The French Foot Revisited

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Abstract

This article aims to re-evaluate the relevance of the foot in French. After a critical review of the literature on the subject, with reference to both adult and child language, we argue that the prosodic structure of French is best understood within a grid-only framework. The model is couched in Stratal Optimality Theory and illustrated with naturalistic data drawn from southern French and Swiss French. Particular attention is paid to phenomena such as the *loi de position* and optional penultimate pitch accent, for which we show that syntagmatic constituency is unnecessary.

Keywords

1. Introduction

The issue of footing is very complex as it implies inducing hidden structure which is not directly recoverable from the speech signal.[*] While the foot is generally considered as one of the fundamental building blocks of the prosodic hierarchy (Nespor and Vogel, 2007 [1986]) and is widely held to be universal, there is little consensus on the rôle and status of this unit in French. Both trochees and iambs have been advocated, but typically to model different parts of the grammar, a situation which is nicely summed up by Montreuil (1994):

> A grammar which ignores final schwas, either on grounds of abstractness… or because its focus bears on low-level rules, e.g. the processes of prosodic morphology – truncation, reduplication, etc. … which apply too late in the derivation for final schwas to play any role, will tend to view French feet as iambic, while an account that involves final schwas in spite of their abstractness and focuses on higher level processes will be more prone to favor a trochaic approach. (Montreuil, 1994, p. 214)

This situation is further complicated by the sheer amount of variation found across the varieties of French. Our goal in this paper is to re-evaluate the relevance of the foot in this language. We argue that the prosodic structure of the French lexicon is best understood within a grid-only framework, in the spirit of Prince (1983), without assuming any kind of syntagmatic constituency.

The paper is organized as follows: Section 2 gives an overview of the facts and analyses that have been put forward to support the existence of trochaic and iambic feet in French, paying particular attention to the issues raised in each case; Section 3 discusses footing from the point of view of acquisition and shows that the empirical support in favor of a 'trochaic bias' is scarce at best; Section 4 develops an analysis of prosodic structure in Stratal Optimality Theory in light of data from European French drawn from the PFC programme (Durand et al., 2002, 2009).

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2. Footing in French

In this section, we offer a critical overview of the accounts of French footing that have been put forward.

2.1 The trochee

Durand (1976) is, to the best of our knowledge, the first (non-linear) treatment of the foot in French, although this unit was not labeled as such. Durand's concern was to account for mid vowel alternations in southern French. While northern hexagonal French has phonological oppositions among the mid vowels /e, ɛ, ø, œ, o, ɔ/ (see for instance Walker, 2001) we find no such contrast in southern French. Thus, pairs such as *épée* 'sword' ~ *épais* 'thick', *jeûne* 'fasting' ~ *jeune* 'young', *beauté* 'beauty' ~ *botté* 'kicked', which are minimal in northern hexagonal French, are homophonous in southern French and are realized [e.ˈpe], [ˈʒœ.nə] and [bo.ˈte], respectively. The distribution of mid (oral) vowels is governed by the *loi de position*, which can be stated as follows:

(1) The *loi de position*: a mid vowel is
    a. close in an open syllable
    b. open in a closed syllable or in an open syllable followed by a schwa-headed syllable
    (after Rizzolo, 2002, p. 11, translation ours)

Examples in (2) illustrate this pattern in word-final position in open syllables (2a), closed syllables (2b), and open syllables followed by schwa (2c), respectively.

(2)	a.	*panacée*	[pa.na.ˈse]	'panacea'
		paresseux	[pa.re.ˈsø]	'lazy (masc.)'
		haricot	[a.ri.ˈko]	'bean'
	b.	carrousel	[ka.ru.ˈzɛl]	'carousel'
		épagneul	[e.pa.ˈnjœl]	'spaniel (masc.)'
		espagnol	[ɛs.pa.ˈnjɔl]	'Spanish (masc.)'
	c.	*varicelle*	[va.ri.ˈsɛ.lə]	'chicken pox'
		épagneule	[e.pa.ˈnjœ.lə]	'spaniel (fem.)'
		espagnole	[ɛs.pa.ˈnjɔ.lə]	'Spanish (fem.)'

