Vestigial Feet in French

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0. Introduction.

This paper offers an OT analysis of strong prosodic positions in contemporary French and claims that a specific type of trochee (a modified version of the French foot proposed by Selkirk 1978) still regulates a large (schwa-related) portion of the word-internal phonology. To account for the behavior of French schwa, three goals must be attained: 1) prosodization: correctly define foot domain and foot form, 2) latency: establish whether or not the prosody dictates that schwa must be realized, and if it must, 3) specification: determine featural information.

The organization of the paper reflects this approach. Section 1 explains the distinction that must be made between strong prosodic positions and actual phonetic stress, while section 2 provides a quick overview of the data. Then the three goals are addressed in the order given above: delimitation of the prosodic domain in section 3, treatment of latency in OT in section 4, and featural specification in section 5. The strongest justification for this approach comes from the patterning of tonic and countertonic schwas, as shown in sections 6 and 7.

1. 'Phonetic' stress vs. 'phonological' stress in French

Prosodic leveling in the history of French has resulted, in most cases, in the disappearance of word-stress and its replacement by a simple mechanism of phrasal demarcation. Even (super-imposed) affective stress adopts a Germanic-like word-initial behavior, which owes nothing to the prosody of the trochaic mother language. It is useful to provide a quick characterization of primary stress in French, in order to distantiate it from the deeper, "more phonological" stress which justifies the existence of vestigial feet.

Primary stress in French is phrasal, demarcative and fixed. Stress-groups are built on the basis of:1) the grammatical nature of words (content words, always stressable vs. function words stressable only under special circumstances), 2) the strength of syntactic boundaries, and 3) semantic relationships. Stress is assigned to the final syllable of stress groups, but modulations for eurhythmicity / disrhythmicity are sometimes required to avoid clashes. The average size of stress groups is seven syllables. Corpus statistics from spontaneous speech (Wioland 1984) indicate that lengthening occurs in 90% of stress-group-final syllables, while F0-variation occurs in 45% of stress-group-final syllables and intensity variation (usually weakening) occurs in 66% of stress-group-final syllables. No secondary stress is to be observed (various claims of antepenultimate secondary stress (Verluyten 1988 and references therein) are severely misguided) but several mechanisms compete for "mise en relief" (emphatic stress, also called emotional , affective, "accent d'insistance" etc...). Emphasis usually forces the stressing of the first onset-initial syllable of: 1) the first stressable word in a stress-group: stylistic stress, 2) any word (including function words): semantic stress, 3) any stressable word in a stress-group: emphasis proper. For the relationship between accentuation and intonation, the reader is referred to Delais-Roussarie (1995) and subsequent work and to Di Cristo (1998). The exact acoustic correlates of primary vs. emphatic stress differ, as shown in (1) (Wioland 1991):

(1) Acoustic correlates of primary vs. emphatic stress

	primary	*emphatic*
intensity	weaker	stronger
F0-variation	glissando	abrupt
duration	much longer	slightly longer

This means that a word like *relèvement*, pronounced [rœlɛvmã] can phonetically undergo two types of stresses: phrasal stress will generate [rœlɛv<u>mã</u>], if the word happens to be phrase-final, while emphatic stress will generate [<u>rœl</u>ɛvmã], if the word happens to receive emphasis. This paper is interested in a third type of prosodic prominence, sometimes called 'phonological stress', which predicts why the schwa vowel of the medial syllable shows up as [ɛ], rather than [œ], [ø] or zero.

From a historical point of view, a singular process of attrition can be observed in the evolution of French prosody. Latin primary stress was characterized as a moraic trochee, whose domain of application was modulated by extrametricality, while secondary stress was still trochaic, but quantity-insensitive (for various analyses of Latin stress, see Hayes 1995, Jacobs 2000, Mester 1994, among many others). Word-stress in Old French was still trochaic, but had already degenerated to a syllabic trochee, with no extrametricality (due to erosion factors), and very weakened secondary-stress effects. Some have argued that in Modern French, nothing remains of this older state of affairs, that word-stress has entirely disappeared and that any correct characterization of contemporary stress must refer exclusively to the phrase level. This paper challenges that notion, and argues, on the basis of the distributional properties of schwa, that vestigial feet still make their presence felt in the synchronic behavior of Modern French.

In the history of French linguistics, many references can be found to the claim that French, like the majority of Romance languages, is entirely syllable-based. Selkirk (1977) challenged that tradition and suggested that French prosody is controlled by feet. Indeed, while sequences of consecutive schwas abound in the input, there are no cases, except in fast speech, where two consecutive schwas both fail to show up in the output. These strong / weak effects suggest that feet are at work, but a special acceptation of the concept of 'weak' syllable must be agreed upon. Selikirk's 'French foot' is coextensive with the syllable, except in cases where it can be expanded to strong syllable + syllable with a schwa. This led to a redefinition of the concept of closed syllable and to the statement that 'a vowel in a closed syllable is a vowel which is not final in the foot'.

