The Coda Mirror, stress and positional parameters

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Abstract

This chapter is concerned with the representation of two parameters that control the cross-linguistic fine-tuning of the strong position {#,C}__. Word-initial consonants may or may not be strong across languages, and whether post-sonorant consonants are strong or not is a matter of a language-specific choice. The relevant empirical record has been documented in Ségéral and Scheer (this volume a).

The second goal of this chapter is to understand why tonic environments are strong: how exactly does the strong effect of stress come about, and how is it represented?

Solutions are sought in the framework of the Coda Mirror (Ségéral and Scheer 2001a). Following Lowenstamm (1999), we describe the phonological identity of the beginning of the word as an empty CV unit, whose presence or absence produces the parametric variation observed. We also propose that stress has a representational incarnation: once its placement determined, it is linearised as an empty CV unit. Finally, we propose that the parameter regarding the strength of post-sonorant consonants is a consequence of the ability of sonorants to branch on neighbouring empty Nuclei: in VRøTV, the coda sonorant R may or may not be able to branch on ø.

Since the same object (the initial CV and branching sonorants) has multiple effects, the co-occurrence of otherwise entirely unrelated typological features is predicted. For example, a language that imposes the regular sonority sequencing restrictions on initial clusters will also have strong word-initial consonants and disallow the first vowel of the word to alternate with zero.

1. Introduction

The Coda Mirror (Ségéral & Scheer 2001a)[1] is a theory of lenition and fortition that roots in Government Phonology (Kaye et al. 1990, Harris 1994) in general and follows CVCV (Lowenstamm 1996, Scheer 2004a) in particular.

The empirical object that it sets out to explain is the so-called strong position: word-initial consonants and consonants that occur after Codas, {#,C}__ in SPE-type notation, recurrently behave alike and then experience an effect of segmental strength. Classical syllabic tools fail to describe the strong position as a uniform and unique phonological object: both word-initial and post-Coda

[1] Work in this direction includes Ségéral & Scheer (1999, 2001b, 2005, 2007), Scheer (2004a:§§110, 556, 2004b), Szigetvári (1999, to appear), Cyran (2003a), Csides (2000, 2007), Pagliano (2003), Seigneur-Froli (2003, 2006), Kijak (2005).

consonants belong to Onsets, but so do intervocalic consonants, which are weak.

We call the strong position disjunction {#,C}__ the Coda Mirror because it is exactly symmetric with respect to the well-known Coda context __{#,C}, both regarding its structural description and the effect produced (Coda Mirror strength vs. Coda weakness). While regular syllable structure is unable to capture the strong position, let alone the mirror effect, both characteristics of the position of consonants in the linear string are predicted by Governing and Licensing relations.

After a brief summary of how the Coda Mirror works (§2, including illustration by a selected data set), the purpose of the present chapter is to introduce some fine-tuning: on the one hand, the theory thus far has been mute regarding stress-conditioned lenition; on the other hand, there appear to be two cross-linguistically recurrent parametric choices that languages can make regarding the word-initial and the post-Coda context: word-initial consonants and post-sonorant consonants (as opposed to post-obstruent consonants) may or may not be strong. The variation concerning the two strong positions has been described in some detail in Ségéral and Scheer (this volume a); it is obviously of parametric nature since individual systems make unpredictable choices. Stress is also a plug-in: while cases where positional influence is the only factor in lenition and fortition are common, systems where lenition is conditioned by stress alone are not on record (see Ségéral and Scheer this volume a:§1.1). The basic positional perspective thus needs to be supplemented with a means of expressing the influence of stress on lenition patterns.

The variable behaviour of word-initial consonants is considered in §3, while the parametric choice regarding post-sonorant consonants is discussed in §4. Finally, a way of implementing stress-related lenition into the Coda Mirror is explored in §5.

2. The Coda Mirror

2.1. The strong position: its empirical reality, the challenge it raises and its (non-)reception

Data that establish the empirical reality of the strong position {#,C}__ have been extensively discussed in Ségéral and Scheer (2001a, this volume a), as well as in the literature mentioned in note 1. In order to serve readers that are not familiar with this literature, let us consider one specific data set from Somali which, unlike most of the evidence discussed in Ségéral and Scheer (this volume a), is of synchronic nature.

In Somali (Cushitic), the Coda Mirror pattern is found in the distribution of underlying stops: plosives appear word-initially and after heterosyllabic consonants, while lenited allophones thereof occur in other positions. Table (1) below shows the behaviour of voiced stops.[2]

(1)

	a. #__	b. Coda__	c. Coda __C	c. Coda __#	d. V__V
	sg indef	pl/ 3 sg masc pf	sg def	sg indef	pl
b	beer				
		garb-o	garab˺-ta	garab˺	
			dab˺-ka	dab˺	daβ-ab˺
d	dile				
		heb˺d-aj	heβed˺-ka	heβed˺	
			geed˺-ka	geed˺	geeð-ad˺
g	gaf				
		nirg-o	nirig˺-ta	nirig˺	
			ɖeg˺-ta	ɖeg˺	ɖeɣ-o

The only context in which /b,d,g/ appear as such on the surface is the strong position, i.e. word-initially (1a) and after Codas (1b). In all other environments, lenited versions thereof occur: [β,ð,ɣ] intervocalically under (1d), plosives with a weak release (or none at all) and/or partial devoicing in Codas under (1c).[3]

The Somali pattern is representative of the general situation: regarding positional influence on lenition and fortition, the five positions that a consonant can

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2 The pattern is described in greater detail for example by Orwin (1993) (who namely provides a more detailed phonetic characterisation of the Coda allophones). The situation of voiceless stops is analogous, but in the interest of space limitations remains unconsidered. Further discussion is available in Ségéral & Scheer (2001a:114ss) and Scheer (2004a:§118).
Glosses (*-o* in column b is the plural marker, *-aj* denotes 3 sg. masc pf.): *beer* "garden", *garab* "shoulder", *dab* "fire", *dile* "killer", *hebed* "tame animal" (*hebdaj* "he became tame" from *hebed* "become tame"), *geed* "tree", *gaf* "error", *nirig* "young female camel", *dheg* "ear".

3 The alternations shown are based on suffixation that commands a regular vowel-zero alternation in bisyllabic stems (CV_1CV_1C). Hence /nirig/ "young female camel" appears as *nirøg-* when the plural morpheme *-o* is added, but surfaces as *nirig-* with the singular definite suffixes *-ka* (masc.) and *-ta* (fem.), as well as in the singular indefinite where no suffix is attached. The stem-final consonant therefore comes to stand in a position adjacent to its root-medial neighbour, i.e. after a Coda in *nirg-*, but not in *nirig-*.

come to stand in lump together as shown under (2) below (see Ségéral and Scheer this volume a).[4]

(2) the five positions and their clustering

	position	usual name		
a.	#__V	word-initial	strong position	
b.	VC.__V	post-Coda		
c.	V__.CV	internal Coda	Coda	weak Positions
d.	V__#	final Coda		
e.	V__V	intervocalic		

In the late 70s and early 80s, the Coda disjunction __{#,C} has made an important contribution to the (re-)introduction of syllable structure into the hitherto linear theory, and to the development of non-linear autosegmental structure. The challenge was to reduce the disjunction to a uniform phonological object: what behaves alike must have the same identity. This goal was achieved by the distinction of two types of consonants, Onset and Coda. The strong position {#,C}__ is the exact symmetric disjunction, which has also the reverse effect (strength, against Coda weakness). This is why we call the strong position the Coda Mirror, and the exact symmetric situation the mirror effect.

The existence of the strong position raises an insuperable challenge for regular syllabic theory.[5] The traditional inventory and geometry of syllabic constituents are able to offer a uniform description (word-initial and post-Coda

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4 Space restrictions do not allow for a discussion of branching Onsets (TR clusters), which are also subject to lenition. Data are much more difficult to come by, and the literature does not offer any generalisations. The empirical pattern that appears to emerge (among other sources, from Celtic as shown by Jaskula this volume, and from Tuscan Italian, as reported by Marotta this volume) is described in Ségéral and Scheer (this volume a:§2.7). An analysis in terms of the Coda Mirror is proposed in Scheer (2000:212ss) and Brun-Trigaud & Scheer (forth).

5 One way of solving the problem is to deny the linguistic relevance of the strong position, which is said to be the simple corollary of the three weak positions (i.e. of the Coda and the intervocalic location): phonological processes cause damage in weak positions because these are singled out as such; the non-lenition in strong position is simply the consequence of the fact that lenition processes do not target them – strength is thus epiphenomenal, a phonological non-event. This perspective suffers from the fact that active phonological processes, such as the fortition of yod, do target the strong position in a positive fashion. This issue is addressed in greater detail in Ségéral and Scheer (2001a:126ss), Scheer (2004a:564). The epiphenomenal perspective is discussed by Smith (this volume).

consonants are Onsets), which however is not unique: intervocalic consonants are also Onsets, but do not share the strong behaviour (they are weak). In the following section we show that the assumption of CVCV and a lateral perspective on syllable structure (Government and Licensing) predict just the picture under (2): three categories of consonants are distinguished, two of which are weak (Codas and intervocalic items), the third being strong (the strong position).

Before turning to this demonstration, a word is in order regarding the non-reception of the strong position in the OT literature, where lenition has received quite some attention (e.g. Beckman 1997, 1998, Kirchner 1998, 2004, Steriade 1997, Zoll 2004, Vijayakrishnan 2003). Surprisingly enough, the strong position disjunction is entirely absent from that literature which, however, is often typologically oriented. While word-initial strength is discussed in detail, the strength of post-Coda consonants, which is made explicit in the description of well-known languages (such as Romance), has been overlooked. This is true even for specialised work on fortition (Smith 2002, 2004).

