European (IE) to Ancient Greek, intervocalic yod is lost without exception (Grammont 1948:89, Lejeune, 1955:§153, Meillet & Vendryes 1963:§55). In Codas, [j] is maintained as the second element of a diphtong: IE **d(w)ej-* appears as **dej-os* > *deos* "fear" and **dej-ma* > *deima* "object of fear". Elsewhere, a Greek coronal consonant regularly corresponds to IE yod, as shown under (8).

| | | | | | | |
|---|---|---|---|---|---|---|
| (8) a. # __[21] | | ***j**ug- | > | **d͡z**ug-on | "yoke" | (Lat ***i**ugum*, Skr ***y**ugám*, Got ***j**uk*) |
| | | ***j**e(s)- | > | **d͡z**e-oo | "boil" | (Skr ***y**ásati*, Ohg ***j**esan*) |
| b. C __ | | | | | | |
| $C_{lab}$ | p | *klep-**j**oo | > | klep**t**oo | "steal" | |
| | b | [no clear example] | | | | |
| $C_{cor}$[22] | t | *melit-**j**a | > | melit**t**a | "bee" | |
| | d | *od-**j**oo | > | o**d͡z**oo | "smell of" | |
| $C_{vel}$ | k | *kaaruk-**j**o | > | keerut**t**oo | "proclaim" | |
| | g | *stig-**j**oo | > | sti**d͡z**oo | "sting" | |

In (8b), the evolution [pj] > [pt] cannot be understood unless it is admitted that [j] belongs to an Onset and is strengthened. This indeed is the view adopted by all authors (cf. op. cit.). It parallels exactly the Gallo-Romance case of *rub-ju*, *sap-ja* discussed later in this section. The various dialectal correspondents [-zd-, -dd-] of Attic [d͡z] < [$C_{+voice}$j] (Lejeune 1955:§§94ff), as well as the geminate result [-tt-] < [$C_{-voice}$j] show that the same holds true for [coronal+j] and [velar+j] sequences. Although involving palatalisation or assibilation, these evolutions cannot be accounted for unless strengthening of the palatal glide is supposed in these contexts as well.

Whatever the detail of this complex evolution, it is clear that IE [j] does strengthen in Ancient Greek, and that strengthening of [j] occurs word-initially and after Codas, that is in the Coda Mirror.

Another case of strengthening in both word-initial and post-Coda position is found in the French evolution of Latin [j]. This process is most commonly quoted in the literature when strengthening is discussed (e.g. Lass 1984:177ff, Trask 1996:55ff).[23]

(9)

| | a. #__ | | b. Coda__ | | c. Coda __C | c. Coda __# | | d. V__V | |
|---|---|---|---|---|---|---|---|---|---|
| j | **j**ocu<br>**j**urare | ʒø<br>ʒyʁe | sap**j**am<br>rub**j**u | saʃ<br>ʁuʒə | | ma**j**(u) | mɛ | ra**j**a<br>je**j**unu | ʁɛ<br>ʒœn |

[21] In some cases, initial IE [j] is represented by Greek [h] as in Gr *heepar*, Lat *jecur*, Skr *yákr̲-t* "liver". Whether Greek shows [d͡z] or [h] in place of IE initial [j] is not predictable. This unclear situation has classically been acknowledged, see for instance Grammont (1948:93), Lejeune (1955:§152), Beekes (1995:143). However, it does not challenge the strengthening observed.

[22] The forms given are those of Attic. In some dialects, the same words show [-ss-], of which Lejeune (1955:§86) provides a survey. For discussion of (unexplained) [-ty-/-θy-] > [-s-] in some Attic words, see Lejeune (1955:§83).

[23] Parallel evolutions are found in other Romance languages. Latin forms are given as before, French words are phonetically transcribed. Glosses (line per line): [j] "game, know subjunctive, May, ray (fish), swear, red"; the last word is found in the French expression *à jeun* "on an empty stomach". Latin [j] does not occur in internal Codas.
The case of Latin [w], although not exactly parallel to [j], is worthwhile in this context. Latin [w] strengthens into [v] regardless of its syllabic position. But the well known strengthening of Germanic [w] to French [g] takes place in initial position only: Germ. *****w**ërra* > ***g**uerre*. In addition, some [w]/ [v] of truly Latin origin also undergo fortition under the influence of the Germanic items, e.g. Lat. ***v**agina* > Fr ***g**aine*. A few more sporadic cases of initial strengthening occur in the evolution of French: Germ. ***h**ludhawic* > ***C**lovis*, Germ. ***θ**arrjan* > ***t**arir*.