Anderson (1982) also introduces a metrical analysis of schwa and uses the concept of schwa as a null segment - first applied to the analysis of French schwa by Meg Withgott (1977) -, and its prosodic consequence, the concept of weak syllable, revised again to mean: deficient syllable. But Anderson makes no use of higher prosodic units, and in fact has strong words against Selkirk's approach, stating - quite correctly - that Selkirk (1978) does not address the problem of the underlying representation of schwa, and that the new interpretation of a closed syllable is untenable. He further states (1982:571): "if the foot corresponds to a phonetically real unit of timing, it would appear realistic to suggest that in a 'syllable-timed' language (as French is sometimes asserted to be), foot structure is essentially trivial: each foot consists of a surface syllable. Some syllable-timed languages may have more complex or abstract notions of the foot, but French appears to provide no motivation for anything of the sort."

In his own syllabic analysis, Anderson is led to postulate a resyllabification rule, namely CV.Cschwa --> CVC.schwa, which allows him to generalize: "schwa is not pronounced when it is in a syllable with no phonetic content", but which flies in the face of markedness and is not well-supported within the context of Romance. Resyllabification ought to be the consequence of the non-surfacing of schwa, rather than its cause.

In this paper, I seek to elaborate on Selkirk's basic insight and maintain that the foot, however redefined, however vestigial, still has a role to play in French. From Anderson (1982) and a number of other researchers since, I adopt the notion of schwa as a null segment without repeating the arguments that justify it. I will contend that the main problem with Selkirk's original proposal consists in its misrepresentation of the *domain* of footing. My proposal - already developed in a derivation framework in Montreuil 1995 - is twofold: 1) the prosodic domain within which feet are active must be restricted, and 2) the Selkirkian foot must be extended to include sequences of two deficient syllables.

2. Overview of the data

The symbol [ə] should never be used in phonetic transcriptions of French: strictly speaking, the term 'schwa' is a misnomer since French schwa never refers to a reduced vowel, as [ə] does in most languages. If pronounced, 'schwa' is a full front mid rounded vowel: [e], [ɛ], [ø] or [œ] under stress (depending on the type of syllable it occurs in), or anywhere in between high mid and low mid when unstressed[1]. Schwa is thus a term for an unstable vowel, primarily defined by alternations. In (2), the [œ] in *beurre* is stable, so is the [e/ɛ] in *cède* (its height variation is due to Mid Vowel Adjustment). The first vowel in *mène*, however, alternates between [œ], [ɛ] and zero: it is a schwa.

(2)

stable [œ]	stable [ɛ]	schwa
je beurre [bœr]	*je cède* [sɛd]	*je mène* [mɛn]
pour beurrer [bœre]	*pour céder* [sede]	*pour mener* [mœne]
nous beurrons [bœrõ]	*nous cédons* [sedõ]	*nous menons* [mnõ]

Schwa is a chameleon and defines itself through its ability to alternate with zero, either as [œ] vs. zero, or as [ɛ] vs zero, as shown in (3):

(3)

	deleting environments		stabilizing environments	
zero / [œ]:	[pluz]	*la pelouse*	[pœluz]	*une pelouse*
	[gisku]	*Guy secoue*	[marksœku]	*Marc secoue*
zero / [ɛ]:	[alte]	*haleter*	[alɛt]	*halète*

Furthermore, there are prosodic positions where schwa can never be deleted. In those cases, schwa can be manifested by [œ] / [ɛ] alternations, as shown in (4), which do not occur with stable /œ/: [sœl] *seule*, never *[sɛl], or stable /ɛ/: [sɛk] *sec*, never *[sœk].

(4)

[œ] / [ɛ]:	[krœvõ]	*crevons*	[krɛv]	*crève*

[1] The height of all French mid vowels is unspecified in unstressed position. For convenience, I will use [œ] in these contexts

Finally, three-way alternations occur, as in (5):

(5)

zero / [œ] / [ɛ]:	[lve] / [lœve] / [lɛvra]	*levé / (pour) lever / lèvera*

The presence of consecutive schwas within a word is also observed. A word like *semelle* Eng. 'sole' arguably contains three schwas[2]. This can be established from a comparison of *semelle* with the derived form *ressemeler* Eng. 'to resole a shoe': [sœmɛl] in *une semelle* vs. [smɛl] in *la semelle* establishes the schwa identity of the first vowel, while [rœsœmle] in *ressemeler* shows that the second vowel is a schwa as well.

3. Prosodization: Minimal prosodic domains and strong prosodic positions

Phonologists often disagree on the amount of prosodic structure which, if any, must be included in the lexicon (in the input). But if it is agreed that systematic aspects of a language should be expressed by its grammar, then prosodic structure in French needs not be lexical; it can be incorporated into the grammar provided the Minimal Prosodic Domain (MPD) be correctly defined. Its definition results directly from the interaction of prosody and morphology, in the spirit of Inkelas (1988). The MPD in French consists of a free form, a minimal stem. This most often means nominal / adjectival roots plus those verbal roots which end in a vowel, as shown in (6).