The only strong position that is known in this literature is "the beginning of X" where X can be the word, the syllable, the morpheme, the root, the stem, the foot, the prosodic word or any other relevant phonological unit. Steriade (1997) for example contains a host of phenomena where the word-initial and the post-consonantal location form a descriptively critical disjunction, a fact that is left unexploited by the author. Steriade (1997) even concludes that

> "we have presented arguments establishing that syllable position does not condition laryngeal neutralization. It would in fact be surprising if it did: there is no a priori reason why being in the onset is better for any feature than being in the coda or indeed somewhere outside of the syllable." Steriade (1997:99)

Kirchner's (1998:8ff) typologically oriented work is subject to the same diagnostic: the post-Coda position is simply absent from his cross-linguistic survey of positional influence on lenition, which is based on 272 languages.[6]

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[6] Kirchner (1998) distinguishes between lenition in word-final position (14 languages), in Coda position (5 languages), fortition/blocking of lenition in word-initial position (17 languages), in the Onset of stressed syllables (6 languages), as well as phrase- or utterance-initial blocking of lenition (4 languages).

2.2. Predictions made by lateral syllable structure

Following immediate constituent analysis, syllable structure is classically understood as a clustering of adjacent segments into arboreal constituents. Government Phonology (Kaye et al. 1990, Harris 1994) has introduced an alternative view where syllabic generalisations are expressed in terms of lateral relations that hold among segments: Government and Licensing. While Standard Government Phonology is a hybrid model where syllabic generalisations are jointly expressed by "old" arboreal structure and "new" lateral relations, the step towards a purely lateral theory has been taken by CVCV, a framework introduced by Lowenstamm (1996).

CVCV represents the ultimate stage of the lateral idea, which is genuine to Government Phonology. Since lateral relations and arboreal structure are competing means of expressing syllabic generalisations, there is a natural trade-off between both: there is no place for arboreal structure when the lateral track is followed. The leading idea of CVCV is that constituent structure boils down to a strict sequence of non-branching Onsets and non-branching Nuclei; hence an empty Nucleus separates consonants that are adjacent on the surface, and an empty Onset intervenes between two adjacent vowels (and between the two pieces of a long vowel). That is, there are no Codas, no Rhymes, no branching Onsets and no branching Nuclei. Syllable structure is thus entirely flat – its function is shifted onto lateral relations. This movement is described in greater detail in Scheer (2004a:§165), and we will see shortly how this works.[7]

On a more general note, a consequence of flat syllable structure is the absence of a tree-building device in phonology. This, in turn, means that there can be no recursion in phonology – a long-standing observation: recursion is the privilege of syntax and morphology (this is a central argument made by Chomsky et al. 2002; see also Neeleman & Koot 2006; this issue is further discussed in Scheer 2004a:§2).

In order to see which are the predictions made by CVCV, a number of core principles of the theory need to be introduced. For one thing, the multiplication of empty Nuclei is marshalled by Government: Nuclei can only be empty if they are governed.[8] As Licensing, Government is head-final, and only phonetically expressed Nuclei are good governors. Therefore a structure where two or more empty Nuclei occur in a row is ill-formed. This is shown under (3) below.

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7 Work that presents CVCV theory includes Scheer (1999, 2004a), Szigetvári and Scheer (2005), Szigetvári (1999), Cyran (2003a,b), Rowicka (1999).

8 Other circumstances allowing for the existence of empty Nuclei are discussed by Kaye (1990, 1992), Gussmann & Kaye (1993) and Scheer (1999, 2004a:§14).

(3) Government defines well-formedness

a. well-formed structure b. ill-formed structure

Empty Nuclei thus call for the Government of the following Nucleus; in case this Nucleus is unable to govern because it lacks melodic (and hence phonetic) content, the structure is ill-formed. Implicit in this description is that Government is not recursive: Nuclei can only govern (and licence) one single target at a time.

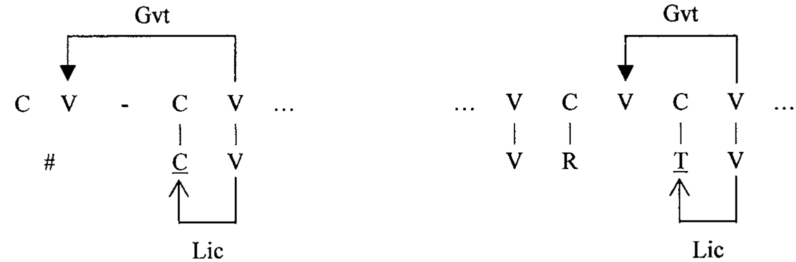
Finally, note that Government and Licensing have opposite effects: while the target of the former is inhibited in its melodic expression (a fact known from vowel-zero alternations: the zero alternant appears under Government), the latter backs up its target. The necessity for two distinct lateral forces is discussed in Scheer (2004a:§151).

Before we can consider the five syllabic positions that are relevant for the lenition and fortition of consonants, a last piece of information needs to be introduced. The demonstration below relies on the assumption that the phonological identity of the beginning of the word is an empty CV unit. This idea has been introduced by Lowenstamm (1999). Diacritics such as # (or the Prosodic Hierarchy) are meaningless placeholders that carry morpho-syntactic information into the phonological string without having any predictable effect: nothing inherent in # or the left edge of, say, the phonological word allows to tell whether word-initial consonants will be strong or weak – any effect and its reverse is compatible with these diacritics. §3.3 shows that the left edge of words produces stable effects across languages – hence colourless diacritics are out of business: morpho-syntactic information must incarnate as truly phonological objects.

Let us now see what kind of characterisation this system provides for the five relevant consonantal positions that are identified under (2) (target consonants are underscored).

(4) consonants in strong position: ungoverned but licensed

a. initial consonant #__ b. post-Coda consonant C.__

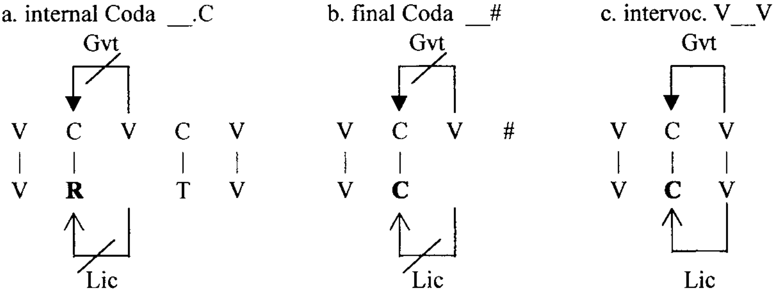


Under (4), the Nucleus following word-initial and post-Coda consonants is called to govern its preceding peer, which is empty. It cannot govern its own Onset for that reason. At the same time, the Nucleus in question has no specific Licensing duties and therefore licenses its own Onset. A consonant in strong position thus 1) occurs after an empty Nucleus and 2) is licensed but ungoverned.

Table (5) below shows the situation of the three remaining positions.

(5) consonants in Codas: ungoverned and unlicensed
intervocalic consonants: both governed and licensed

a. internal Coda __.C b. final Coda __# c. intervoc. V__V



Consonants in the Coda disjunction (5a,b) occur before an empty Nucleus; they are both ungoverned and unlicensed for that reason: empty Nuclei are laterally disabled. On the other hand, intervocalic consonants are not adjacent to any empty Nucleus; they are both governed and licensed: their Nucleus is contentful (and hence a good lateral actor), but (unlike under (4)) has no governing duties.

The three contexts that are relevant for lenition and fortition are thus defined by empty Nuclei: phonological identity of the strong position disjunction (4) is its position after an empty Nucleus (ø__), the Coda disjunction (5a,b) is symmetric and reduces to the context before an empty Nucleus (__ø); finally, no empty Nucleus occurs in the vicinity of intervocalic consonants (5c). Note that the three contexts not only enjoy a uniform description; their phonological identity is also unique (recall that this is what classical arboreal syllable structure cannot provide for regarding the strong position).

CVCV and the lateral perspective on syllable structure thus predict that

- just like the Coda disjunction, the strong position disjunction reduces to a uniform and unique phonological object.
- this object, ø__, is symmetric with respect to the identity of the Coda, __ø.
- the strong position is stronger than the Coda and the intervocalic position.
- the Coda and the intervocalic position are weak (as compared tot he strong position), but they are distinct: there are two different ways of being weak.

The second but last statement follows from the governing and licensing conditions that the respective consonants experience: given that Government destroys melodic integrity while Licensing provides support, maximal segmental health is produced when a consonant is ungoverned but licensed; this is the description of the strong position under (4). Being neither governed nor licensed (Coda consonants) and experiencing both lateral forces (intervocalic consonants) is certainly less comfortable. Consonants in these positions are therefore weak in comparison to their peers in strong position. Whether it is more comfortable to be neither damaged nor backed up (Coda consonants) or to experience both damage and support remains an open question. In any event, however, governing and licensing relations identify two distinct weak positions.

These predictions are a fairly good match of the empirical situation:

- reduction of the strong position disjunction
  the strong position needs to be reduced to a uniform and unique phonological object for the same reasons that led to the reduction of the Coda disjunction in the late 70s. The uniform and unique phonological identity of the strong position is ø__.
- the mirror effect
  the phonological identities of the strong position (ø__) and of the Coda (__ø) are symmetric. This is echoed by their symmetric structural description ({#,C}__ vs. __{#,C}) and behaviour (strength vs. weakness).

- who is who?
  The distribution of strength and weakness over the various positions is not arbitrary: on grounds that have got nothing to do with lenition (i.e. the obligation to govern empty Nuclei), the theory predicts that the strong position will be strong, and the weak positions weak, rather than the reverse. This is exactly how languages are found to behave.
- two distinct weak positions
  empirically, two distinct weak positions must be distinguished. We have seen in §2.1 that while Coda consonants and consonants in intervocalic position are both weak, they show different reactions. This is also demonstrated in Ségéral and Scheer (this volume a:§2.3) (even if effects of both positions may occasionally overlap).
- strength and weakness are relative, not absolute
  in lateral theory, strength and weakness are relative, not absolute: the strength or weakness of a position is identified by the lateral relations that it is subjected to, but only in comparison to the lateral forces that other positions experience. This matches the empirical situation: nothing shields strong positions per se since they may also experience lenition (Ségéral and Scheer this volume a:§2.5).