Word-initially and after Codas, the French reflex of Latin [j] is the fricative [ʒ]. This evolution may be appreciated in post-Coda position only after labials because Latin [j] has merged with dentals and velars elsewhere, causing palatalisation (see note 6). Viewing [-pj-, -bj-] as heterosyllabic clusters may seem implausible at first sight. If these clusters were homosyllabic, however, the change from [pj,bj] to [ʃ,ʒ] would have to be interpreted as a palatalisation of labials, which is unexpected since labials never palatalise in Latin (and elsewhere). If on the other hand [pj,bj] are heterosyllabic, fortition obtains in post-Coda position as predicted, and [p,b] are lost in Codas just as everywhere else in the language (see (1)). This is indeed the view which is classically adopted by philologists, cf. Bourciez (1926:224), Pope (1952:97).

In weak positions on the other hand, Latin [j] is always lost.

Hence, Latin [j] evidences another positive phonological process occurring in the Coda Mirror. The observed evolution is in line with the consonantal properties induced by this position, that is strength.

Harris (1996) reports another case of fortition in Cypriot Greek. The phenomenon at hand is restricted to post-Coda positions. In Cypriot Greek as described in Newton (1972) and Kaisse (1992), /i/ appears as a glide when occurring before another vowel. For instance, consider the [i]-[j] alternation obtaining for nominative *mantili-n, stamni-n* vs. genitive *mantilj-u. stamnj-u* "handkerchief, jar". In these cases, /i/ is preceded by [n,l]. No other process than glidification occurs. If on the other hand /i/ follows [r] or an obstruent and precedes a vowel, fortition is observed in addition. As shown under (10), the expected [j] appears as [k] in the former, but as [c] in the latter case.[24]

(10)

| a. #__ | b. Coda__ | | c. Coda | | d. V__V |
|---|---|---|---|---|---|
| | underlying | surface | __C | __# | |
| **j**atria | ter**i**-azo | ter**k**-azo | | | lo**j**azo |
| **j**erakos | var**i**-ume | var**k**-ume | | | a**j**azin |
| | nap**i**-o | naf**c**-o | | | |
| | e-p**i**a-s-en | ef**c**a-s-en | | | |
| | vaθ**i**-s (m) | vaθ**c**-a (f) | | | |
| | plat**i**-s (m) | plaθ**c**-a (f) | | | |
| | not-**i**a | noθ-**c**a | | | |

Harris (1996) shows that stops appear instead of [j] only in true post-Coda positions, and thereby establishes the previously unrecorded fact that the process under scrutiny is syllabically conditioned.[25] Moreover, as evidenced under (10b), plosives spirantise in Codas when fortition takes place. Hence, Cypriot Greek illustrates both strengthening in post-Coda position and weakening in Codas. This double-reaction on specific positions in the string is in line with the evidence reviewed so far.

[24] Glosses: (10a) "cure, falcon", (10b) "I match, I am bored, that I drink, he took, deep NOMsg, wide NOMsg, dew", (10d) "pay attention to, chill wind". Under (10b), the underlying /i/ is guaranteed either by the variation shown between masculine and feminine forms, or by other forms of the words quoted that exhibit overt [i]. Compare [teri, vari, pi, not-o] "one of a pair, heavy, drink, south".
The identical underlying identity of all [j] (in post-coda position, initial and intervocalic) is demonstrated in Harris (1996: 328, note 2).

[25] For instance, no glidification nor fortition occurs when a branching Onset precedes /i/ as in [krias, tria, kopria, krios, krioti] "meat, three, manure, cold, cold weather". See Harris (1996:320ff) for discussion.

Finally, let us mention the case of the Armenian word *erku* "two" from IE **dwoo*. Boltanski (1995:70), summarizing Martinet (1986:72), proposes the following evolution: IE **dwoo > *dg$^w$oo > *dgo > *dkoo > *rkoo >* Arm *erku*. The kind of intermediate stages assumed are not very plausible because [dg$^w$], [dg], [dk] and [rk] do not qualify as word-initial clusters that could be accommodated in a branching Onset.

Leaving aside the speculation regarding unattested intermediate forms, the beginning of this word is subject to three processes: 1) [w] > [k], 2) [d] > [r], 3) appearance of a prothetic vowel [e]. Clearly, the first evolution illustrates strengthening, while the second is an instance of lenition. According to the evidence reviewed in this article, strengthening is likely to occur in the Coda Mirror, while lenition obtains in Codas and intervocalically. It is striking to observe that the third process, that is the appearance of the prothetic vowel, entails that both IE consonants [d] and [w] come to stand in precisely the syllabic position for which we expect strengthening and lenition, respectively: given the prothetic [e], [d] belongs to a Coda, while [w] resides in a post-consonantal Onset.[26] Hence, this Armenian evolution, which may appear puzzling at first sight, enters the general fortition – lenition pattern.

In the Armenian example, the appearance of a vowel modifies the syllabic status of two consonants. For the same reasons, we expect consonants to react if a vowel disappears. Namely, if [$\underline{V}$] is lost in a word-internal sequence such as [$VC_1\underline{V}C_2V$] where both consonants are intervocalic, $C_1$ comes to stand in a Coda, while $C_2$ will end up in a post-Coda position. Hence, we expect strengthening to affect the latter, while the former should undergo lenition.