(6)

MPD:	*trou*	| tru |	'hole'	*troua*	| tru | a	'pierced'
	chant	| ʃ̧ã |	'song'	*chanter*	*| ʃ̧ãt | e	'to sing'

In (6), [tru] constitutes a proper MPD, as indicated by the notation in vertical bars: | tru |. In derivational theory (DT), syllable-building would apply to | tru |, and in a second step would incorporate the [a] verbal desinence, thereby creating a bisyllabic output [trua] (contrasting with the monosyllabic [trwɑ] pronunciation of *trois*, generated in a single step). In [ʃ̧ãte], however, *| ʃ̧ãt | does not constitute a proper MPD and in DT, syllable-building must be delayed until the desinential vowel [e] is added: [e] functions as a "prosodizer", i.e. it frees the morpheme and creates an MPD. The point of this paragraph is precisely that *schwas are prosodizers*.

[2] Or possible only two. This paper does not concern itself with the controversial issue of final schwas, but see Montreuil 1998.

Prosodization must properly align the MPD to the morphology of the word (section 3.1.) and align the feet within the MPD (section 3.2.).

3.1. MPD alignment

The delineation of the prosodic domain within which French feet still participate in phonology can be expressed most simply by recognizing two alignments constraints: Align (MPD, L, PhW, L), henceforth L(EFT)-ALIGN, which aligns the left edge of the domain to the left edge of the phonological word and Align (MPD, R, Stem, R), henceforth R(IGHT)-ALIGN, which aligns the right edge of the domain to the right edge of the minimal free stem. To illustrate, the word like *allaitement* [alɛtmã], with a stable /ɛ/ (as shown by its verbal source: [alɛte] *allaiter*) has the morphological structure given in (7):

(7) Morphological structure of *allaitement*:
prefix: *a(l),* root: *lait,* 'milk', prosodizer: **schwa**, suffix: *ment*
MPD = | l ɛ t - | (read - as schwa)

In Tableau 1, where schwa is represented by a hyphen, several possible alignments are considered. Long vertical bars indicate MPD boundaries. Candidate b. emerges as the winner, since it is properly aligned on both sides:

/ a l ɛ t - m ã /	R-ALIGN	L-ALIGN
a. | a lɛt - mã |	**	
☞ b. | a lɛt - | mã		
c. | a lɛt | - mã	*	

Tableau 1. *allaitement* [alɛtmã] with a stable /ɛ/

L-ALIGN plays a minimal role: it only ensures that some prefixes will be excluded from the MPD[3]. I follow here the definition of the left edge of the phonological word in French given in Hannahs (1995). In *allaitement*, it makes no difference whether the 'old' prefix *a(l)-* is prosodized or not; but in a word like *ressemeler*, mentioned above, the semi-productive prefix *re-* must be excluded from the MPD. See section 7 for more discussion.

[3] Like English, French makes a distinction between deep, unproductive suffixes which through lexicalization have become soldered to the root, and more peripheral suffixes which retain prosodic independence.

R-ALIGN plays a much more vital role: consonant-initial suffixes are excluded, like the *-ment* in *allaitement*, but vowel-initial suffixes function as prosodizers: for instance *laitage* (n.), also derived from *lait*, functions as a minimal domain. It is important to note that words like *allaitement* provide no clue as to the domain of footing. Whether feet are restricted to the MPD: (a) (l ɛ t -) m ã, or not (a) (l ɛ t -) (m ã), and in DT whether they are built from the right or from the left, the same output is predicted: [alɛtmã]. However, the motivation for a restricted domain as well as for an extension of the Selkirkian foot becomes apparent a soon as two sequences of two deficient syllables are considered.

Indeed, there exist many words which show a / C + schwa + C / root followed by a schwa prosodizer: these words need to be footed. A good example would be *halètement*, which is homophonous with *allaitement*, but has no prefix, and two consecutive schwas in the MPD. It alternates with *haleter* [alte]. Its morphological structure is as given in (8), where <h> indicates that 'h' is not pronounced and again schwa is represented by a hyphen:

(8) Morphological structure of *halètement*:
root: *<h>al-t*, Eng. 'pant', prosodizer: **schwa**, suffix: *ment*
MPD = | a l - t - |

3.2. Foot alignment

To prosodize *halètement* correctly in OT, the following constraints on foot-alignment and foot-form need to be recognized:

ALIGN MPD-L (= Align, MPD, left, foot, left)
to the left edge of the MPD, align the left edge of a foot
ALIGN MPD-R (= Align, MPD, right, foot, right)
to the right edge of the MPD, align the right edge of a foot
PARSE-σ: syllables are parsed into feet
RIGHTMOST: The headfoot is rightmost in MPD
FT-BIN: Feet are binary