An important challenge for phonological theory has been to capture the generalization expressed by the disjunctive context of (1b). According to Durand's analysis, which was framed in Dependency Phonology (Anderson and Ewen, 1987), all vowels but schwa project a foot, whereas a schwa-headed syllable is adjoined to the syllable on its left, as illustrated in (3).

(3) Dependency representation of *cerceau* 'hoop' and *guerre* 'war' (adapted after Durand, 1976, pp. 17-18)
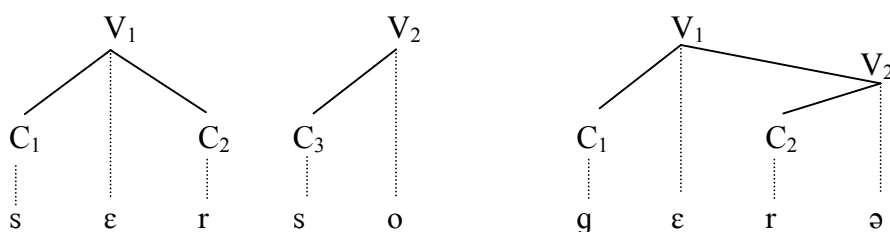
The intuition behind this approach is that there is a path in the graph which connects the head vowel and the following onset (which can be a consonant cluster, e.g *autre* [ˈɔ.trə] 'other'). This connection is either direct (dependence), in the case of a closed syllable, or indirect (subordination), in which case it is mediated by schwa by transitivity.[1] As the author points out, another way of stating this generalization is to consider that a vowel is realized mid open if it has a right-hand side dependent, whether it is a consonant (cluster) or a schwa – we shall come back to this interpretation in §4. Either way, it is important to keep in mind that mid vowel adjustment is triggered by the fact that the mid vowel has a right dependent, independently of its segmental quality. (see also Watbled 1995 for additional arguments drawn from Provençal borrowings in Marseilles.) The dependency approach elegantly captures the fact that lexical stress always falls on the last syllable (2a and 2b) except when it is schwa-headed (2c), in which case stress is penultimate: It suffices to say that stress is assigned to the right-most non-dependent head.

A very similar analysis was independently developed by Selkirk (1978) to explain the behavior of schwa in northern hexagonal French, in response to Morin's (1978) concrete account of this vowel. Selkirk's account is the first one to explicitly resort to the foot as a prosodic domain. This analysis has received considerable attention in the literature on French schwa; it has been widely criticized (Noske, 1982) and a number of enhancements over the original formulation have been proposed (Durand, 1986; Montreuil, 1994, 2002 *inter alia*). Selkirk's account is based on Dell's (1985 [1973]) derivational analysis of the phonology of his own idiolect. Dell postulates the existence of word-final schwas, which are involved in a number of morpho-phonological processes and which are deleted by an optional rule applying late in the derivation. These word-final schwas, which usually correspond to <e> in the spelling, are typically pronounced in southern French (cf. *assiette* 'plate' [a.ˈsjɛ.tə]) but do not normally appear in other varieties (*assiette* [a.ˈsjɛt]), unless their realization prevents the formation of complex clusters (e.g. *arbre cassé* 'broken tree' [ar.br(ə).ka.se]). Because she postulates the existence of such abstract schwas, Selkirk's underlying representations are very close to those postulated by Durand in southern French and indeed the two approaches share much in common. In addition, her approach yields an elegant treatment of the so-called 'closed syllable adjustment' (Dell, 1985 [1973]), a phenomenon whereby schwa alternates with /ɛ/ (e.g. *mener* 'to lead' [m(ə).ne] ~ *mène* 'lead (3rd pers. sg.)' [mɛn]; *appeler* 'to call' [a.p(ə).le] ~ *appelle* 'call (3rd pers. sg.)' [a.pɛl]) in a number of morphological contexts. According to Selkirk's analysis, a word such as *promène* 'wander (3rd pers. sg.)' is underlyingly /prɔmənə/ and is assigned the foot structure /(prɔ)$_\Sigma$.(mə.nə)$_\Sigma$/. The schwa which is the head of the trochee is then realized as [ɛ], yielding the surface form [prɔ.mɛ.n(ə)].