Romance languages, namely Gallo-Romance, provide ample illustration of this pattern. Indeed, the diachronic loss of post- or pretonic vowels give rise to consonant clusters [$VC_1øC_2V$] of the kind mentioned. In these instances, $C_2$ is the site of consonantal epenthesis. Examples are given under (11) (syncopated vowels appear in brackets).

| | | | | | |
|---|---|---|---|---|---|
| (11) | Latin | | French | | |
| | cam(e)ra | > | ʃã**b**rə | chambre | "room" |
| | sim(u)lare | > | sã**b**le | sembler | "seem" |
| | *ess(e)re | > | ɛ(s)**t**rə | être | "be" |
| | cin(e)re | > | sã**d**rə | cendre | "ash" |
| | laz(a)ru | > | la**d**rə | ladre | "leprous (mod. miserly)" |
| | spin(u)la | > | epɛ̃**g**lə | épingle | "pin" |

The expected strengthening is instantiated by the consonantal epenthesis observed.

## 2.7. Sievers's Law

In this section, we show that the Coda Mirror, just as the Coda, also has a vocalic manifestation. Before we address Siever's Law itself, let us see how the Coda, i.e. the context __{#,C}, also conditions phonological phenomena occurring in Nuclei. Consider relevant vowel-zero alternations in various genetically unrelated languages given under (12) (the alternation-site is indicated by "__" in the column-headers).[27]

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[26] Lenition of [d] to [r] in Coda position is found for example in dialectal Latin, compare Latin *adfuisse* "be present, participate" with dialectal *arfuisse* (C.I.L. $I^2$ 581, X 104, see Ernout 1957:58f). The same process occurs in intervocalic position, e.g. Napolit. *pere, surore* < Lat *pede, sudore*.

[27] See Scheer (1997) for a general survey of vowel-zero alternations. Data regarding the languages mentioned can be found in Scheer (1996) for Czech, Gussmann & Kaye (1993) for Polish, Nikiema (1989) for Tangale,

| (12) | zero<br>C__C-V | vowel<br>C__C-ø | vowel<br>C__C-CV | gloss |
|---|---|---|---|---|
| Moroccan Arabic | k**ɨ**t**ø**b-u | køt**ɨ**b-ø | k**ɨ**ttɨb-ø | write perf.act.3pl, 3sg, 3sg causative |
| German (optional elision) | inn**ø**r-e | inn**e**r-ø | inn**e**r-lich | inner+infl, inner, internal |
| Tangale (Chadic) | dob**ø**-go | dob**e** | dob**u**-n-go | called, call, called me |
| Somali (Cushitic) | nir**ø**g-o | nir**i**g-ø | nir**i**g-ta | young female camel pl, sg indef, sg def |
| Turkish | dev**ø**r-i | dev**i**r-ø | dev**i**r-den | transfer ACC, NOM, ABL |
| Slavic (e.g. Czech) | lok**ø**t-e | lok**e**t-ø | lok**e**t-ní | elbow GEN, NOM, adj. |
| Hungarian | maj**ø**m-on | maj**o**m-ø | maj**o**m-ra | monkey Superessive, NOM, Sublative |

Languages vary as to whether the elision is obligatory or optional, and with respect to the vowel(s) concerned. But the phonotactics of vowel-zero alternations are remarkably stable in all these systems. The correct descriptive generalisation is as under (13).

(13) alternation-sites show
a. zero / __CV
b. vowel / __C $\left\{\begin{array}{c}\# \\ C\end{array}\right\}$

The structural description of this generalisation includes the disjunctive Coda-context __{#,C}, with a C intervening between "__" and the angle brackets. This situation simply translates the fact that the alternation concerns the vowel, and hence does not take place in the Coda itself, but the Nucleus preceding it. The formal description of vowel-zero alternations thus makes crucial reference to the disjunctive context that is characteristic for Codas: vowels occur *before* a Coda, zeros elsewhere.

As will be shown below, Sievers's Law is the exact mirror event of this process. The phenomenon at hand affects vowels *following* the Coda Mirror, i.e. vowels appearing in {#,C}C__ contexts.

In 1878, Eduard Sievers (1878) discovered a regularity in Gothic regarding the alternation of [j] and [ij] in weak verbs of the *–jan* class. The Gothic root is suffixed by a thematic element, namely the [j] or [ij] examined here, and personal endings. The two thematic allomorphs are distributed according to the structure of the root they join: [j] follows "light" roots, that is those ending in a short vowel plus a single consonant, √-VC, or a long vowel without consonantal element, √-VV. On the other hand, [ij] occurs after "heavy" roots, that is those ending in a long vowel plus a single consonant, √VVC, or a short vowel followed by two consonants, √VCC. Examples illustrating this distribution are given under (14).[28]

Kaye (1990b) for Moroccan Arabic, Barillot (1997) for Somali, Törkenczy (1992) for Hungarian, and Wiese (1995), Noske (1993) for German.
Government-based analyses thereof appear in, among others, Kaye (1990a,b), Charette (1991), and, in a CVCV framework, Scheer (1996,1997,1998a,b).