This is the baseline of the Coda Mirror as it stands. The remainder of this chapter proposes fine-tuning regarding two parametric variations (§3 and §4), as well as a means of introducing stress as a conditioning factor of lenition and fortition into the picture without modifying its basic contours (§5).

3. The variable behaviour of word-initial consonants

A relevant cross-linguistic variation regarding positional strength appears to concern the behaviour of word-initial consonants. We show in Ségéral and Scheer (this volume a:§3) that they are strong in some languages (or language families) such as Romance and Germanic, but weak in others such as Greek.

3.1. Direct Interface: diacritics do not qualify

The necessity for morpho-syntactic information to be represented by truly phonological objects has already been mentioned in §2.2. Diacritics such as # or constituents of the Prosodic Hierarchy do not qualify because they are phonologically colourless: anything and its reverse may happen under their influence – while it is not true that anything and its reverse happens word-initially in natural language. For example, consonants may or may not be strong in this context, but there is no case on record where the choice is between weakness or non-weakness (this is precisely the parametric variation encountered at the other edge of the word). Also, the beginning of the word produces restrictions on consonant clusters that are known as sonority sequencing: languages may or may not be subjected to the #TR-only pattern – but there is no language on record where words may only begin with #RT clusters (or #TT/#RR clusters for that matter).

A third stable effect of the left edge of the word concerns the possibility for the first vowel to alternate with zero. There are languages where this vowel may alternate just like any other vowel elsewhere in the string (Slavic languages such as Russian, Polish and Czech illustrate this pattern). In other languages, though, the first vowel of words is shielded against deletion, while vowels freely alternate with zero elsewhere in the string (Tiberian Hebrew and Akkadian are in this case, see Scheer 2004a:§90).

Take the following two processes: one systematically deletes the first vowel of words (and only this vowel, i.e. V → ø / #C__CV), the other on the contrary inserts a vowel in a word-initial consonant cluster (ø → V / #C__CV). It is obvious that the latter represents natural phonological activity, while the former is unheard of. The problem is that diacritics such as # or ω (the phonological word, or any other item of the Prosodic Hierarchy for that matter) make no prediction as to the phonological effect that they produce: a vowel could be deleted just as much as it could be inserted; the real and the outlandish rule are equally probable.

Diacritics fail to bear on phonology because they are uninterpretable in phonological terms: phonology reacts only on phonological items, that is on vocabulary that is part of the phonological language. Whatever the phonological representative of the morpho-syntactic information "beginning of the word", however, it has a perfectly uniform and oriented effect. Colourless diacritics therefore do not qualify. Instead of an arbitrarily chosen diacritic with arbitrary effects, what is needed are representatives of morpho-syntactic information that are truly phonological. A truly phonological object is one which exists in phonological processes that are not conditioned by any extra-phonological information.

Hence palatality, stopness and so forth are truly phonological, but # and ω are not: they are created for the exclusive purpose of storing morpho-syntactic information in phonology. Because it rejects any diacritic mediation between morpho-syntax and phonology, the interface theory that allows only for truly phonological representatives of morpho-syntactic information is called Direct Interface by Scheer (2000, 2004a:§83, 2008a, forth). The direct effect may be illustrated by the contrast between the non-effect of #s and omegas on phonology and the precise predictions that are made when the beginning of the word is an empty CV unit. Consider the reaction of CVCV and the initial CV on the two hypothetical rules that have been discussed above.

(6) Government defines well-formedness

a. ø → V / #C__CV
well-formed structure produced

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C V - C V C V
      |   | |
#     C   C V

      V
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b. V → ø / #C__CV
ill-formed structure produced

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C V - C V C V
      | | | |
#     C V C V
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Under (6a), the input representation is ill-formed: it features two empty Nuclei in a row. The insertion process provides melodic material for the second empty Nucleus and thereby makes the structure well-formed. It is thus one possible repair. By contrast, the deletion of the first vowel as under (6b) is "masochistic" insofar as it creates an ill-formed sequence of two empty Nuclei in a previously well-formed structure.

The prediction of the theory is therefore obvious: the insertion process may well occur, but the deletion process is martian – exactly the picture that is observed across languages.

3.2. The word-initial parameter: presence vs. absence of the initial CV

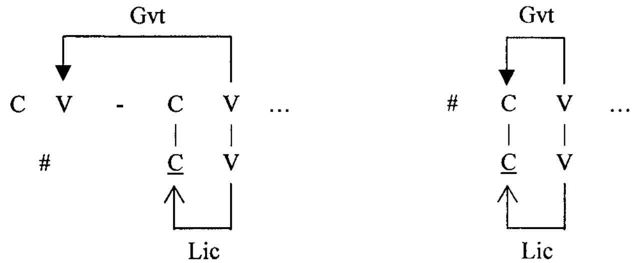
It has been mentioned that the beginning of the word has three stable cross-linguistic effects: the (eventual) strength of word-initial consonants, the (eventual) impossibility for the first vowel to alternate with zero and the (eventual) restriction of word-initial clusters to TR (sonority sequencing). In every case, though, the specific and non-arbitrary effect is only "eventual", that is a language may or may not show it. This is exactly the parametric variation that we are after in this section. Or rather, we are interested in one of the three effects, the strength of word-initial consonants.

We have seen in §2.2 that the presence of the initial CV enforces strength: its empty Nucleus calls for Government from the following Nucleus, which is therefore unable to govern its own Onset. The situation of languages where word-initial consonants are weak may thus be easily calculated: in absence of the initial CV, the first vowel of the word will govern its own Onset, which is then governed and licensed, that is intervocalic. This is shown under (7) below.

(7) word-initial situation in languages with and without the initial CV

a. languages possessing the initial CV

b. languages lacking the initial CV



Following this scenario, languages parametrically choose to implement a trace of the morpho-syntactic information "beginning of the word" into phonology or not.[9] In case they do, word-initial consonants are strong; otherwise they are weak. Observe that a specific prediction is made to the effect that the kind of weakness that is encountered in the latter option is intervocalic, rather than Coda weakness.

Note that the binary behaviour (presence/absence) of extra-phonological information in phonology is consistent with what is known from morpheme boundaries. In languages with distinct affix classes such as English, the contrast between class 1 and class 2 affixes is encoded in terms of complete transparency vs. intervention (see Kaye 1995): the boundary of class 1 affixes is "invisible" for the phonology (a [root+class 1] string behaves exactly like a monomorphemic item). For example, *parént-al* has regular penultimate stress just as if there were no morpho-syntactic division (cf. *párent*). By contrast, the boundary is relevant, i.e. "visible", in *párent-hood* where it modifies the regular penultimate pattern.

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9 An alternative solution is to consider that the initial CV is always present, but "activated" only in some languages. In case it remains inactivated, it has no phonological effect, i.e. is invisible. This is Lowenstamm's (1999) take. The two options are discussed in Scheer (2000:273ff), Seigneur-Froli (2003, 2006), Lowenstamm (2002).

3.3. One parametric choice, three consequences

If the strength of word-initial consonants is controlled by the presence or the absence of the initial CV, what about the two other phenomena mentioned that are conditioned by the beginning of the word? Are there three independent controls that open a parametric space of nine different patterns, i.e. where a language may, say, have strong word-initial consonants, but may or may not allow for alternating first vowels, and may or may not impose the TR-only restriction on word-initial clusters?

In a perspective where diacritics represent morpho-syntactic information in phonology, any option for a given phenomenon may be crossed with any parametric value of another process: diacritics do not make any predictions. If on the other hand the beginning of the word has a precise phonological identity, a prediction should be made regarding the concomitance of the parametric values of the three processes.

This is indeed the case: the presence of the initial CV not only produces the strength of word-initial consonants; it also enforces the TR-only restriction on word-initial clusters, and it prohibits vowel-zero alternations of the first vowel of the word. The former effect cannot be demonstrated here for the sake of space restrictions (see Scheer 1999, 2004a:§§102, 402). The latter has already been discussed under (6b): in a language where the initial CV is present, the absence of the first vowel of the word produces an ill-formed structure since it creates a sequence of two empty Nuclei. In systems where the initial CV is absent on the other hand, nothing withstands the first vowel of a word to alternate with zero: it may always been governed by the following Nucleus, which has no other governing duties. Czech for example illustrates this pattern: *pes* "dog NOMsg" appears as *ps-a* in GENsg.[10]

In sum, thus, the parameterisation of the initial CV has (at least) three empirical consequences, which the theory predicts to co-occur in the way shown under (8) below.

[10] Note that this pattern is different from the one that is described under (6b), i.e. where a rule deletes *all* first vowels of words, and only first vowels. In Polish (and other languages with vowel-zero alternations), a lexically and/or phonologically specified subset of vowels alternates with zero anywhere in the word: the left edge has no triggering virtue.

(8) predictions made by the parameterisation of the initial CV

	in a language where the initial CV is present	in a language where the initial CV is absent
a.	word-initial consonants are strong	word-initial consonants are non-strong
b.	initial clusters are restricted to #TR	there are no restrictions: #TR, #RT, #TT and #RR clusters may occur
c.	first vowels of words may not alternate with zero	first vowels of words may alternate with zero

Note that these predictions are anything but trivial: they chain together three empirical situations for which otherwise there is no reason to suppose a necessary relationship. Also, they are empirically explicit and may be falsified easily: any language that displays one of the three properties of the righthand or the lefthand column under (8) must also instantiate the two other properties of the same column.