While the problem was not broached upon in early treatments, a proper analysis of footing must address the question of how the foot relates to higher levels of prosodic structure. The Strict Layer Hypothesis (Selkirk, 1984; Nespor and Vogel, 2007 [1986]) requires that feet be exhaustively

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1   Durand (1995) develops a more direct formalization of this approach where the onset of the schwa-headed syllable
     (e.g. /t/ in *dette* 'debt' [dɛtə]) is represented as ambisyllabic.

contained in a prosodic (or phonological) word (ω): This predicts that the application of footing is bounded by the prosodic word, which corresponds in French to a base + its suffix(es) (e.g. *écolier* 'school boy' /ekɔl + je/) or to a prefix (e.g. /ɑ̃ti/ in *anti-atomique* 'anti-atomic' [ɑ̃.ti.a.tɔ.mik]) (see Basbøll, 1978; Hannahs, 1995). This prediction is essentially correct: in varieties where the *loi de position* applies, /sC/ clusters are generally realized as heterosyllabic within a prosodic word (*despote* 'despot' [dɛs.pɔ.tə]) but are tautosyllabic when they are located at its left edge (*déstabiliser* 'to destabilize' /de#stabilize/ → [de.sta.bi.li.ze]), blocking the lowering of the preceding mid vowel. In addition, closed syllable adjustment is limited to the domain of the prosodic word. Thus the form *(se) démène* 'struggle (3rd pers. sg.)', which is assumed to have the structure /de#mənə/, is realized [de.mɛn] (see Durand, 1986; Montreuil, 2002).

As successful as it may be, the trochaic approach has been widely abandoned for the analysis of non-southern varieties of French. First, as has been convincingly shown by Tranel (1981), the postulation of abstract final schwas is empirically untenable and creates more problems than it is meant to solve. A clear example of this situation is the analysis of vowel nasalization: in Dell's (1985 [1973]) account, where a final schwa is postulated to block vowel nasalization, forms such as *cousin* [ku.zɛ̃] 'cousin (masc.)' and *cousine* [ku.zin] 'cousin (fem.)' are derived from the underlying forms /#kuzin#/ and /#kuzin + ə#/ respectively. Yet, the postulation of abstract schwas becomes necessary to account for preconsonantal nasals on the surface (as in *clamse* 'die (3rd pers. sg.)' [klams], not *[klɑ̃s]; *hymne* 'anthem' [imn], not *[ɛ̃n]). The postulation of abstract schwas in underlying forms in order to block vowel nasalization (*clamse* /#klaməs + ə#/; *hymne* /#imənə#/) incorrectly predicts that the schwa would be realized as [ɛ] if closed syllable adjustment is assumed to be an active process, yielding *[kla.mɛs] and *[i.mɛn]. In any event, *[kla.məs] and *[i.mən] are not grammatical variants of *clamse* and *hymne* in any variety (compare with *samedi* 'Saturday' [sam.di] ~ [sa.mə.di]) and it is clear that the postulation of such abstract underlying schwas is inadequate and unfounded. Furthermore, Morin (1988) demonstrated that the [ə] ~ [ɛ] alternation is not purely phonological: it is a case of phonologically-conditioned allomorphy and it must be treated within the wider contexts of all alternations involving [ə], where schwa is the historical result of vowel reduction in unstressed position. Thus, the alternation *mener* 'to lead' [m(ə).ne] ~ *mènent* 'lead (3rd pers. pl.)' [mɛn] mirrors that of *venir* 'to come' [v(ə).nir] ~ *viennent* 'come (3rd pers. pl.)' [vjɛn] or *devoir* 'must' [d(ə).vwar] ~ *doivent* 'must (3rd pers. pl.)' [dwav]. Notwithstanding these issues, the trochee has remained an important device to account for the effect of the *loi de position* in southern French (Durand, 1995; Rizzolo, 2002; Turcsan, 2005; Eychenne, 2006).