[28] The forms shown are those of reconstructed Common Germanic (CG) because only at this level the alternation [j] – [ij] appears as such. In true Gothic forms, the alternation takes the form *j – ei* because of CG *-iji > Got **-**ii, spelled *ei*, thus Got 2sg pres *nasjis* vs. *sôkeis* "you (sg) save, you (sg) search". See Braune & Ebbinghaus (1987:26f,44,118ff) for details and reconstruction.

(14)

| | "light" roots | | vs. | "heavy" roots | |
|---|---|---|---|---|---|
| | √VC- | √VV- | | √VVC- | √VCC |
| 2sg pres | nas-j-is | stoo-j-is | | sook-ij-is | sand-ij-is |
| 3sg, 2pl pres | nas-j-iþ | stoo-j-iþ | | sook-ij-iþ | sand-ij-iþ |
| | "save" | "keep" | | "search" | "send" |

Sievers had already observed the same pattern in Vedic. His followers have identified the regularity at hand in other Indo-European (IE) languages such as Iranian, Latin, Greek and Balto-Slavic. Moreover, they have shown that it extends to all Indo-European (IE) sonorants, the vocalised counterpart of a sonorant being its syllabic version, hence [j] is to [ij] what [n] is to [n̥n]. The final formulation of Sievers's Law is due to Edgerton (1934,1943). It is commonly ascribed to the IE mother language since its traces are found in many otherwise unrelated IE dialects.[29]

Returning to the Gothic data, these have to be reinterpreted if the phenomenon goes back to IE. Namely, according to the Laryngeal Theory issued by Saussure[30], IE long vowels come from a short vowel plus a Laryngeal word-finally and before a consonant. The real identities of √stoo and √sook thus are √stoH, √soHk, respectively, where "H" is a Laryngeal consonant. The context conditioning the complementary distribution of [j] and [ij] may thereby be unified: [j] occurs after √-VC, [ij] after √-VCC stems.

Unfortunately, Germanic offers no testimony of the IE situation obtaining for sonorants in word-initial position. Their behaviour, however, is brought to light in Vedic. In the Rigveda, the syllabic value of a word can be calculated on the basis of metrics since the overall number of syllabic peaks is constant for each line. For a form such as the first person singular optative of the verb IE **es* "to be", two allomorphs appear in the Rigveda: *s-jaam* and *s-ijaam*. In the same way, the word "two" comes along as either *dvaa* or *duvaa*, the *v* being the Vedic reflex of IE [w]. Edgerton (1934,1943) provides many more cases of this kind. Both allomorphs are in complementary distribution according to the following pattern ("…V/C" is the ending of the preceding word).

(15) s-jaam, dvaa / …V # __

$$\text{s-ijaam, duvaa} \;/\; \left\{ \begin{array}{l} \text{…VC \# \_\_} \\ \text{…VV \# \_\_} \\ \text{initial in a line} \end{array} \right\}$$

Vedic obviously ignores word-boundaries when calculating the context for the alternation at hand. And as before, Vedic long vowels amount to a former short vowel followed by a Laryngeal, so that the context governing the alternation may be unified: [j] occurs after a short vowel followed by a consonant *…V # s__aam*, i.e. iff the preceding word ends in a short vowel. On the other hand, [ij] is observed when preceded by a short vowel plus two consonants *VC # s__aam*, i.e. iff the preceding word ends in a short vowel followed by a consonant (or a long vowel, but recall that VV < VH). So far, the behaviour of Vedic is strictly identical to what we have seen in Germanic. The crucial piece of evidence betraying the word-initial status, however, is the fact that [ij], and not [j], is found when the word occurs initial in a line. In other words, the absolute initial position "##" counts as a consonant.

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29 See e.g. Collinge (1985:159ff), Lehmann (1993:103ff), Seebold (1972), Lindeman (1965) for more discussion.
30 See Lindeman (1987) for a survey.

We are now in a position to state the generalisation based on both Germanic and Vedic, that is the description of Sievers's Law for the IE mother language.

(16) a. Sievers's Law
= vowel-zero alternation
*after* {C,#} plus C

$$\begin{array}{l} [\,\text{ø}\; j] \;/\; VC\,\_\_ \\ [\,\underset{.}{i}\; j] \;/\; \left\{ \begin{array}{c} \# \\ C \end{array} \right\} C\,\_\_ \end{array}$$

b. vowel-zero alternations
*before* C plus {C,#}

$$\begin{array}{l} \text{zero} \;/\; \_\_CV \\ \text{vowel} \;/\; \_\_\; C \left\{ \begin{array}{c} \# \\ C \end{array} \right\} \end{array}$$

The description of vowel–zero alternations (13) has been repeated for convenience under (16b). As indicated by the circles in (16), Sievers's Law is in fact a vowel-zero alternation just as the process shown under (13). Only does it not occur before a consonant and {C,#}, but after {C,#} and a consonant. Hence, both processes are the exact mirror images of each other. If vowel-zero alternations are the vocalic manifestation of the Coda context, Sievers's Law is the vocalic manifestation of the Coda Mirror. Both contexts condition a vowel-zero alternation.