The alignment constraints are uncontroversial. The ranking of ALIGN-MPD-R over ALIGN-MPD-L ensures that prosodizers are footed and corresponds to what a prosody-building DT theory calls the right-to-left directionality of feet. Footform constraints[4] however, need clarification, since foot-binarity (FT-BIN) takes here a

[4] Footform constraints also include high-ranked TROCHEE: (= feet are left-dominant), not included in Tableau 2.

special meaning. The normal understanding of FT-BIN is that it will be satisfied by <u>H</u>, <u>H</u>L and <u>L</u>L and violated by L, <u>H</u>H, <u>H</u>LL, <u>L</u>LL etc.... Here, "FT-BIN" is satisfied by σ, σ σ', and σ' σ'. It is violated by σ' (which define too small a domain), and by σ σ, σ σ' σ', σ' σ' σ' etc.. (which define too large a domain). This is distributionally similar to the traditional concept of binarity, except that H would correspond to a full syllable and L to a deficient syllable[5]. This is of course precisely what makes the Selkirkian foot different.

/ a l - t - /	RIGHT MOST	"FT-BIN"	ALIGN-MPD-R	PARSE-σ	ALIGN-MPD-L
a. (a) (l -) (t -)		**			
b. a l - t -	*		*****	***	*****
c. (a l - t -)		*			
d. (a l -) (t -)		*			
e. (a l -) t -			**		
☞ f. $(a)_w (l - t -)_s$					
g. $(a)_s (l - t -)_w$	*				
h. a (l - t -)				*	*

Tableau 2. Footing *halète* (two schwas in the MPD)

Tableau 2 shows how an MPD such as | a l - t - | which contains two consecutive schwas must be footed. The worst candidate is b, where no attempt at footing is made.Candidates a, c and d display feet that are either too large or too small, while e fails to align properly on the right. The optimal candidate is f, which obeys all the constraints. Candidate g has the same two feet as f, but in a strong - weak sequence and violates RIGHTMOST. Indeed French shares with English the phenomenon of reversal of dominance: feet are left-dominant but the word-structure is right-dominant. Finally, candidate h emerges as the second best, since it incurs only minor violations, showing that in words of this configuration, nothing phonetic depends on the footing of initial syllables. Longer words, however, as shown in sections 6 and 7, demonstrate the need for exhaustive footing within the MPD.

Because it illustrates the mechanism of footing within the MPD, Tableau 2 reflects the phonology of all the words that share that MPD. Since a suffix like -*ment* is outside the MPD, the schwas in *halètement* 'panting, n.' and *halète* 'pants, v.' behave in an identical manner. Failing to restrict footing to the MPD (ex:

[5] Throughout this paper, I adopt the following convention: σ refers to a full syllable, while σ' refers to a deficient syllable, i.e. a syllable with an empty rime.

footing (a) (l-t-) (mã) would convert the first schwa to a countertonic schwa and predict the wrong realization for it, as will be shown in section 7.

The infinitive form *haleter* 'to pant' has a different prosody altogether, since the desinential [e] serves as the prosodizer, making the MPD coextensive with the word. Its optimal footing will be (a l -) (t e), as shown in Tableau 3.

/ a l - t e /	RIGHT MOST	"FT-BIN"	ALIGN-MPD-R	PARSE-σ	ALIGN-MPD-L
a. (a) (l -) (t e)		*			
b. a l - t e	*		*****	***	*****
c. (a l - t e)		*			
d. (a l -)$_s$ (t e)$_w$	*				
e. (a l -) t e			**		
☞ f. (a l -)$_w$ (t e)$_s$					

Tableau 3. Footing *haleter* (MPD = word)

It was pointed out earlier that the high ranking of rightmost and trochee ensures that final feet are the strongest within the MPD, while initial syllables are the strongest within the foot. This effectively enforces a three-position scale of prosodic strength within the MPD, corresponding to prosodic strength values as they could be encoded in a grid-like framework. This is illustrated in (9) with the word *Geneviève*, where all nuclei are x'ed at level 1, all footheads are x'ed at level 2, and only the head of the rightmost foot is x'ed at level 3:

(9)

Geneviève Input: four syllables, two feet (w + s)
Output: two syllables [ʒœnvjɛv]

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PS3                              x
PS2          x                   x
PS1        (  x     x)       (   x     x)
           [ ʒ ø . n - ] f   [ v j ɛ . v - ] Φ
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4. Latency: schwa as a null segment

Null segments are clearly phonological aberrations, which any acceptation of markedness should unambiguously penalize. In purely phonetic terms, the notion of "empty vowel" is obviously meaningless. Yet they have been posited in a number of different languages and their existence as a phonological construct is not in question (see for instance Marlett & Stemberger 1983 on Seri, Hualde 1992 on Aranese, Rubach 1995 on Slavic yers, and for more references Montreuil 1996 and Zoll 1998). They are metrical positions unassociated to segmental information. French schwa is such an abstraction. In OT terms, it is abstract precisely in the sense that no phonetic output can be considered as faithful to the input. Schwa always needs resolution. Schwa / vowel alternations can never be the result of simple deletion or simple epenthesis.