We have checked languages that we are familiar with; the results are encouraging (even though most of the time there are only valid diagnostics for two of the three criteria). Regarding left-column languages for example, initial consonants are always strong in typical #TR-only languages such as Romance and Germanic (see Ségéral and Scheer this volume a). On the right column, in many (but not all) Slavic languages such as Polish, Czech or Russian, initial #RT clusters occur. In the same languages, the first vowel of words may alternate with zero (e.g. Czech *pes - ps-a* "dog NOMsg, GENsg"). Also, in North-Eastern dialects of Polish (see Ségéral and Scheer this volume a:§3.3), the only case in Slavic that we are aware of where a diagnostic for the strength of word-initial consonants is available, these appear to be weak. By contrast, in a left-column language like Belarusian that imposes the #TR-only restriction on initial clusters, the typical Slavic vowel-zero alternations are accompanied by a vocalic prothesis when they concern the first vowel of the word: *lav - i-lv-a* "lion NOMsg, GENsg" (Scheer 2000:276ss, forth).

Finally, a non-trivial prediction is made to the effect that in languages where some #RT clusters exist but others are absent, the latter represent accidental, rather than systematic gaps. That is, the presence of one single #RT item implies the absence of the initial CV, which means that grammar does not object against any #RT cluster. Hence if some #RT sequences are missing, they are simply uninstantiated lexical possibilities that could well come into being tomorrow.

Based on North-Eastern Demotic dialects, Seigneur (2006:420ss) shows that this is indeed the case in Greek, where only a small subset of non-#TR clusters exist on the surface (#ft (#fθ), #xt (#xθ), #mn). Examining the situation of 14 Slavic languages, Scheer (2007) shows that the anarchic distribution of non-#TR clusters in those languages that allow for violations of sonority sequencing (Polish for example has #rt, but not #rp) can have no systematic explanation; rather, they are the result of the diachronic loss of yers, which has created an arbitrary set of initial #CC clusters because the original distribution of yers was lexical, i.e. free and hence arbitrary.

4. The variable behaviour of consonants after sonorants

The second cross-linguistic variation concerns the behaviour of consonants that occur after sonorant Codas. The two patterns that are encountered are described and illustrated in Ségéral and Scheer (this volume a:§4). That is, post-Coda consonants are strong after obstruent Codas in all languages; after sonorant Codas, however, they may be either strong or weak.

The pattern "post-Coda consonants strong no matter what" may be illustrated by the evolution of Latin obstruents in French: they are shielded against damage both after obstruents (*cris**p**are* > *crê**p**er* "to crimp", *rup**t**a* > *rou**t**e* "road", *vec**t**ura* > *voi**t**ure* "car") and sonorants (tal**p**a > tau**p**e "mole", her**b**a > her**b**e "grass", can**t**are > chan**t**er "to sing", an**g**ustia > an**g**oisse "fear") (but suffer lenition in weak positions, see Ségéral and Scheer this volume a:§2.2).

By contrast, post-tonic t-lenition in various varieties of English (as described for example by Harris & Kaye 1990:265 and Harris 1994:222ff) occurs in weak positions (e.g. intervocalically in *city*) and after sonorant Codas (*quarter*, *winter* are pronounced with a flap in New York, with a glottal stop in London); the dental is guaranteed against lenition only in case it occurs after an obstruent (*after*, *custard*, *chapter*, *doctor* appear with unlenited [t] in both varieties).

4.1. Sonority bears on positional strength – it is not a melodic prime

Smith (this volume) and Ségéral and Scheer (this volume a:§1.1) argue that positional phenomena are opposed to adjacency effects. The latter implies an exchange of melodic primes (distinctive features or privative items) between an agent and a patient (e.g. palatality that is transmitted from a palatal to a velar); also, triggers are defined in melodic terms (only palatal items can trigger palatalisations). By contrast, positional phenomena are entirely independent of the melodic properties of adjacent segments: for example, l-vocalisation in Codas (e.g. l-darkening in certain varieties of English) goes into effect no matter what the preceding vowel (which may be front or not, velar or not, rounded or not etc.), and no matter what the following consonant. The position "after a vowel and before a consonant/in word-final position" alone is responsible for the effect observed.

On these grounds, the phenomenon to be considered in this section should not exist in the first place: the strength of post-Coda consonants should follow exclusively from positional properties. In actual fact, though, it depends on whether the preceding Coda consonant is a sonorant or an obstruent. The melodic make-up of an adjacent segment thus seems to bear on the positional status of post-Coda consonants.

A blurred distinction between positional and adjacency-driven phenomena is a problem in itself: something must be wrong. A solution appears when considering two related facts: for one thing, only sonority seems to be able to unsettle the melody-free definition of positional strength. That is, no other melodic property (no other distinctive feature), such as for example labiality, frontness, palatality or roundedness, is observed to bear on the definition of positional strength. If, despite the apparent counter-example, one abides by the opposition between positional and adjacency effects, the only possible conclusion is that sonority is not a melodic prime – it is ontologically different from labiality, palatality and the like.

Another hint in this direction comes from stress, where the fraction line is the same: only positional (syllabic) factors define stress placement, except sonority, which may play a role in some languages. No other melodic prime (labiality, palatality etc.) can bear on stress placement. Regarding consonants, it is well-known that Codas may or may not make a syllable heavy (and hence attract stress); this parametric choice is called Weight-by-Position since Hayes (1989). This pattern, however, allows for more fine-tuning: in some languages, sonorant Codas, but not obstruent Codas, contribute to the weight of their syllable. Documented cases are found in native American Wakashan languages (e.g. Wilson 1986, Zec 1995:103ff, Szigetvári & Scheer 2005:44f). The literature on stress, which has a strong typological orientation, has not identified cases where other melodic properties (such as labiality, palatality etc.) influence stress placement.

On the vocalic side, de Lacy (2002) has established the same generalisation (which is also based on broad cross-linguistic evidence): sonority, but no other property of vowels may influence stress placement.

"One issue this typology raises is not why stress is sensitive to sonority, but rather why it is not sensitive to so many other properties. There are no stress systems in which subsegmental features such as Place of Articulation or backness in vowels plays a role in assigning stress. The same goes for features such as [round], [nasal], and secondary articulation." de Lacy (2002:93)

Sonority is thus singled out on two entirely independent grounds, the definition of positional strength and stress placement. Following de Lacy (2002), we thus conclude in Ségéral and Scheer (this volume a:§4.4) that sonority is not a melodic prime: it is different in kind. If it is not a prime, it must be derived from something. Unlike in feature-geometric models, this has always been a the position of Government Phonology, where sonority has always been a derived category, based a notion called Charm in the earliest versions of the theory, later on segmental complexity (i.e. the number of primes that a segment is made of, see Harris 1990, Scheer 1999, 2004a:§46) or on skeletal relations (Jensen 1994, Szigetvári to appear). In such a perspective, sonority cannot contaminate adjacent segments since it is immaterial: there is no sonority prime that could spread. The only solution, then, is to describe its influence on positional strength and on stress placement by positional means.

4.2. Phenomena whereby sonority has bearing on syllable structure

In order to see how this insight that sonority is not a melodic prime could be formalised, let us try to list common phenomena where sonority has bearing on syllable structure, that is on positional matters.

For the time being our record is made of sonority-sensitive lenition and sonority-sensitive stress-placement. A third item is of course sonority sequencing, the motor of all syllabification algorithms: syllable structure is a function of the sonority slope of consonant clusters. That is, sequences of rising sonority (TR clusters) show solidary behaviour and on classical syllabic assumptions are syllabified within the same constituent, a branching Onset. Non-TR clusters, i.e. where the sonority profile is either falling or invariable (RT, TT, RR sequences), impact the behaviour of the preceding vowel and are therefore considered heterosyllabic.

A fourth item on our list are sonority-controlled restrictions in certain syllabic positions. For example, in some languages only sonorants can occur in Codas (e.g. Itô 1986: 26ff, Piggott 1999, Blevins 1995: 227ff).

Both sonority sequencing and sonority-controlled restrictions in certain positions have been analysed in terms of the aforementioned segmental complexity: following Harris (1990), the number of melodic primes that a segment is made of determines its ability 1) to interact with neighbouring consonants (sonority sequencing) and 2) to exist in weak positions (from which heavy segments may be excluded).[11] Relevant literature includes Harris (1990, 1997), Scheer (1999, 2004a:§14).

Let us now look at a fifth type of sonority-controlled syllabic effect that, just like sonority-conditioned positional strength and stress-placement, has not been argued to be a consequence of segmental complexity. In most languages where consonants may be syllabic (that is, assume vocalic function), only sonorants have this prililege. Examples are English, German, Czech and so forth. The literature also describes some rare languages where obstruents are reported to be syllabic, but the existence of syllabic obstruents is disputed.[12] In any event, the relationship between syllabic sonorants and syllabic obstruents is implicational: if the latter are found in a given language, the former will also occur; the reverse, however, is not true.

The traditional way of representing syllabic consonants builds on their function: since they behave like vowels, they *are* vowels, i.e. are syllabified into Nuclei (and/or bear the feature [+syll], e.g. Blevins 1995). An alternative analysis takes into account their function, which is vocalic, as well as their body, which is consonantal: like all other consonants, syllabic consonants are dominated by an Onset – but they acquire vocalic properties by branching on a neighbouring Nucleus. Work that builds on the branching analysis of syllabic consonants includes Hall (1992:35f), Harris (1994:224f), Wiese (1996), Szigetvári (1999:117ff) Blaho (2001, 2004), Rowicka (2003), Scheer (2004a:§240, 2008b) and Ziková (2007).

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11 Note that the notion of segmental complexity supposes privative (or monovalent) melodic primes: in a feature-geometric approach where features have binary values, the number of features that define a segment is the same fore all segments (underspecification is a form of privativity in melodic representation). It is only when melodic primes may or may not be present that different segments are made up of a different number of primes, and hence have contrasting complexity.