In this section, we have given empirical evidence in support of the claim that the Coda Mirror is a relevant phonological context that has to be taken just as seriously as was the Coda. Both environments refer to syllabic structure, both have consonantal as well as vocalic manifestations. The reality of the Coda Mirror has been demonstrated by synchronic as well as diachronic evidence coming from various genetically unrelated languages.

## 3. Consequences for syllable structure

By the same reasoning that led to the (re)introduction of the Coda into representations, phonological theory is called to find a means of unifying the disjunctive context "word-initially or after a consonant" into a single phonological object. Furthermore, not only are the formal descriptions of the Coda and the Strong Position exact mirror images of each other, but the two contexts also provoke opposite effects on segments they contain, that is "weakness" in the former[31], "strength" in the latter case. This matching of both antipodal occurrence and effect can hardly be regarded as accidental. Hence, not only is phonological theory requested to capture Coda Mirror contexts as a single object, but this object should also display antipodal properties with respect to the formalisation that is proposed for the Coda.

Current theories of constituency fail to even describe the Coda Mirror as a single object that is different from any other context. Indeed, using a syllabic inventory that recognises Onsets, Rhymes, Nuclei and Codas leads to view consonants in Coda Mirror positions as Onsets: both word-initial and consonants occurring after a Coda belong to Onsets. Consonants standing in intervocalic position, however, also do, but they are not affected by Coda Mirror effects at all.[32]

[31] Codas are commonly associated to "weakness" because they admit only a subset of possible consonants, segments devoice, deaspirate, lenite, in short decomplexify in this position. See for example Goldsmith (1990:112f), Harris (1994: 66ff), Blevins (1995:227ff) for discussion.

[32] The Coda Mirror context {C,#}__ has been used in order to adduce evidence in favour of the existence of syllables, cf. the discussion in Blevins (1995:209). It is argued that reference to this context is required for processes that occur at the beginning of syllables. However, the disjunctive context {C,#}__ is inaccurate for this purpose since the correct description of the left edge of the syllable is {V.,C.,#}__, i.e. *including*

This odd situation may not be amended by introducing a new constituent, as it was done before for Coda contexts. Faced with the disjunctive context __{C,#}, the "new" constituent *Coda* was added to the syllabic inventory that consisted only of vowels and consonants. Two kinds of consonants were now distinguished, rather than only one: those pertaining to Onsets, and those associated to Codas. A similar move cannot be made in order to implement the Coda Mirror into syllable structure. If the minimal syllabic unit is considered to be CV, the Coda could be introduced because the right edge of the syllable was virgin. This is not the case at its left edge, which is already occupied by a constituent, i.e. the Onset. Subdividing Onsets into "real" Onsets in intervocalic position and Coda Mirrors would lead to the absurd situation of encountering syllables that sometimes begin with an Onset, and sometimes with a Coda Mirror. Unlike in the case of Codas, syllable-typology would not bear the alternative parameter "presence vs. absence of the one object (Coda)", but the mutually exclusive presence of two objects, i.e. an Onset or the Coda Mirror. A proposal of this kind would fail to express any relevant generalisation about the syllable as a uniform unit.

We will show below that unlike the standard model of constituency, an alternative view of syllable structure dispensing completely with Codas and branching constituents does achieve a proper discrimination of the Coda Mirror context and its complement set. The next section introduces the theoretical devices needed for the demonstration.

## 4. The CVCV model and the beginning of the word

### 4.1. The CVCV model

In recent work, the assumption of a strict CVCV syllable structure has been evaluated for particular analyses in various languages.[33] The CVCV-model (Lowenstamm 1996, in press) views syllabic structure as a strict sequence of non-branching Onsets and non-branching Nuclei (i.e. no branching constituents, no Codas). For the sake of clarity, consider the representation of closed syllables, geminates, long vowels and the right edge of consonant-final words within this frame:[34]

```
(17)  closed syllable   geminate      long vowel     […C#]
      O  N  O  N        O  N  O  N    O  N  O  N     O  N
      |  |  |  |                  |   |               |  |
      C  V  C  ø           C      V   C     V      …C  ø  #
```

All structural information contained in traditional syllabic approaches is preserved. For instance, phenomena related to the Coda are referred to as occurring “before an empty Nucleus”. The difference between the Coda- and the CVCV-approach, which are descriptively equivalent, is the causal relation obtaining between the relevant environment and the observed event. Apart from the general **observation** that Codas are “weak” because e.g. they admit only a subset of possible consonants, there is no reason why segments should devoice, deaspirate, lenite, in short decomplexify in this specific position. The correct cross-linguistic observation pointing to the "weakness" of Codas can only lead to a less surprised

intervocalic Onsets. Hence, the literature that aims at demonstrating the existence of syllable boundaries by presenting triple-disjunctive contexts does not bear on the phonological event at stake in this article.