In French, null segments can either be left alone or 'resolved' 1) by deleting of the metrical position and its association to the prosody (structural deletion), or 2) by providing featural information (filling up the matrix through segmental epenthesis). To appreciate what the resolution of a null segment entails, it is instructive to make a brief parallel with the well-known case of 'h-aspiré' in French, commonly analyzed structurally as an empty onset. Its presence at the suprasegmental level is motivated by the facts summarized in (10). The first three criteria (elision, liaison, suppletion) refer to sandhi phenomena which are responsive to the presence of onsets[6].

(10)

	V-initial *ache, f.* *or, .m.*	h-aspiré *hache, f.* *hors-bord, m.*	C-initial *tache, f.* *tort, m.*
elision	yes *l'ache* [laʃ]	no *la hache* [laaʃ]	no *la tache* [lataʃ]
liaison	yes *en ache* [ãnaʃ]	no *en hache* [ãaʃ]	no *en tache* [ãaʃ]
suppletion	long *cet or*	short *ce hors-bord*	short *ce tort*
preceding schwa	no *et l'or* [elɔr]	yes *et le hors-bord* [elœɔrbɔr]	no *et le tort* [eltɔr]

H-aspiré words mostly originate from Germanic and synchronically exhibit one of three types of behavior in contemporary Oïl dialects, as shown in (11). The most

6 The fourth criterion in Figure 4, with respect to which h-aspiré words differ from consonant-initial words, is included in order to show that positing empty onsets provides only partial answers to the problem of h-aspiré. There is an extensive literature on the topic, but this complication does not invalidate the line of argumentation concerning null segments.

conservative dialects, in the north and in the east, where the penetration of Germanic was the deepest, have retained a full aspiration or merged [h] with some other consonant within their system, usually [r]. Standard French represents a transitional stage, at which the segmental information has been deleted but the suprasegmental information is left untouched, hence the synchronic abstraction. Innovative Western dialects have undergone deletion and disposed of the suprasegmental structure as well, with the result that all h-aspiré words pattern after vowel-initial words.

(11)

Western dialects *en haut* [ãno]	Standard French *en haut* [ão] 'up'	Northern, Eastern dialects *en haut* [ãho, ãro] etc..
Nuc | [o]	Ons Nuc | o	Ons Nuc | | [h] [o]
DEP-VRN, LIC >> MAX-STRUC	MAX-STRUC, DEP-VRN >> LIC	LIC, MAX-STRUC >> DEP-VRN

In OT, leaving a null segment unresolved violates some licensing constraints (here generic LIC). Deletion and insertion here refer to partial therapies, as explained. Deletion violates MAX-STRUC (suprasegmental-only deletion) while insertion violates DEP-VRN (segmental-only insertion).

LIC = metrical units must be associated to features
MAX-STRUC = do not delete structure
DEP-VRN = do not insert vowel root-nodes

Unlike h-aspiré, however, schwa cannot be left unresolved. The fact that schwas are normally not heard reflects the domination of DEP-VRN over MAX-STRUC. But schwas will be heard if they occur in 'stabilizing contexts', in which case a prosodic or phonotactic constraint dominates DEP-VRN > MAX-STRUC.

In (2), the word *mène* was chosen to illustrate the allophony of schwa. We are now account for it. The input of *mène* is / m - n - /. Its second schwa is never realized, as a result of DEP-VRN > MAX-STRUC. Due to its prosodic prominence, its first schwa always corresponds to a vowel in the output (whatever its exact specification: in tableau 4, V will suffice). The prosodic constraint which dominates DEP-VRN is MAXFOOTHEAD.

MAXFOOTHEAD = do not delete the head of a foot

/ m - n - /	MAXFOOTHEAD	DEP-VRN	MAX-STRUC
mVnV		**	
☞ mVn		*	*
mnV	*	*	*
mn	*		**

Tableau 4. Latency (*mène* [mɛn])

5. Specification

This section explains the details of how the phonetics of schwa respond to the flexibility of the prosody - morphology interface and how OT can account for all its occurrences and the colors it assumes.

Once the prosodic structure of the word is correctly generated and the mechanism of latency is allowed to operate as shown above, the grammar is able to determine whether schwa should be pronounced or not (which is a matter of faithfulness). It is also equipped to deal with specification proper, i.e. to explain exactly how it will be pronounced (as expressed mostly by markedness).