12 Candidate languages with syllabic obstruents include Berber (Dell & Elmedlaoui 2002), the Salish family (native American Northwest languages, e.g. Bagemihl 1991) and the Mon-Khmer family (Austro-Asiatic, e.g. Sloan 1988). Bagemihl (1991:593ff) discusses the cross-linguistic occurrence of and motivation for syllabic obstruents; he concludes that there are none. Further discussion appears in Scheer (2004a:§376, 2008b).

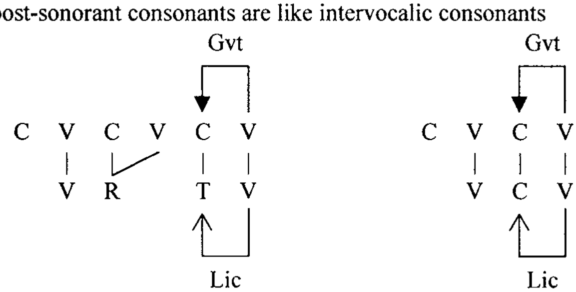
4.3. When sonorants branch on neighbouring Nuclei: three effects

We believe that the branching analysis of syllabic consonants is the key to the understanding of the parameter on the strength of post-sonorant consonants. Or rather, it may provide a uniform explanation for the three sonority-conditioned phenomena that have no direct explanation in terms of segmental complexity: syllabic consonants, sonority-driven positional strength and sonority-based stress assignment.

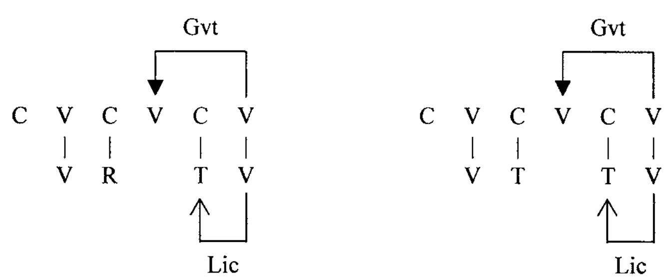
Consider under (9) below the contrasting structure of VRTV sequences in languages where sonorants do, against those where they do not branch on the following empty Nucleus.

(9) VRTV sequences and the branching parameter

a. sonorants branch
post-sonorant consonants are like intervocalic consonants



b. sonorants do not branch
post-sonorant consonants are like post-obstruent consonants



Under (9a), a language is depicted where sonorants branch on neighbouring Nuclei, while they (9b) represents the case of a language where they do not branch. Under (9a), the fact that the following Nucleus acquires melodic content through the branching of the sonorant places both the sonorant itself and the following obstruent in intervocalic position: they are flanked by contentful

Nuclei and hence both governed and licensed. This analysis has first been proposed by Pöchtrager (2001:64) on the basis of Finnish consonant gradation, where post-sonorant consonants are weak.

By contrast under (9b), the Nucleus of the sonorant remains empty and therefore calls for Government from the following vowel. Just like post-obstruent consonants, consonants are strong after sonorants in this system: they are ungoverned but licensed.

The parameter that regulates the strength of post-sonorant consonants thus reduces to the ability vs. inability of sonorants to branch. Note that in addition a prediction is made to the effect that the weakness that experience post-sonorant consonants in languages where sonorants branch is intervocalic, not Coda weakness. This is parallel to the parametric variation that concerns the other strong position: when word-initial consonants are weak, they are exposed to intervocalic weakness, rather than to Coda conditions. The intervocalic position is thus a kind of neutral environment for a consonant to occur in: as soon as strong conditions are relieved, consonant fall back on it. This is also true on the other end of the string: word-final consonants may or may not behave like Codas. In case they do not (a situation that is traditionally referred to as extra-syllabicity), they behave like intervocalic consonants (rather than as consonants in strong position, see Ségéral and Scheer this volume a:§3.1).

The third sonority-controlled phenomenon, stress assignment, has also been analysed in terms of branching sonorants. Szigetvári and Scheer (2005:58ff) argue that Weight-by-Position is a parameter on the visibility of empty Nuclei: closed syllables (VRø.TV) count as heavy in languages where the empty Nucleus following the coda consonant is counted by the stress algorithm, but are light in system where the algorithm only counts contentful Nuclei. That is, the sequence VRø counts for two vocalic units (morae) because, just like CVV, it is made of two Nuclei – provided that empty Nuclei are counted.

Within Weight-by-Position languages, recall that the sub-regularity where Coda sonority plays a role distinguishes between languages where any Coda makes a syllable heavy, and languages where only sonorant Codas are counted. According to Szigetvári and Scheer (2005), systems of the latter type have branching sonorants but no Weight-by-Position: the Coda-counting effect is achieved by the fact that the "empty" Nucleus in VRøTV in fact is not empty since it receives the branching of the sonorant. Just like all other contentful Nuclei, it is therefore counted (while empty Nuclei are not: the language at hand does not have Weight-by-Position).

We believe that the three sonority-controlled parameters at hand – the strength of post-sonorant consonants, the visibility of sonorant Codas for stress and the syllabicity of sonorants – are in fact consequences of the same parametric choice: the (in)ability of sonorants to branch.

The situation is thus analogous to the one under (8): one single parametric choice controls three phenomena, whose respective parametric options are tied together. This prediction is as non-trivial as the one made under (8): nothing predestines the association of the three parametric effects at hand, whose combination could also be free, or which could combine in some other way. The prediction at hand needs to be evaluated by a broader empirical record.

Finally, the question why sonorants have the (exclusive?) privilege to branch on Nuclei needs to be asked. Recall that two other sonority-controlled syllabic effects, sonority sequencing and sonority-based restrictions in particular syllabic positions, have been analysed in terms of segmental complexity. But that segmental complexity does not seem to be responsible for the characteristic ability of sonorants to branch. Sonority, however, is unlikely to have two distinct identities: if sonority is a function of segmental complexity, all its effects must ultimately originate in this property. This means that only a certain (minimal or maximal) complexity allows a consonant to branch on Nuclei. We leave this an open question.

5. Stress-related (non-)lenition

5.1. Stress as syllabic space

Bye and de Lacy (this volume) provide an overview of stress-related lenition and fortition. Even though its implementation and consequences may be manifold, the fundamental effect of stress is to provide strength – to the vowel (or the syllabic consonant) on which it falls, and to the consonantal environment. Why is this so?

In this section, we attempt to answer this question along the lines of Direct Interface (see §3.1): only truly phonological objects may be added to phonological structure; diacritics (such as # or units of the Prosodic Hierarchy) do not qualify. Syllable structure (be it arboreal or lateral) is a projection of intrinsic and lexically recorded properties of segments: consonants lump together according to the sonority slope of adjacent items, and sonority is a lexical property of each segment.[13] In sum, then, phonological structure is just like syntactic structure: a projection of terminal elements.

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[13] This is the traditional scenario. According to the alternative discussed in §4, rather than being a prime, sonority derives from segmental complexity. In any case, sonority has a lexical origin, directly in form of features or indirectly via segmental complexity.

This is why the Prosodic Hierarchy is a diacritic: Prosodic Words, Prosodic Phrases, Intonational Phrases and Phonological Utterances are not the result of any projection on the basis of phonological terminal elements. Rather, they are built on morpho-syntactic information (and on nothing else), which is imported into phonology from the outside in order to modify regular phonological behaviour. Being neither a phonological prime nor a projection thereof, the Prosodic Hierarchy is a diacritic (Scheer 2008a, forth).

Let us compare this situation with the representation of stress, which classically incarnates as foot structure. Are feet a lexically recorded phonological prime or a projection thereof? They are certainly not a prime; but neither are they a projection based on other phonological units. True, the construction of foot structure is influenced by syllable structure (e.g. Weight-by-Position) – but it is not predictable from it. That is, the stress algorithm itself makes decisions that are entirely independent of phonological primes and phonological structure (iamb, trochee, bounded, unbounded and so on).

In this sense, stress is like morpho-syntactic information: it carries alien information into the phonology, which then impacts phonological computation. Inasmuch as only truly phonological objects can be taken into account by phonological computation, whatever the stress-representing structure, it must be made of items that are independently known in phonology. Recall from §3.1 that a truly phonological object is one that is used in phonological computation in absence of any extra-phonological (in this case: stress-related) conditioning.

Feet do not meet this requirement: they represent stress and nothing else: feet never occur in phonological computation independently of stress. Since it is not a projection of phonological primes either, foot structure must be considered as a diacritic.

We therefore explore an alternative whereby stress materialises as syllabic space – specifically in CVCV, as an empty CV unit. A stress CV may thus split up the linear chain of segments; its insertion introduces a kind of demarcation line in the middle of a segmentally contentful string. The notion of demarcative stress is familiar from the structuralist literature. As far as we can see, the idea that stress provides syllabic space has been first proposed by Nespor & Vogel (1979) for the sake of the analysis of Italian Tonic Lengtheing and Radoppiamento Sintattico. Further work along this line includes Piggott (2003:414ss) and Larsen (1998), who adapts the idea to the environment of CVCV (stress comes down as a CV unit, rather than as an extra skeletal slot, which was Nespor & Vogel's original scenario).

5.2. Identical behaviour word-initially and in tonic environments

Let us now consider an empirical argument that lends support to the idea that stress identifies as an empty CV unit: the disjunction "word-initially and in tonic environments". A number of phonological phenomena indeed produce the same segmental effect these contexts, which – like the Coda and the strong position disjunction – do not seem to share any property at first sight. The same reasoning applies as before: the two environments at hand need to be reduced to a uniform (and unique) phonological identity. The list of processes that take place in the disjunction described includes the following items (relevant data are introduced with greater care in Scheer 2000:140ss).