[33] See Bendjaballah (1998), Bonvino (1995), Creissels (1989), Guerssel & Lowenstamm (in prep.), Heo (1994), Hérault (1989), Larsen (1994,1995), Lowenstamm (1988,1996), Nikiema (1989), Scheer (1996,1997,1998a,b, in press a,b), Ségéral (1995,1996), Ségéral & Scheer (1998a).

[34] Discussion of sequences that are traditionally interpreted as branching Onsets goes beyond the scope of this article. Section 6 provides further examination of this topic.

b. consonants stand in Codas iff they occur **BEFORE** an empty Nucleus

| word-final: […**C**#] | before a (heterosyllabic) consonant: […**R**TV…] |
|---|---|
| …O N # | O N O N |
| \| \| | \| \| \| \| |
| **C** ø | **R** ø T V |

Note that both disjunctive contexts are unambiguously discriminated: all and only the consonants behaving like Codas occur before an empty Nucleus, and all and only the consonants behaving like Coda Mirrors occur after an empty Nucleus.

Furthermore, the second requirement expressed in section three is met: the antagonistic situation obtaining for the structural description of the Coda and its Mirror is not only paralleled by its effects, but also reflected in theoretical terms.

| (25) | structural description | | segmental effect | | syllabic analysis |
|---|---|---|---|---|---|
| Coda | __{#,C} | = | weakness | = | before empty Nuclei |
| | vs. | | vs. | | vs. |
| Coda Mirror | {#,C}__ | = | strength | = | after empty Nuclei |

The syllabic analyses of the Coda and the strong position are not only the mirror of each other as are their structural descriptions. They also match exactly the configuration of the structural descriptions: the contextual indicator "__" is truly translated by "before" and "after", while the phonological identity of the disjunctive surface-object "{#,C}" is the empty Nucleus. It turns out that a phonetically inexistent object, the empty Nucleus, is in fact the angle stone which determines lateral relations among segments.

The question remaining to be addressed is the causal relation between the syllabic situation and the effect it produces on segments: why are consonants weak when they come to stand before empty Nuclei, and why are they strong when occurring after empty Nuclei, rather than the reverse?

## 6. The Coda Mirror: explanatory adequacy

Government and Licensing are antagonistic forces that have an influence on the segmental expression of segments which are associated to constituents they apply to, cf. (22). Hence, there are four and only four logically possible combinations a consonant may be exposed to.

First, if a segment is supported by Licensing while escaping Government, it enjoys a maximally comfortable situation and is not expected to undergo lenition. Rather, it should display relative strength. In other words, this configuration is predicted to correspond to the Coda Mirror.

Second, a segment which is both licensed and governed is expected to show less segmental health: on one hand, it is backed up by Licensing, but on the other, it is spoiled by Government. The same holds true for segments that are neither licensed nor governed. While lacking support from Licensing, they are not struck by Government either. It is not immediately clear how these two configurations should be ranked with respect to each other on a scale of segmental health. There is, however, no doubt that their situation is less favourable than the one illustrated before.

As mentioned earlier in section 4.4, the configuration assuring maximal segmental integrity is precisely the one corresponding to the Coda Mirror. Segments that are both licensed and governed stand in intervocalic position, and those escaping both Licensing and Government are Codas.

The fourth possible configuration is logically excluded: if an Onset is not licensed, its Nucleus is empty. In this case, there is no way for it to be governed by this empty Nucleus.

Table (26) sums up the discussion.

(26)

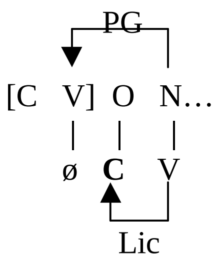
| Licensing | Government | gloss | segmental health according to predictions |
|---|---|---|---|
| + | – | Coda Mirror | splendid |
| | + | V__V | unfavourable |
| – | – | Coda | unfavourable |
| | + | *impossible* | --- |

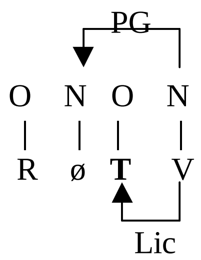
For the sake of convenience, we will briefly discuss all possible distributional configurations a consonant may come to stand in.

When occurring in the Coda Mirror, consonants are licensed, but escape Government.