There are two types of constraints which contribute to the specification of schwa: 1) *segmental* or linear constraints, which regulate the phonotactics of the speech chain[7]. - we are not concerned with segmental contexts in this paper - and 2) *prosodic* constraints, which merely look at the position of schwa in the foot and the MPD. These prosodic constraints refer to the prosodic strength numbers (PS1, PS2, PS3) illustrated in (9). They conspire to match position and outputs as shown in (12)[8]:

[7] A well-established example of such constraints translates what is known under the name of *la loi des trois consonnes*. By this principle (which is submitted to infinite stylistic, sociolinguistic and pragmatic variations), schwa is stabilized when preceded by two consonant and followed by at least one consonant, as in *garnement* [garnœmã] 'urchin'. Another well-kown stabilizing context arises when schwa is preceded by one consonant and followed by a liquid + glide sequence as in *(nous) voterions* [vɔtœrjõ] '(we) would vote'. There are others.

[8] Figure (12) simplifies the data in so far as schwa in weak branches of weak feet is somewhat more fragile than schwa in weak branches of strong feet. As suggested in footnote 2, several phonologists of French in fact refuse to believe that there may be 'final schwas' (such as the last schwa in *Geneviève* - see (9) -).

(12)

Outputs:

PS3: strong branch of strong feet: schwa = [ɛ]
PS2: strong branch of weak feet: schwa = [œ]
PS1: weak branch of strong feet: schwa = zero
PS1: weak branch of weak feet: schwa = zero

When pronounced, schwa always corresponds to a front mid vowel in the output, but it may be rounded or unrounded. Since there are no features in the input, any account of the exact pronunciation of schwa with respect to rounding will have to show how featural constraints must interact with MAXFOOTHEAD. Specifically, we must make use of *[MFR], a phonetically well-motivated markedness constraint.

*[MFR] = penalize mid front round vowels
*[MFR] > *[MF] = intrinsically penalize [ø] and [œ] more than [e]and [ɛ]

In any framework of feature analysis, mid front rounded vowels are more marked than their unrounded counterparts. The *[MFR] > *[MF] constraint ranking is well motivated on the basis of frequency of phoneme occurrence in French. Wioland (1991) gives the occurrence percentages of oral vowels compared to all phonemes, as shown in (13):

(13) Oral vowels in all positions

e + ɛ	= 10,60%	o + ɔ	= 03,36%
a	= 08,55%	u	= 02,42%
i	= 05,11%	y	= 01,90%
ø + œ	= 04,31%		

Pure markedness will always favor [e / ɛ] over [ø / œ]. However, the 15th c. labialization rule has brought about the distribution of Modern French, whereby [ø] and [œ] are far more common than [e] and [ɛ] as a realization of schwa[9]. This forces an M&F conjunction , as shown in (14)

(14)

DEP-VRN&*[MF] > *[MFR] > *[MF]
DEP-VRN&*[MF] = penalize schwa as [e] or [ɛ]

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[9] This fact differentiates Standard French from the northern dialects, which prefer [e] for schwa in all positions. Compare Standard French [ynpœtitfij] with Norman [œnpetitfil] *une petite fille* 'a little girl'.

This is the grammar we obtain if prosodic prominence is not factored in. However, since all French schwas do not correspond to [ø / œ] in optimal outputs. French epentheis, however, it is clear that segmental epenthesis is modulated by prosodic strength. A parallel can be drawn to English epenthesis, which selects different vowels as dictated by prosody (Borowsky 1986, Harris 1994, Yip 1987 and others). If the comparative statistics cited in (14) are now limited to stressed position, or even more precisely strong prosodic position (Montreuil 1992, modified from Malécot 1974), /e/-sounds reach the highest percentage (close to 34% of all vowels), while /ø/-sounds reach the lowest percentage (lower than 3%). As a result, different conjunctions emerge, as it appears that the occurrence of mid, front and round features with the highest positions in prosody, here POS3, is most heavily marked.

*[MFR]POS3 = penalize mid front round vowels in POS3

The crucial generalization is the following: even though on the one hand [ø] and [œ] can occur under stress and on the other hand can be a frequent realization of schwa, they can never be optimal outputs for schwa under stress. The most direct way to express this generalization is to conjoin *[MFR] POS3 with DEP-VRN. This conjunction is undominated.

*[MFR] POS3&DEP-VRN: no [œ] as schwa in strong feet.

The outputs corresponding to an input like /m-n-/ can now be evaluated with more precision: the output [mɛːn] will emerge as optimal provided that *[MFR] POS3&DEP-VRN dominates DEP-VRN >> [MFR]POS3, as shown in Tableau (5).