A first case in point is aspiration in English (notwithstanding the fact that dialectal and other variation is difficult to appraise, an issue which cannot be further discussed here). Voiceless stops are aspirated before tonic vowels as well as in word-initial position; in the latter case, they are aspirated regardless of the position of stress: **p**^{h}ólitics vs. **p**^{h}oli**t**^{h}ícian (e.g. Iverson & Salmons 1995).

The distribution of h in Dutch follows the same disjunction: it occurs only word-initially (*hoed* [hut] "hat") and before stressed vowels (*Johannes* [johánəs] "first name"). Elsewhere a glide (copied from the preceding vowel) appears in its place (at least in Eastern varieties: *Johan* [jówan] "first name") (e.g. Gussenhoven & Jacobs 1998:230). The same distribution of h is actually known from English, where it only occurs word-initially (*house* etc.) and before stressed vowels: compare *véhicle* with *ve[h]ícular*, *prohibítion* with *pro[h]íbit* (e.g. Harris 1997:320).

More of the same is found in German, where the glottal stop (which is not contrastive) is obligatorily inserted at the beginning of vowel-initial words: *Auto* [ʔawtoo] "car", *essen* [ʔɛsən] "to eat" etc. In addition, there is just one other environment where it is met: vowels in hiatus are broken up by a glottal stop in case stress falls on the second vowel: compare *Cháos* with *cha[ʔ]ótisch* "chaos, chaotic", *The[ʔ]áter* with *theatrálisch* "theatre, theatrical" etc. (e.g. Alber 2001).

Another illustration of the pattern in question is Verner's Law, whichcontrols the voicing of Common Germanic fricatives (i.e. the outputs f,þ,h of Grimm's Law from IE *p,t,k plus unshifted original *IE s). Typically, textbook descriptions only indicate that the original voiceless items become voiced in Common Germanic if IE stress (visible only in the Indian branch) did not fall on the preceding vowel. What is left unmentioned, then, is the word-initial situation (something that Collinge 1985:205 points out; he also provides exhaustive literature regarding the Law): word stress can hardly fall on the vowel preceding the first consonant of a word, so according to the canonical formulation we would expect initial fricatives to undergo voicing. In fact they do not: word-initial Germanic fricatives are always voiceless. The correct statement for the complete distribution of Common Germanic fricatives is thus "voiceless fricatives word-initially and after originally stressed vowels, voiced fricatives elsewhere". This leaves us with a classical diachronic scenario whereby a general lenition process has affected all target items (fricatives), except when they were protected by a strong environment (which may be positional or tonic).[14]

Finally, the disjunction discussed also has vocalic effects: in the evolution from Latin to French, "vowels occurring in the initial syllable [...], together with tonic vowels, are the only ones that systematically appear in French" (Bourciez & Bourciez 1926:101). All other vowels are either completely lost or reduced to schwa (Ségéral forth discusses the detail of this phenomenon in a CVCV-based perspective).

5.3. Why tonic environments are strong and the post- vs. pre-tonic parameter

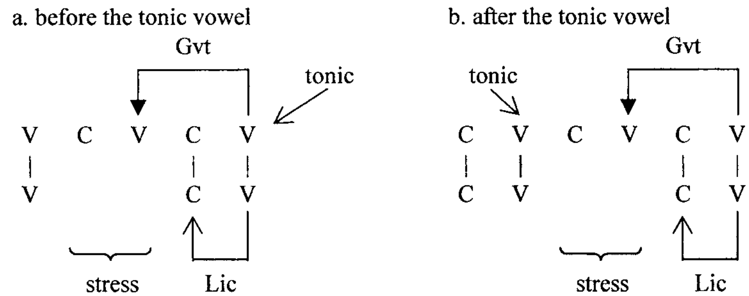
Given this empirical record (just in the languages that we are familiar with), the stress/initial disjunction does not appear to be anecdotal. If it is indicative of what stress really is, we may rely on the advantage of its disjunctive character and the conclusions it allows to draw (which are the same as in the case of the Coda and the strong position disjunction): if you have an idea of what one half looks like, you may conclude on the identity of the other half. Hence if it is true that the word-initial context is strong (in those languages where it is) because the word is preceded by a CV unit, the phonological identity of stress is an empty CV unit as well.

On this assumption, the strength of consonants in tonic environments follows. In order to see that, let us first factor out what the cover term "tonic environment" actually means: it represents two situations since nothing a priori

[14] Post-Coda consonants are also expected to be strong; fricatives in this position should thus escape voicing as well. Unfortunately their behaviour may not be tested: we know from Grimm's Law that the post-sonorant position is weak in Common Germanic, while post-obstruent consonants are strong (see Ségéral and Scheer this volume a:§4.2. In the former Grimm's Law applies (compare Lat. uerto with Goth waírÞan "to become"), while the latter it is inhibited (compare Lat. captus, noctis with Old High German haft, naht "captiveness, night"). Therefore, fricatives originating in Grimm's Law do not occur after obstruents in Common Germanic (and IE *s does not either).

indicates whether the stress-CV is inserted *before* or *after* the tonic vowel. Table (10) below depicts both situations.[15]

(10) linearization of stress



Both under (10a) and (10b), the empty Nucleus of the stress-CV must be governed. Therefore the consonant to its right is strong: it will be licensed but ungoverned because the Government of its Nucleus is absorbed by the stress-CV.

Translated back into surface terms, this means that we predict two empirical situations: one where the consonant *preceding*, another where the consonant *following* the tonic vowel is strong. This is precisely what we have observed: the strong alternants in Dutch, German and English ([h], the glottal stop and aspiration, respectively) occur before stressed vowels, while Common Germanic fricatives are strong when they come to stand after the tonic vowel.[16]

Another interesting prediction is that in systems where the stress CV follows the tonic vowel – but not in those where it precedes –, stress may have a lengthening effect. This is because the tonic vowel may expand onto the nu-

15 This is the situation once the tonic vowel has been identified. Its choice is an independent issue. In those languages where stress placement is the result of a calculus (i.e. where stress is not lexical), the computation at hand is done on the basis of syllable structure alone. This is the take of Szigetvári and Scheer (2005), to which we subscribe.

16 All of the languages quoted are Germanic languages, and one may reasonably expect that the parameter regarding the placement of the stress CV is somehow correlated with genetic kinship. The split, however, is not really random: it opposes modern Germanic languages (Dutch, English, German) to Common Germanic (Verner's Law). This is consistent with the fact that the stress system of Germanic languages underwent a major evolution precisely between Common Germanic, where stress was free and historically attested versions of Germanic, where it has become fixed (this is why Karl Verner had to look into Vedic, which has preserved the original IE free stress, in order to understand the Germanic variation whose trigger had been washed away).

cleus of the stress CV under (10b), but not under (10a), where the preceding consonant stands in the way.

The pattern described is quite common: so-called tonic lengthening occurs for example in Icelandic (e.g. Gussmann 2006), Selayarese (Austronesian, Piggott 2003:414ff) and Italian (e.g. Chierchia 1986) (see Scheer 2004a:§222 for an overview). Significantly, tonic lengthening is typically conditioned by following (not preceding) clusters: this is an unmistakable witness of the side on which the syllabic material lies that receives the expanding vowel. In Italian for example (but also in Icelandic), the tonic vowel lengthens in *fáto* "destiny" where no cluster follows, but not in *fátto* "fact".

Finally, the symmetric prediction is made for (10a), i.e. when the stress CV precedes the tonic vowel: like on the other side, the prime candidate for its identification is the adjacent member of the tonic CV, that is the onset in this case. We believe that the expansion of the consonant that precedes the tonic vowel in English is indeed the reason for its aspiration. This line of attack is further discussed in the following section.

This interpretation of stress leaves us with three, instead of two strong positions: the two parts of the Coda Mirror {#,C}__ plus the tonic environment. We thus expect cases where strong position effects are observed word-initially, after Codas and in tonic environments.

Also, recall that post-Coda consonants (sometimes only post-obstruent consonants) ought to be strong in all languages, while the strength of word-initial consonants is parameterised. Since the initial CV is responsible for both initial strength and #TR-only restrictions on initial clusters (see (8)), however, the disjunction "word-initially and in tonic environments" should only be encountered in #TR-only languages. This is true for all phenomena that were discussed in the previous section.

By contrast in the other type of language where the initial CV is absent (that is, where initial consonants are weak and no restrictions imposed on initial clusters), the disjunction at hand is predicted not to exist. In systems of this kind, however, the disjunction "after a Coda (an obstruent) and in tonic environments" can be active. We take this to be a relevant prediction for languages that impose no restrictions on word-initial clusters.

5.4. Why the post-Coda position is not involved in the disjunction

Finally, in all cases where a phenomenon is observed word-initially and in tonic environments, the question arises why the same effect is not observed in the third strong environment as well, that is after Codas (after obstruents). In all cases discussed in the previous section, the answer is simply that the target item of the process at hand does not occur after Codas. This is true for Verner's Law (there are no fricatives after obstruents, cf. note 14), Dutch (and English) [h] and the German glottal stop.

The German case is peculiar insofar as the glottal stop is epenthetic, rather than underlying. Therefore its non-occurrence after Codas cannot be explained by its lexical absence from this position. There must thus be another reason why there is no glottal stop epenthesis after Codas in German. The answer is that unlike in word-initial position and before stressed vowels in hiatus, there is no empty Onset that could receive epenthesis: glottal stop insertion targets empty Onsets in strong position. Post-Coda Onsets are strong but never empty – hence there is no epenthesis.

Regarding the phenomena discussed in the previous section, we are thus left with just one case where the target item occurs after Codas but does not show the same effect as in word-initial and position and in tonic environments: English aspiration. That is, why does the /t/ in *party*, *guilty* or *captive* remain unaspirated? If we are on the right track, there must be something that makes the post-Coda position different from the word-initial and the pre-tonic position. This is indeed the case: consonants in all three contexts are preceded by an empty Nucleus – but only in the latter two is this empty Nucleus also preceded by an empty Onset. That is, the empty Nucleus that separates a Coda-Onset cluster is preceded by an Onset which dominates the Coda consonant (e.g. the lateral in *guiløty*).