2.2 The iamb

While the recourse to the trochaic foot to account for the prosodic weakness of schwa seems like a natural fit, there is no independent evidence supporting the validity of this unit in the phonology of French, and in fact much against it. Since prominences normally fall on the rightmost syllable of a word (or phrase), several scholars have argued that French is an iambic language (see for instance Hammond, 1995 and §3 below). One domain where the iamb has revealed particularly insightful is the analysis of non-concatenative morphology, where it has been appealed to in order to analyze abbreviations, hypocoristics (truncated and reduplicated) and language games such as verlan, loucherbem and javanais (see Plénat, 1984 and subsequent work; Scullen, 1997 *inter alia*). Because it is characteristic of non-standard French, non-concatenative morphology is often assumed to shed a crucial light on the unmarked patterns of the language. Let us consider the following abbreviations

(L = light; H = heavy):[2]

(4)	a.	*faculté*	[fak]	H	'faculty'
		baccalauréat	[bak]	H	'baccalaureate'
		fromage	[frɔm]	H	'cheese'
	b.	*cinéma*	[si.ne]	LL	'movie theater'
		catholique	[ka.to]	LL	'Catholic'
		dégueulasse	[de.gø]	LL	'yucky'
	c.	*cafétéria*	[ka.fɛt]	LH	'cafeteria'
		manifestation	[ma.nif]	LH	'protest'
		traduction	[tra.dyk]	LH	'translation'

These truncated forms illustrate the three templates that an iamb is generally assumed to represent (see McCarthy and Prince, 1993, p. 46; Hayes, 1995, p. 71; Scullen, 1997, pp. 86-87), LL being by far the dominant category. The iambic approach to non-concatenative morphology is able to account for a wide array of phenomena, such as reduplication in hypocoristics (*Christophe* → [kiki], *André* → [de.de], *Brigitte* → [gi.git], etc.), verlan (*flic* 'cop' → [kœf], *lourd* 'heavy' → [rœ.lu], *énervé* 'irritated' → [ve.nɛr], etc.) and acronyms (*CAPES* [ka.pɛs], *DEUG* [dœg], *UQAM* [y.kam], etc.). Yet, there are many cases where the result of non-concatenative morphology is not a minimal prosodic word composed of one iambic foot, as illustrated in (5) (see also Scullen, 1997, §3.2.3.2):

(5)	a.	*écologiste*	[e.kɔ.lo]	LLL	'ecologist'
		mégalomane	[me.ga.lo]	LLL	'megalomaniac'
	b.	*distribution*	[dis.trib]	HH	'retailing'
		certificat	[sɛr.tif]	HH	'certificate'
	c.	*hebdomadaire*	[ɛb.do]	HL	'weekly'
		pornographie	[pɔr.no]	HL	'pornography'
	d.	*professionnel*	[pro]	L	'professional'
		psychologue	[psi]	L	'psychologist'

Examples in (5a) illustrate cases where a prosodic word contains three syllables, which cannot be parsed as one iamb. One could follow Plénat (1994) and treat the initial vowel as extrametrical; a form like *écolo* could indeed be analyzed as [<e>.(kɔ.ˈlo)$_\Sigma$], but such an analysis is not available when the initial syllable has an onset, as is the case in *mégalo.* The forms in (5b) can be considered as disyllabic minimal words but both syllables are heavy, which means that they must be analyzed as two iambs. Unless the definition of the iamb is reworked, binary branching in those cases must be a property of the prosodic word, not of the foot. Examples in (5c) are even more problematic: weight-wise, they seem to correspond to a syllabic trochee but this analysis conflicts with stress assignment. The best analysis that is available is as a monosyllabic heavy iamb + a degenerate foot (Hayes, 1995, p. 102), for instance [(ɛb)$_H$.(ˈdo)$_L$]. Here again, binarity can only be a property of the prosodic word, not of the foot. Finally, examples in (5d) show that a minimal prosodic word need