(27) ungoverned but licensed: Coda Mirror

a. word-initial: [#**C**V…]    b. after a (heterosyllabic) consonant: […R**T**V…]

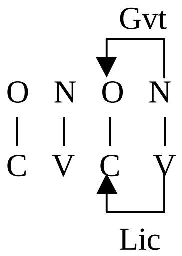



In both cases shown, the Nucleus of the consonant that occurs in the Coda Mirror is called to properly govern and hence cannot govern, but does license its own Onset.

Consonants in intervocalic position are both licensed and governed.

(28) governed and licensed: […V**C**V…]

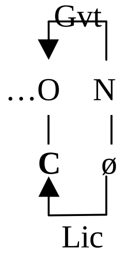



Unlike in Coda Mirror positions, the vowel following a consonant in intervocalic position has no governing duties because there is no empty Nucleus to be governed. As a consequence, it may hit its own Onset. On the other hand, the situation regarding Licensing is the same as before. Intervocalic consonants are thus both governed and licensed.

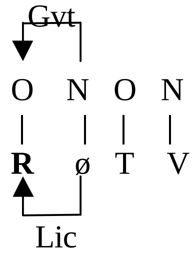
Finally, the situation of Codas with respect to Licensing and Government is as follows.

(29) ungoverned and unlicensed: Coda

a. word-final: […**C**#]




b. before a (heterosyllabic) consonant: […**R**TV…]




Since consonants in Codas occur before an empty Nucleus, they can neither be governed nor licensed.

According to our predictions, consonants in intervocalic and Coda position are both fragile. However, as stated earlier, it is not clear which is the relative health of two objects one of which is spoiled and backed up at the same time, the other being neither supported nor diminished. Even though we will not be able to answer this question here, the prediction that both contexts share the property of being unfavourable for their hosts is certainly correct.

Notoriously, lenition occurs in Coda positions and intervocalically. In recent work, Harris (1997) has reviewed various phenomena illustrating contexts that allow only for a subset of oppositions that are found elsewhere. His ambition is to be able to refer to all lenition-contexts in a uniform way, and to explain why certain oppositions are neutralised in these environments rather than in others. The solution he proposes is based on direct vs. indirect Licensing. He shows that distributionally fully endowed positions are directly licensed, while an intermediate constituent intervenes on the licensing path of distributionally defective subsystems. In this view, the amount of Licensing that an object receives is a function of the path Licensing takes from its source. Constituents intervening between the dispenser and the target act as a filter and transmit only part of the Licensing. Government plays no role in this theory of Licensing Inheritance.

As far as lenition is concerned, Harris' and our own predictions are thus equivalent. However, if it is true that both Codas and intervocalic consonants share the tendency to undergo lenition, the particular phonological events occurring in both environments are not the same at all. Consider the contrastive table under (30) that opposes phenomena which are typically found in Codas and intervocalic contexts. Examples for most of the processes mentioned can be found in Harris (1997).

(30)

| process affecting a segment because of its position in a string | Coda | V__V |
|---|---|---|
| devoicing | typical | highly improbable |
| deaspiration ($C^h$-->C) | typical | highly improbable |
| velarisation (l,n-->ɫ,ŋ) | typical | highly improbable |
| s-debuccalisation (s-->h) | typical | highly improbable |
| liquid gliding (r,l-->j) | typical | highly improbable |
| depalatalisation (ɲ-->n) | typical | highly improbable |
| l-vocalisation (ɫ-->w/o) | typical | highly improbable |
| r-vocalisation/ loss ([kaad] "card") | typical | highly improbable |
| $[NC]_{hom}$: homorganisation of nasals | typical | highly improbable |
| spirantisation (b,d,g-->β,ð,ɣ) | highly improbable | typical |
| voicing (t-->d) | highly improbable | typical |

This table is to be understood so that the phonological process mentioned does not simply occur in the relevant environment, but in fact is triggered by it. For instance, spirantisation occurs in Codas in many languages, among which Tiberian Hebrew as discussed in section 2.4. However, it is never triggered by the fact of coming to stand in a Coda. Rather, as is the case in Tiberian Hebrew, spirantisation typically takes place in postvocalic contexts, regardless of whether the consonant concerned pertains to an Onset or a Coda.

Furthermore, we do not claim that there are no processes that occur in both Coda and intervocalic positions. The only thing (30) is supposed to illustrate are phonological events which occur in one of the contexts at hand, to the exclusion of the other. However, our predictions would be falsified if one of the processes mentioned occurred in the opposite context it is related to in (30), but never in the other (e.g., if in a given language spirantisation was triggered by Codas, but did never occur in intervocalic position).

Let us now consider an example where the process mentioned does stand in a causal relation with the relevant context. Devoicing is a prominent feature triggered by the Coda position. However, it never occurs intervocalically. On the other hand, the reverse process voicing, or spirantisation, are frequently due to intervocalic positions, but are never reported to be triggered by Codas.[40]

The almost complementary distribution of events that are triggered by Codas and intervocalic contexts supports the view that both sites are phonologically different. Above all, the existence of one process and its reverse in mutually exclusive contexts such as voicing vs. devoicing gives a hard time to the view that Codas and intervocalic positions share the same phonological identity.