In other words, the distribution of aspiration is correctly described as "in strong position iff the preceding Onset is empty": in order to surface, aspiration needs the presence of an additional consonantal slot. The obvious conclusion, then, is that English aspirated voiceless stops are in fact geminates; they cannot occur after Codas because there is no skeletal slot on which they could branch.

Looked at from a different perspective, geminates in English have chosen not to leave a direct phonetic trace of their geminacy; rather, another phonetic exponent is chosen, aspiration. Note that there are no phonetic geminates in English, which means that the systemic slot is orphaned. Given basic autosegmental principles and a non-one-to-one relationship between phonetics and phonology, there is no surprise to see that a given phonological object may signal its presence through variable cues. The effect that object X appears in an "unexpected" phonetic coat has been demonstrated especially for long vowels (Lowenstamm 1991, Bendjaballah 1999, Rizzolo 2002) and geminates (which are then called virtual geminates, see Ségéral & Scheer 2001c, Barillot and Ségéral 2005).

6. Conclusion

On the foregoing pages, three plug-ins have been added to Coda Mirror theory: the impact of stress on lenition and fortition, and two binary parametric choices concerning the two strong positions, respectively. The left edge of the word on the one hand and the position after sonorants may or may not be strong. The implementation of these parameters as well as the analysis of stress has been guided by a specific view on how phonology processes extra-phonological information: Direct Interface allows only truly phonological objects to play a role in phonology; that is, objects which are used in phonological computation in absence of extra-phonological and tonic conditioning (or projections thereof). On these grounds, #, units of the Prosodic Hierarchy or foot structure are diacritics and do not qualify.

The analysis of the parametric variation of the left edge that we propose, as well as our linear analysis of stress, are illustrations of this approach. In both cases, we submit a solution in terms of an empty CV unit: this is the truly phonological (that is, non-diacritic) identity of the left edge of the word and of stress. The binary parameter that governs the former, then, is expressed as the presence or the absence of the initial CV, which is controlled by extra-phonological interface mechanisms (Scheer 2008a, forth).

Finally, the third issue regarding the binary parametric choice that makes post-sonorant consonants strong or weak is analysed in terms of branching: the sonorant Coda may or may not be able to branch on the following empty Nucleus.

Coda Mirror theory together with the three new plug-ins makes a number of predictions. For one thing, the intervocalic position identifies as the unmarked syllabic environment, to which both strong positions swing back when, for the sake of a parametric choice, they cease to be strong: word-initial consonants are weak when the initial CV is absent, and so are post-sonorant consonants in case the preceding sonorant branches – but the weakness that is encountered then is intervocalic, not Coda weakness.

The theory also makes strong predictions regarding the networking of parametric (typological) properties that otherwise have no reason to depend on each other. The co-occurrence of this or that value of the parametric choices at hand are purely accidental in alternative analyses.

Network predictions are made on two occasions, i.e. when a single phonological object is found to be responsible for a variety of phenomena. On the one hand (see (8)), languages where initial consonants are weak will also be able to have alternating first vowels and to display non-#TR clusters word-initially (while languages with strong initial consonants have stable first vowels and tolerate only sonority-obeying #TR clusters). On the other hand, in languages where post-sonorant consonants are weak, stress assignment may be sensitive to Coda sonority (while stress is not sensitive to Coda sonority in languages where post-sonorant consonants are strong).

Finally, since stress may create a third strong position (in addition to the two positionally defined strong positions), predictions are made regarding the disjunctions that should be found: strong effects should occur word-initially and in tonic environments (which is the case, see §5.2), but also in post-Coda (post-obstruent) position and in tonic environments, or in all three strong positions. The realisation of these disjunctions, however, depends much on the particular phonological process at hand. Also, the theory predicts that there is a substantial difference between word-initial and tonic strength on the one hand, and post-Coda strength on the other: consonants in all positions occur after an empty Nucleus, but only in the two former cases is this empty Nucleus also preceded by an empty Onset.

Note that these predictions are non-trivial and quite easily falsifiable. They are due to the representational character of the parameters, and to their intrinsic binary (rather than n-ary) variability (presence vs. absence of the initial CV, branching vs. non-branching of sonorants).

Finally, a contribution to the understanding of what sonority really is has been made: sonority of adjacent segments should not contribute to positional phenomena such as lenition and fortition. It is only when the influence of sonority is understood as an effect of branching (and its identity as non-melodic) that lenition and fortition recover their autonomy as a process that does not overlap with assimilation. The perspective of representing sonority as a non-melodic (non-featural) property unifies its behaviour in regard of stress and lenition (see de Lacy 2002 on stress) – an encouraging result.

References

References followed by
ROA can be downloaded at http://roa.rutgers.edu/index.php3
SZIG can be downloaded at http://seas3.elte.hu/szigetva/papers.html
SCH can be downloaded at http://www.unice.fr/dsl/tobias.htm

Alber, Birgit
2001 Regional variation and edges: glottal stop epenthesis and dissimilation in standard and Southern varieties of German. *Zeitschrift für Sprachwissenschaft* 20: 3-41.

Barillot, Xavier, and Philippe Ségéral
2005 On phonological Processes in the '3rd' conjugation in Somali. *Folia Orientalia* 41: 115-131.

Bagemihl, Bruce
1991 Syllable Structure in Bella Coola. *Linguistic Inquiry* 22: 589-646.

Beckman, Jill
1997 Positional faithfulness, positional neutralisation and Shona vowel harmony. *Phonology* 14: 1-46.
1998 Positional Faithfulness. Ph.D. dissertation, University of Massachusetts at Amherst. Published by Garland Press, New York 1999. ROA.

Bendjaballah, Sabrina
1999 Trois figures de la structure interne des gabarits. Ph.D dissertation, Université Paris 7.

Blaho, Sylvia
2001 The representation of Slovak syllabic consonants in strict CV. *The Odd Yearbook* 6: 3-24.

Blevins, Juliette
1995 The Syllable in Phonological Theory. In *The Handbook of Phonological Theory*, Goldsmith John (ed.), 206-244. Oxford: Blackwell.

Bourciez, Edouard, and J. Bourciez
1967 *Phonétique française*. 9th edition Paris: Klincksieck.

Brun-Trigaud, Guylaine, and Tobias Scheer
forth La lénition des attaques branchantes en français et dans les dialectes de l'ALF. In *Approches de la variation linguistique gallo-romane*, Mario Barra-Jover, Guylaine Brun-Trigaud, Jean-Philippe Dalbera, Patric Sauzet and Tobias Scheer (eds.).

Chierchia, Gennaro
1986 Length, syllabification and the phonological cycle in Italian. *Journal of Italian Linguistics* 8: 5-34.

Chomsky, Noam, Marc Hauser, and Tecumseh Fitch
2002 The faculty of language: what is it, who has it, and how did it evolve? *Science* 298: 1569-1579.

Collinge, N. E.
1985 *The Laws of Indo-European.* Amsterdam, Philadelphia: Benjamins.

Csides, Csaba
2000 Government and Licensing: a CV analysis of consonant lenition. *SOAS Working Papers in Linguistics and Phonetics* 10: 41-80.
2007 A strict CV approach to consonant lenition: bidirectional government in English phonology. *Language Sciences* 29: 177-202.

Cyran, Eugeniusz
2003a *Complexity Scales and Licensing Strength in Phonology.* Lublin: KUL.
2003b Branching onsets in Polish. In *Living on the Edge. 28 papers in honour of Jonathan Kaye*, Stefan Ploch (ed.), 303-320. Berlin: Mouton de Gruyter.

De Lacy, Paul
2002 The formal expression of markedness. Ph.D dissertation, University of Massachusetts.

Dell, François, and Mohamed Elmedlaoui
2002 *Syllables in Tashlhiyt Berber and in Moroccan Arabic.* Dordrecht: Kluwer.

Gussenhoven, Carlos, and Haike Jacobs
1998 *Understanding Phonology.* London: Arnold.

Gussmann, Edmund
2006 Icelandic vowel length and governing relations in phonology. *Lingua Posnaniensis* 48: 21-41.

Gussmann, Edmund, and Jonathan Kaye
1993 Polish notes from a Dubrovnik Café: I. The yers. *SOAS Working Papers in Linguistics and Phonetics* 3: 427-462.

Hall, Tracy
1992 *Syllable Structure and Syllable-Related Processes in German.* Tübingen: Niemeyer.

Harris, John
1990 Segmental complexity and phonological government. *Phonology* 7: 255–300.
1994 *English sound structure.* Oxford: Blackwell.
1997 Licensing Inheritance: an integrated theory of neutralisation. *Phonology* 14: 315-370.

Harris, John, and Jonathan Kaye
1990 A tale of two cities: London glottaling and New York City Tapping. *The Linguistic Review* 7: 251-274.

Hayes, Bruce
1989 The Prosodic Hierarchy in Meter. In *Rhythm and Meter*, Paul Kiparsky and G. Youmans (eds.), 201-260. Orlando, Florida: Academic Press.

Itô, Junko
1986 Syllable Theory in Prosodic Phonology. Ph.D dissertation, University of Massachusetts at Amherst.

Iverson, Gregory, and Joseph Salmons
1995 Aspiration and laryngeal representation in Germanic. *Phonology Yearbook* 12: 369-396.

Jensen, Sean
1994 Is ? an element? Towards a Non-segmental Phonology. *SOAS Working Papers in Linguistics and Phonetics* 4: 71-78.