/ m - n - /	MAXFOOT HEAD	DEP-VRN &*[MFR]POS3	DEP-VRN	MAX-STRUC	*[MFR]POS3
mnœ	*		*	*	
mn	*			**	
☞ mɛːn			*	*	
mɛːnœ			**		
mœnœ		*	**		*
mœn		*	*	*	*

Tableau 5. Interaction of latency and specification (*mène* [mɛːn])

6. Tonic schwas: three sample patterns

The term tonic schwas refers to schwas which are located in the last pronounced syllable of a word. All tonic schwas are heads of strong feet, even though the reverse is not true. Tableau (5) has shown why a schwa which is the head of a strong foot will always be realized as a mid front unrounded vowel. This is further illustrated in (15), where rt = root, pfx = prefix and sfx = suffix:

(15)

morphology	gloss	MPD	footing	phonetics
m-n $]_{rt}$ + -	'leads', v.	| m-n- |	(m-n-)	[mɛn]
ʒ-t $]_{rt}$ + -	'throws', v.	| ʒ-t- |	(ʒ-t-)	[ʒɛt]
ap-l $]_{rt}$ + -	'calls', v.	| ap-l- |	(a) (p-l-)	[apɛl]
pro $]_{pfx}$ + m-n$]_{rt}$ + -	'walks', v.	| prom-n- |	(pro) (m-n-)	[prɔmɛn]

This pattern could easily be extended to handle deverbal nouns such as *appel* 'call, n.' (homonymous with *appelle* 'calls, v.) or *jet* 'throw, n.' (compare with *jette* 'throws, v.'). Recall that, as opposed to verbal roots, nominal roots may constitute free domains even if they are consonant-final. This opens up a number of controversial issues which lie beyond the scope of this paper (and none of which invalidate the arguments made so far).

This extension could be most simply effected by defining a deficient syllable (σ') as a syllable which has an empty rime (as opposed to an empty nucleus).In this fashion, the | a p - l | MPD of nominal *appel* is footed exactly as the | a p - l - | MPD of verbal *appelle*[10], as shown in (16):

(16)

morphology	gloss	MPD	footing	phonetics
ap-l $]_{rt, stem}$	'call', n.	| ap-l |	(a) (p-l)	[apɛl]

Similarly, the same notion could be invoked in the analysis of alternations like *jet* [ʒe] 'throw, n.' vs. *jette* [ʒɛt] 'throws, v.', provided the structural representation of latent consonants is compatible with our understanding of a closed / open syllable.

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10 Here *appel*, n. is a free form, while the root of *appelle*, v. is a bound form and requires a schwa prosodizer.

The fact that [t] does not surface conditions the realization of schwa as [e] rather than [ɛ]. This is shown in (17), where a small superscript consonant indicates latency.

(17)

morphology	gloss	MPD	footing	phonetics
ʒ-^{t}]$_{\text{rt, stem}}$	'throw', n.	| ʒ-^{t} |	(ʒ-^{t})	[ʒe]

7. Countertonic schwas: three sample patterns

The term counter-tonic schwas refers to schwas which are not located in the last pronounced syllable of a foot, but still show some degree of prosodic prominence. Their behavior constitutes the strongest evidence for the presence of 'weak' feet, i.e. feet which are not MPD-final. The range of realizations of counter-tonic schwas can only be accounted for in a principled fashion if more than one foot is posited in longer MPD's. Three patterns, illustrated in (18), (19) and (20) will suffice to illustrate the relevance of prosodic strength.

All words in (18) have an MPD which is shorter than the word, since the suffix is not included. As a result, schwa is the head of a strong foot, as it was in (15), even though it is no longer a tonic schwa.

(18)

morphology	gloss	MPD	footing	phonetics
av-n]$_{\text{rt}}$ + - + mã]$_{\text{sfx}}$ m-n]$_{\text{rt}}$ + - + ra]$_{\text{sfx}}$ ap-l]$_{\text{rt}}$ + - + rɛ]$_{\text{sfx}}$	'advent', n. 'will lead' 'would call'	| av-n- | | m-n- | | ap-l- |	(a) (v-n-) (m-n-) (a) (p-l-)	[avɛnmã] [mɛnra] [apɛlrɛ]

A second pattern shows schwa in Pos2, i.e. as head of a weak foot. This regroups two morphological different word-types: 1) monomorphemic words like *Geneviève*, in which the initial schwa is stabilized as / œ /. OT predicts that *[ʒɛnvjɛv] and, after a vowel *[ʒnœvjɛv] are impossible pronunciations; and 2) bimorphemic words whose bound roots are followed by vowel-initial suffixes, thus making the MPD co-extensive with the word, as in *chevelure* (cf. **chèvelure, *la ch'velure*). This is further illustrated in (19):

(19)

morphology	gloss	MPD	footing	phonetics
ʒ-n-vjɛv(-)]$_{rt}$	'Genevieve'	| ʒ-n-vjɛv(-) |	(ʒ-n-) (vjɛv-)	[ʒœnvjɛv]
ʃ-v-l]rt + yr]$_{sfx}$	'head of hair'	| ʃ-v-lyr |	(ʃ-v-) (lyr)	[ʃœvlyr]

This understanding of the underlying morphology of words is crucial, especially in cases where words share the same phonotactics. Compare for instance *mènera* in (18) and *chevelure* in (19), which share a very similar sequence of C-C-CV(C). Yet, their initial schwas are not in the same prosodic position. Bimorphemic [mɛnra] has a consonant-initial suffix outside the MPD and a prosodizing schwa, hence its first schwa is [ɛ] in Pos3. Bimorphemic [ʃœvlyr] has a vowel-initial (prosodizing) suffix inside the MPD, hence its first schwa is [œ] in Pos2.