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2 This discussion assumes that codas are moraic in French. See Scullen (1997, chapter 2) and Eychenne (2006, pp. 161-165) for arguments and references supporting this view.

neither be binary nor be composed of (at least) one iamb, since they correspond to a degenerate foot (see also Scullen, 1997, pp. 103-105). All these examples show that the iambic approach is not able to capture the whole range of attested forms without additional – and *ad hoc* – stipulations. The strong preference for the disyllabic template might well be the result of a bias towards binary words, without reference to moraic weight or foot structure.

2.3 Further issues

The two views of footing that we have outlined are at odds with each other and both carry along a number of issues. The trochaic approach relies on the assumption that all underlying full vowels are the head of a unary foot, except when they are followed by a schwa-headed syllable, in which case they head a trochee. A derived word like *bêtement* /bEtə + mã/ 'stupidly' is thus predicted to display secondary stress on the first syllable in varieties where this schwa is pronounced, yielding [($_{\mathfrak{l}}$bɛ.tə)$_\Sigma$.($^{\mathfrak{l}}$mã)$_\Sigma$], which is indeed correct. But let us consider the issue of secondary stress assignment in greater detail. While counter-tonic stress is optional and phonetically weaker (and therefore harder to assess) than primary stress, its relevance, at least for southern French, seems beyond doubt (see also Dell, 1984, §6 for northern hexagonal French). In the general case, secondary stress displays an alternating rhythm spreading leftward from the main stress onto every other peak, which is probably best described as an echo accent (see Laks, 1997, p. 61, fn 30).[3] A word like *ordinateur* 'computer' is stressed [ɔr.$_{\mathfrak{l}}$di.na.$^{\mathfrak{l}}$tœr] (or [ɔr.di.na.$^{\mathfrak{l}}$tœr] without counter-tonic stress) but is not realized *[$_{\mathfrak{l}}$ɔr. di.na.$^{\mathfrak{l}}$tœr] as would be typical of a Germanic pronunciation, for instance.[4]

Let us consider the rhythmic structure of pentasyllabic adjectives derived in *–al* or *–iel*. Examples in (6) illustrate a typical southern French pronunciation, with schwa realized:

(6)   a.   *expérimental*   [$_{\mathfrak{l}}$ɛks.pe.$_{\mathfrak{l}}$ri.mã.$^{\mathfrak{l}}$tal]   'experimental (masc.)'

       sinusoïdal   [$_{\mathfrak{l}}$si.ny.$_{\mathfrak{l}}$zo.i.$^{\mathfrak{l}}$dal]   'sinusoidal (masc.)'

       caricatural   [$_{\mathfrak{l}}$ka.ri.$_{\mathfrak{l}}$ka.ty.$^{\mathfrak{l}}$ral]   'caricatural (masc.)'

   b.   *gouvernemental*   [gu.$_{\mathfrak{l}}$vɛr.nə.mã.$^{\mathfrak{l}}$tal]   'governmental (masc.)'

       comportemental   [kɔ̃.$_{\mathfrak{l}}$pɔr.tə.mã$^{\mathfrak{l}}$tal]   'behavioral (masc.)'

       évènementiel   [e.$_{\mathfrak{l}}$vɛ.nə.mã.$^{\mathfrak{l}}$sjɛl]   'eventful (masc.)'

   c.   *monoparental*   [mo.$_{\mathfrak{l}}$no.#pa.rã.$^{\mathfrak{l}}$tal]   'single-parent (adj., masc.)'

       médico-légal   [me.di.$_{\mathfrak{l}}$ko.#le.$^{\mathfrak{l}}$gal]   'medicolegal (masc.)'

       préélectoral   [$_{\mathfrak{l}}$pre.#e.$_{\mathfrak{l}}$lɛk.to.$^{\mathfrak{l}}$ral]   'preelectoral (masc.)'