Kaye, Jonathan
1992 Do you believe in magic? The story of s+C sequences. *SOAS Working Papers in Linguistics and Phonetics* 2: 293-313. Reprinted in *A Festschrift for Edmund Gussmann*, Henryk Kardela and Bogdan Szymanek (eds.), 155-176. Lublin 1996: Lublin University Press.
1995 Derivations and Interfaces. In *Frontiers of Phonology*, Jacques Durand and Francis Katamba (eds.), 289-332. London & New York: Longman. Also in SOAS Working Papers in Linguistics and Phonetics 3, 1993, 90-126.

Kaye, Jonathan, Jean Lowenstamm, and Jean-Roger Vergnaud
1990 Constituent structure and government in phonology. *Phonology* 7: 193-231.

Kijak, Artur
2005 Polish and English complex consonantal onsets: a contrastive analysis within the Government Phonology framework. Ph.D dissertation, University of Katowice.

Kirchner, Robert
1998 An effort-based approach to consonant lenition. Ph.D dissertation, University of California at Los Angeles. ROA.
2004 Consonant Lenition. In *Phonetically Based Phonology*, Bruce Hayes, Robert Kirchner and Donca Steriade (eds.), 313-345. Cambridge: Cambridge University Press.

Larsen, Bergeton Uffe
1998 Vowel length, Raddoppiamento Sintattico and the selection of the definite article in Italian. In *Langues et Grammaire II-III, Phonologie*, Patrick Sauzet (ed.), 87-102. Paris: Université Paris 8.

Lowenstamm, Jean
1991 Vocalic length and syllable structure in Semitic. In *Semitic Studies in Honor of Wolf Leslau on the occasion of his 85th birthday*, A.S. Kaye (ed.), 949-965. Wiesbaden: Harrassowitz.
1996 CV as the only syllable type. In *Current trends in Phonology. Models and Methods*, Jacques Durand and Bernard Laks (eds.), 419-441. Salford, Manchester: ESRI.
1999 The beginning of the word. In *Phonologica 1996*, John Rennison and Klaus Kühnhammer (eds.), 153-166. La Hague: Holland Academic Graphics.
2002 A note on the segmental identification of templatic sites. Ms, University Paris 7.

Neeleman, Ad, and Hans Van De Koot
2006 On syntactic and phonological representations. *Lingua* 116: 1524-1552.

Nespor, Marina, and Irene Vogel
1979 Clash Avoidance in Italian. *Linguistic Inquiry* 10: 467-482.

Orwin, Martin
1993 Phonation in Somali Phonology. In *Anthropologie somalienne: Actes du IIè Colloque des Etudes Somaliennes*, Mohamed Cabdi (ed.), 251-257. Besançon: Université de Besançon.

Pagliano, Claudine
2003 L'épenthèse consonantique en français. Ce que la syntaxe, la sémantique et la morphologie peuvent faire à la phonologie. Ph.D dissertation, Université de Nice.

Piggott, Glyne
1999 At the right edge of words. *The Linguistic Review* 16: 143–185.
2003 The phonotactics of a "Prince" language: a case study. In *Living on the Edge. 28 Papers in Honour of Jonathan Kaye*, Stefan Ploch (ed.), 401-425. Berlin: Mouton de Gruyter.

Pöchtrager, Markus
2001 Finnish Consonant Gradation. MA thesis, University of Vienna. SCH.

Rizzolo, Olivier
2002 Du leurre phonétique des voyelles moyennes en français et du divorce entre Licenciement et Licenciement pour gouverner. Ph.D dissertation, Université de Nice.

Rowicka, Grażyna
1999 On Ghost vowels. A Strict CV Approach. Ph.D dissertation, Leiden University.
2003 /r/ syllabicity: Polish *versus* Bulgarian and Serbo-Croatian. In *Living on the Edge. 28 papers in honour of Jonathan Kaye*, Stefan Ploch (ed.), 511-526. Berlin, New York: Mouton de Gruyter.

Scheer, Tobias
1999 A theory of consonantal interaction. *Folia Linguistica* 32: 201-237.
2000 De la Localité, de la Morphologie et de la Phonologie en Phonologie. Habilitation thesis, Université de Nice.
2004a *A Lateral Theory of Phonology. Vol.1: What is CVCV, and why should it be?* Berlin: Mouton de Gruyter.
2004b How minimal is phonological change? *Folia Linguistica Historica* 25: 69-114.
2007 On the Status of Word-Initial Clusters in Slavic (And Elsewhere). In *Annual Workshop on Formal Approaches to Slavic Linguistics. The Toronto Meeting 2006*, Richard Compton, Magdalena Goledzinowska and Ulyana Savchenko (eds.), 346-364. Ann Arbor: Michigan Slavic Publications.
2008a Why the Prosodic Hierarchy is a diacritic and why the Interface must be Direct. In *Sounds of Silence: Empty Elements in Syntax and Phonology*, Jutta Hartmann, Veronika Hegedüs and Henk van Riemsdijk (eds.), 145-192. Amsterdam: Elsevier.
2008b Syllabic and Trapped Consonants in (Western) Slavic: the Same but yet Different. In *Formal Description of Slavic Languages: The Fifth Conference, Leipzig 2003*, Gerhild Zybatow, Luka Szucsich, Uwe Junghanns and Roland Meyer (eds.), 149-167. Frankfurt am Main: Lang.

Scheer, Tobias (continued)

forth *A Lateral Theory of Phonology. Vol.2. Interface: How morpho-syntax talks to phonology. A survey of extra-phonological information in phonology since Trubetzkoy's Grenzsignale*. Berlin: Mouton de Gruyter.

Ségéral, Philippe

forth Remarques sur le vocalisme atone en gallo-roman. In *Approches de la variation linguistique gallo-romane*, Mario Barra-Jover, Guylaine Brun-Trigaud, Jean-Philippe Dalbera, Patric Sauzet and Tobias Scheer (eds.).

Ségéral, Philippe, and Tobias Scheer

1999 The Coda Mirror. Ms, slightly less evolved English version of Ségéral and Scheer 2001a. SCH.

2001a La Coda-Miroir. *Bulletin de la Société de Linguistique de Paris* 96: 107-152. SCH.

2001b Les séquences consonne + yod en gallo-roman. *Recherches Linguistiques de Vincennes* 30: 87-120. SCH.

2001c Abstractness in phonology: the case of virtual geminates. In *Constraints and Preferences*, Katarzyna Dziubalska-Kołaczyk (ed.), 311-337. Berlin & New York: Mouton de Gruyter. SCH.

2005 What lenition and fortition tells us about Gallo-Romance *Muta cum Liquida*. In *Romance Languages and Linguistic Theory 2003*, Twan Geerts, Ivo Van Ginneken and Haike Jacobs (eds.), 235-267. Amsterdam: Benjamins. SCH.

2007 Le statut syllabique multiple des séquences muta cum liquida: l'exemple du gallo-roman. In *Etudes sur le changement linguistique en français*, Bernard Combettes, Christiane Marchello-Nizia and Sophie Prévost (eds.), 261-282. Nancy: Presses Universitaires de Nancy. SCH.

Seigneur-Froli, Delphine

2003 Diachronic consonant lenition and exotic word-initial clusters in Greek: a unified account. In *Studies in Greek Linguistics. Proceedings of the 23rd annual meeting of the department of linguistics*, M. Stavrou-Sifaki and A. Fliatouras (eds.), 345-357. Thessaloniki: University of Thessaloniki. SCH.

2006 Le Statut phonologique du début de mot grec. Lénitions consonantiques et libertés phonotactiques initiales dans la diachronie de la langue commune et dans le dialecte de Lesbos. Ph.D dissertation, Université de Nice. SCH.

Sloan, Kelly

1988 Bare-consonant reduplication: implications for a prosodic theory of reduplication. *Proceedings of the West Coast Conference on Formal Linguistics* 7: 319-330.

Smith, Jennifer

2002 Phonological Augmentation in Prominent Positions. Ph.D dissertation, University of Massachusetts.

2004 Making constraints positional: Toward a compositional model of CON. *Lingua* 114: 1433-1464.

Steriade, Donca

1997 Phonetics in Phonology: The case of Laryngeal Neutralization. Ms, University of California, Los Angeles.

Szigetvári, Péter
1999 VC Phonology: a theory of consonant lenition and phonotactics. Ph.D dissertation, Eötvös Loránd University Budapest. SZIG.
to appear Manner as a skeletal relation. In *Phonologica 2002: Structure and Melody, Proceedings of the 9th International Phonology Meeting*, Friedrich Neubarth, Markus Pöchtrager and John Rennison (eds.). Berlin: de Gruyter.
Szigetvári, Péter, and Tobias Scheer
2005 Unified representations for the syllable and stress. *Phonology* 22: 37-75.
Vijayakrishnan, K.G
2003 Weakening processes in the Optimality Framework. In *The Phonological Spectrum. Vol I: Segmental Structure*, Harry van der Hulst, Vincent van Heuven and Jeroen van de Weijer (eds.), 241-255. Amsterdam: Benjamins.
Wiese, Richard
1996 *The Phonology of German*. Oxford: Oxford University Press.
Wilson, Stephen
1986 Metrical Structure in Wakashan Phonology. In *Proceedings of the Twelfth Annual Meeting of the Berkeley Linguistics Society*, Vassiliki Nikiforidou, Mary Van Clay, Mary Niepokuj and Deborah Feder (eds.), 283-291. Berkeley: Berkeley Linguistics Society.
Zec, Draga
1995 Sonority constraints on syllable structure. *Phonology* 12: 85-129.
Ziková, Markéta
2007 Czech syllabic consonants revisited. Paper presented at *Formal Description of Slavic Languages 7*, Leipzig 1st December.
Zoll, Cheryl
2004 Positional Asymmetries and Licensing. In *Optimality Theory in Phonology: a Reader*, John McCarthy (ed.), 365-378. Oxford: Blackwell. ROA #282.