The point was made earlier that, because of the directionality of feet, the presence of prefixes does not interfere with the proper footing of MPD. Many words in this pattern illustrate the status of prefixes. For instance, *échevelé* 'disheveled' has the same root as *chevelure*. As explained above, it cannot be footed *(éche) (velé), which would yied *[ɛʃvle] or *(é) (cheve) lé, which would yield *[ɛʃɛvle]. But whether is footed é (cheve) (lé) or (é (cheve) (lé) is immaterial, both yielding the same pronunciation: [ɛʃœvle]. Prefixes rarely interfere with prosody in Romance languages. The specification of schwas will not be affected by them, even if they are vowel-final, for the same reason that in English, stress-assignment is mostly unaffected by prefixes. Similarly, *semelle*, mentioned in section 2, yields a verb *semeler* [sœmle] 'to sole a shoe', in which the first schwa is in Pos2. The addition of a prefix *re-* as in *ressemeler* [rœsœmle] 'to re-sole a shoe' does not alter the prosody of the basic stem. Many similar examples are discussed in detail from a linear point of view in Tranel (1983) and subsequent work and in Morin (1988).

Finally, a third pattern must be considered, in which the proper footing of an MPD leaves a deficient syllable to the left of a strong foot, as the *(se-)* syllable in *semelle* above. In such syllables, schwa is typically very unstable, and it is fair to say that it does not receive any degree of prosodic stabilization. The various strategies which could be designed to deal with this kind of prosodic situation (appended syllables, non-exhaustive footing, degenerate feet, etc...) will not be probed in this paper, essentially because they do not make different empirical predictions. In *semelle*, the fate of the first schwa is left entirely to the segmental constraints mentioned in footnote (7): for instance *la semelle* gives [smɛl], while *par semelle* gives [sœmɛl]. This is illustrated in (20):

(20)

morphology	gloss	MPD	footing	phonetics
s-m-l-]$_{rt}$ ʃ-val]$_{rt}$	'sole' 'horse'	| s-m-l- | | ʃ-val |	(s-) (m-l-) (ʃ-) (val)	[s(œ)mɛl] [ʃ(œ)val]

8. Conclusion

In this paper, I have made a number of claims regarding French phonology in general and strong prosodic positions in particular. In attempting to present a unitary account of the behavior of schwa which does not resort to suppletion, I have argued:

1) that the prosody-morphology interface determines the extension of the minimal prosodic domain in contemporary French,

2) that the ''Selkirkian' foot (full σ + deficient σ') operates in full force within this domain,

3) that, however, the foot operates *exclusively* within this domain, and that in that respect it is vestigial[11],

4) that the matrix specification of French schwa can be determined on the basis of foot structure, in a manner that opposes featural epenthesis and structural deletion: through featural epenthesis, schwas are /e/-type sounds in the strongest positions; otherwise, they surface as /œ/-type sounds. In the weakest prosodic positions (Pos1), they are not pronounced when no linear constraint stabilizes them: this is accomplished through structural deletion

5) that the foot must be extended to include two sequences of deficient syllables, as demonstrated by the behavior of countertonic schwas, and

6) that OT captures these facts mostly through common constraints. However, some constraints crucially must refer to the segmental level and the suprasegmental level separately. In addition, M&F conjunctions are required to handle the distribution of [+rnd] vs. [-rnd].

In a sense, arguing for the 'Selkirkian' foot (however modified) can be interpreted as adding to the typology of feet. This would clearly be an undesirable move, since it begs the question of knowing whether other languages recognize

[11] And that furthermore, many of the attacks that have been levied against the French foot (e.g. Tranel 1983) lose their force if its domain of application is well understood. The recognition that the MPD is so restricted means that it is quite possible to acknowledge the foot while maintaining that French is on the whole mostly syllable-timed (on this issue, see Wenk & Wioland 1982).

this unusual foot. However, this consideration must be tempered by a recognition of the vestigial character of the French foot. Selkirk's original work, and in its wake the present paper, does not so much posit a new foot as suggest a way in which an existing foot fades away.

The proposals made in this paper must be inscribed within the evolutionary context of the French foot. In order to find evidence of a French-like foot in other languages, similar circumstances would have to prevail. But this is rather unlikely: French prosody evolved (contracted might be a better word) under very unique historical circumstances, controlled by specific parameters of erosion. The nature of the French foot reflects this uniqueness.

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