Examples in (6a) illustrate the fact that secondary stress spreads leftward from the rightmost prominence in an alternating fashion. It is worth mentioning that secondary stress in these forms is not faithful to the pattern found in the base forms (see *sinusoïde* [si.$_{\mathfrak{l}}$ny.zo.$^{\mathfrak{l}}$i.də], *caricature* [ka.$_{\mathfrak{l}}$ri.ka.$^{\mathfrak{l}}$ty.rə]). Examples in (6b) all include a schwa in the third position. As can be seen from the stress pattern, the preceding syllable receives secondary stress, which is consistent with an analysis which parses these two syllables as a trochee, as in [e.($_{\mathfrak{l}}$vɛ.nə)$_\Sigma$.mã.$^{\mathfrak{l}}$sjɛl]. In those cases, counter-

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tonic stress is identical to that of the base form (*gouvernement* [gu.ˌvɛr.nə.ˈmã], *comportement* [kɔ̃.ˌpɔr.tə.ˈmã], *évènement* [e.ˌvɛ.nə.ˈmã]), contrary to (6a). This asymmetry clearly shows that the presence of schwa may locally perturb the otherwise regular echo accent. Finally, examples in (6c) illustrate words that are composed of two prosodic words. Here we see that the final (or sole) syllable of the first prosodic word is accentuated, which clearly shows the relevance of morphological structure for the assignment of stress, which is bounded to the level of the prosodic word.

To further understand the issue at stake, let us consider a string like [ˌsi.ny.ˌzo.i.ˈdal], for which a number of parses are theoretically possible. The parse [(ˌsi.ny)$_\Sigma$.(ˌzo.i).(ˈdal)$_\Sigma$] displays under-application of mid vowel lowering[5] in the head of the second trochee. Such an instance of counterfeeding opacity militates in favor of some sort of leveling in the grammar, where different levels of footing capture different generalizations. Such facts can be accommodated in derivational models, but theories like standard Optimality Theory (Prince and Smolensky, 1993), which assumes a direct mapping between input and output forms, cannot handle them without extra machinery. Another possible parse for this string is [(ˌsi)$_\Sigma$.(ny.ˌzo)$_\Sigma$.(i.ˈdal)$_\Sigma$], with two iambs. Such an analysis, however, is highly problematic as it is inconsistent with the behavior of schwa. To understand why, let us consider the assignment of secondary stress in masculine (7a) vs. feminine (7b) polysyllabic adjectives:

(7) a. *équatorial*   [e.ˌkwa.to.ˈrjal]   'equatorial (masc.)'

        promotionnel   [pro.ˌmo.sjo.ˈnɛl]   'promotional (masc.)'

        supersticieux   [sy.ˌpɛχ.sti.ˈsjø]   'superstitious (masc.)'

     b. *équatoriale*   [e.ˌkwa.to.ˈrja.lə]   'equatorial (fem.)'

        promotionnelle   [pro.ˌmo.sjo.ˈnɛ.lə]   'promotional (fem.)'

        supersticieuse   [sy.ˌpɛχ.sti.ˈsjœ.zə]   'superstitious (fem.)'

The masculine and feminine members of each pair all have the same accentual pattern. While one may be tempted to parse *promotionnel* as [(pro.ˌmo)$_\Sigma$.(sjo.ˈnɛl)$_\Sigma$], this analysis cannot be applied to the feminine form since *[(pro.ˌmo)$_\Sigma$.(sjo.ˈnɛ)$_\Sigma$.(lə)$_\Sigma$] would fail to predict both mid vowel adjustment and main stress assignment. Treating the last syllable as extrametrical *[(pro.ˌmo)$_\Sigma$.(sjo.ˈnɛ)$_\Sigma$.<lə>] is only a marginal improvement as it still fails to predict the quality of the last mid vowel.