The challenge is to account for both the tendency of Codas and intervocalic consonants to lenite **and** the very different results of their respective lenition. In this sense, the analysis developed above is satisfactory: it predicts lenition for both contexts while keeping them phonologically different. Further work must bring to light the causal relation between the two contexts and their different effects.

Another issue is beyond the scope of this article. So far, we have only reviewed the behaviour of simple consonants in Coda Mirror contexts. Clusters of rising sonority of the TR-kind require more detailed discussion. In any event, considering the status of single consonants only in a first step is justified by the fact that we might expect results going from simple to complex, rather than the reverse. Clusters of the kind mentioned are doubly marked: of course they are more complex than simple consonants, and their existence is the most extreme case of complexity a language can face. Indeed, languages may be overtly CV, or possess Codas. In addition, a minority tolerates TR clusters. Languages that exhibit sequences of rising sonority while lacking Codas do not exist.

Space restrictions preclude discussion of an analysis thereof that was presented in Ségéral & Scheer (1998b). The complexity of TR-clusters does not seem to undermine any of the generalisations established in this paper. For instance, throughout the evolution from Latin to French, [tr,dr] remain stable in the Coda Mirror, but undergo lenition intervocalically (of course they do not occur in Codas).[41]

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[40] Except of one single case known in the literature, that is the abnormal behaviour of Somali shown in section 2.3.

[41] Latin forms are as before, French words are spelled. Glosses: [tr] "three, other, stone, treat, piece of wood used in house building, wander about", [dr] "sheet, lose, square".

(31)

| | a. #__ | | b. Coda__ | | c. Coda | | d. V__V | |
|---|---|---|---|---|---|---|---|---|
| | | | | | __C | __# | | |
| tr | **tr**es | **tr**ois | al**t**(e)**r**u | au**tr**e | | | pe**tr**a | pie**rr**e |
| | **tr**actare | **tr**aiter | capis**tr**u | chevê**tr**e | | | i**t**(e)**r**are | e**rr**er |
| dr | **dr**appu | **dr**ap | per**d**(e)**r**e | per**dr**e | | | qua**dr**atu | ca**rr**é |

As may be seen, Latin [tr,dr] that stand in the Coda Mirror appear as such in French, whether original (*capistru*) or secondary (*perd(e)re*). By contrast, their stop is lost with ensuing compensatory lengthening of the sonorant if they occur in intervocalic position. Again, the primary (*petra*) or secondary (*it(e)rare*) character of the cluster does not matter.

## 7. Conclusion

In the foregoing pages, we have drawn attention to the phonological reality of the disjunctive context mirroring the Coda. To all intents and purposes, the Coda Mirror is the exact opposite of the Coda: its structural description is the mirror of the one referring to the Coda, and its effect on the segments it hosts is "strength", as opposed to "weakness" for the Coda. Classical constituency that recognises Codas and branching Onsets is unable to refer to the Coda Mirror in a unified fashion. For the sake of precisely the arguments that have led to the (re)habilitation of Codas in early Generative Phonology, a modification in syllable structure is thus in order. Lowenstamm's (1996, in press) proposals regarding the existence of an initial [C V]-unit and constituency viewed as a strict sequence of non-branching Onsets and non-branching Nuclei offers a very simple way of referring to the Coda Mirror as a unique phonological object: consonants in this position are preceded by an empty Nucleus. Not only does this analysis achieve descriptive adequacy, it also proposes a phonological identity that is the exact mirror image of the Coda context, in which consonants occur iff they are *followed* by an empty Nucleus. Hence, objects that are phonetically inexistent, namely empty Nuclei, appear to be the phonological centre of gravitation. The most important and cross-linguistically stable phonological contexts turn out to be defined with respect to this empty category.

In a second step, we have shown how the interplay of two antagonistic forces, Government and Licensing, answers the question why the segmental effects of the Coda and its Mirror are "weakness" and "strength", respectively, rather than the reverse. Namely, consonants in the Coda Mirror escape Government, which inhibits segmental expression, because the governor must take care of the empty Nucleus preceding them. Codas, on the other hand, also escape Government because their Nucleus is empty, but they are not supported by Licensing either for the same reason. Consonants standing in intervocalic position are also weakened, but for opposite reasons: they are both hit by Government and backed up by Licensing. Both Codas and intervocalic contexts are cross-linguistically typical for lenition; they, however, produce very different, sometimes opposite effects on consonants. This supports the view that even though both share a tendency to lenite, they do so because of different reasons, and possess two distinct phonological identities. Our results are compatible with these considerations. Further research must show why absence of both Government and Licensing produces certain segmental effects that are different from those observed when both forces apply to a consonant, rather than the reverse.

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