A better approach would be to leave the third syllable unfooted and to parse the first two syllables as an iamb, yielding [(pro.ˌmo)$_\Sigma$.<sjo>.(ˈnɛ.lə)$_\Sigma$]. Following Selkirk (2004), one could assume that the Strict Layer Hypothesis actually corresponds to several constraints (Layeredness, Headedness, Exhaustivity and Non-recursivity) and that the unfooted syllable simply violates Exhaustivity. It seems to us, however, that this is a serious weakening of prosodic theory, and there does not seem to be any principled explanation as to why constraints like Layeredness and Headedness are undominated in all languages, whereas Exhaustivity and Non-recursivity are violable and freely rankable.[6]

Yet another approach would be to parse the stray syllable into a superfoot (∑') (Selkirk, 1980), for

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5 Had the *loi de position* applied transparently, the predicted pronunciation would be *[si.ny.zɔ.i.dal] since mid-vowel lowering is triggered by the presence of a right dependent.
6 But see Itô and Mester (2008) for a proposal that tries to improve on Selkirk's proposal.

instance *promotionnelle* [((pro.ˌmo)$_\Sigma$.(sjo))$_{\Sigma'}$.(ˈnɛ.lə)$_\Sigma$].[7] But the theoretical status of this unit is unclear and it seems to have been advocated precisely to solve the kind of issue we are dealing with. Critically, there does not seem to be any empirical argument that could distinguish [((pro.ˌmo)$_\Sigma$.sjo)$_{\Sigma'}$.(ˈnɛ.lə)$_\Sigma$], where the stray syllable is associated to the leftmost iamb, from [(pro.ˌmo)$_\Sigma$.(sjo.(ˈnɛ.lə)$_\Sigma$)$_{\Sigma'}$], where it is adjoined to the rightmost trochee.

One last resort is to consider that final schwa is extra-metrical, a position which has been advocated by Delais-Roussarie and Rialland (2007, p.5, fn 3) among others. Under such an analysis, the form *bête* 'silly' would be parsed as [(bɛt)$_\Sigma$.<ə>]. There are however two important problems with this approach. First, treating schwa as extrametrical would force us to analyze obstruent+liquid clusters as codas, as in *sobre* 'sober' [(sɔbr)$_\Sigma$.<ə>] and *socle* 'base' [(sɔkl)$_\Sigma$.<ə>]. While it may be argued that in varieties where final schwa has been lost, such as North American varieties, these clusters have indeed been reanalyzed as codas and are often simplified (e.g. /sɔbr/ → [sɔb]), we find no independent evidence that these clusters can be analyzed as codas in southern French. These clusters never appear in syllable-final or word-final position, except after schwa deletion in the case of innovative speakers. More critical is the fact that this analysis wrongly predicts that 'extrametrical' schwa cannot occur morpheme-internally due to the peripherality condition, which requires extrametrical constituents to align with either edge of their domain (Hayes, 1995, pp. 57-58). This prediction is falsified by the existence of monomorphemic forms like *céleri* 'celery' [sɛləri] and *écrevisse* 'crayfish' [ɛkrəvisə], where the internal schwa triggers mid-vowel lowering.

It is of course possible to dismiss the relevance of word-level stress entirely and to treat stress assignment as a property of larger phonological units. As a matter of fact, a number of scholars have argued that stress assignment is a property of the so-called 'breath group' (*groupe de souffle*, roughly the intonational phrase) rather than of the word (Laks, 2006), a point of view which is made quite explicit by Fox (2000):

> French is sometimes said to have word-final stress, but this is a misconception. It is the final syllable of a *phrase* that is prominent, and a word spoken in isolation constitutes a phrase and is therefore accented on the final syllable. But *within* the phrase there is no such accent. (Fox, 2000, p. 94, fn 77, emphasis in the original)

While it is the case that individual words are unstressed within an intonational phrase, Lyche and Girard (1995) have convincingly demonstrated that the (prosodic) word plays a crucial role in the phonology of French and the examples discussed in (6c) prove the relevance of this unit in French. We are thus left with a situation where constituency seems to be relevant to some subdomains of the phonology of French, and yet raises a number of empirical and conceptual problems.[8]

One domain that is likely to shed an interesting light on the issue of constituency is child language acquisition: if, as it is generally assumed, prosodic structure is not unlearned once it is acquired, evidence of the existence of feet in French child language would be a strong argument in favor of its presence in adult language as well. The foot has indeed been argued to play a critical role in the acquisition of French, yet, as we shall see, the evidence that has been available so far is not decisive.

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7   Alternatively, one could postulate amphibrachs (LHL), yielding parses such as [(pro.ˌmo.sjo)$_\Sigma$.(ˈnɛ.lə)$_\Sigma$] or [(pro.ˌmo)$_\Sigma$.(sjo.ˈnɛ.lə)$_\Sigma$]. Such an approach would fail to account for mid-vowel alternation, however, and the analytical benefits that such an approach would bring are not clear.

8   See Laks (1997, chapter 3) for a fuller discussion of the problems faced by constituent-based theories of metrical structure.

3. Universality of footing: Evidence from acquisition?

Early studies on prosodic structure in child language argued for an innate, and thereby universal, bias towards trochaic footing in child language. The *trochaic bias* was first proposed by Allen and Hawkins (1978, 1979, 1980), and their hypothesis of a natural preference for trochees was in part founded on a deletion pattern observed in English child language, whereby an upper bound on the prosodic shape of polysyllabic lexical targets yields trochees (e.g. *banana* [ˈnænə] or [ˈbænə]), with preservation of the tonic and the post-tonic syllables, and not iambs (e.g. *[bəˈnæn]), with retention of the pre-tonic syllable (Allen and Hawkins, 1979, p. 928). Fikkert (1994) observed the same deletion pattern for Dutch – thereby strengthening the trochaic hypothesis –, but she nevertheless underlined the importance of also studying children exposed to iambic languages.[9] Vihman et al. (1998) carried out perceptual and acoustic analyses of children exposed to French and English, respectively, and whereas the adult-like iambic pattern was attained early on by the children learning French, the children learning English produced both trochees and iambs – the latter prosodic shape explained as a holistic interpretation of the iambic *phrases* abundantly present in the input, e.g. *a báll*. Joint together, the strong presence of iambs in both French- and English-learning children led the authors to discard the presence of a trochaic bias. Allen and Hawkins' hypothesis has recently been further challenged by Rose and Champdoizeau's (in press-a, b) study of a bilingual English-French child (Anne). Performing acoustic analyses of Anne's stress patterns in target disyllables, they concluded to the fact that 'she had mastered both the basic metrical properties and the main acoustic correlates for stress in each of the target languages' (Rose and Champdoizeau, in press-b, p. 364), and this during the third year.

Contributions to the debate regarding foot structure in French child language have mainly been based on learners of L1 Québec French – a variety that resembles northern Hexagonal French with regard to word-final schwas (cf. however Milne, 2012). One main contribution is Rose (2000), who argued in a longitudinal study of two children (Clara and Théo) that phenomena like the absence of word-initial syllable deletion, asymmetrical reduction in complex onsets, compensatory lengthening and consonant harmony were best understood as a function of licensing relations at the level of the foot. Considering underlying representations to come fully prosodified (Gnanadesikan, 2004; Goad and Rose, 2004), Rose analyzed the faithful realization of *dedans* 'inside' [daˈdæ] by Clara (1;03.16) (vs. *behind* reduced to [haiːn] by English-learning Trevor) to reflect an underlying iambic template. Further, in OT terms, complex onsets are first licensed in the foot head by virtue of the constraint order MAXHEAD(foot)[10] >> *COMPLEX(onset) (*glisse* 'slide (3rd pers. sg.)' [klɪs] vs. *brûlé* 'burned' [byˈle] (Clara 1;10.04 and 1;09.29)). With the subsequent demotion of *COMPLEX(onset) below MAX(seg) are complex onsets licensed in both positions. Another argument in favor of the foot is word-final vowel lengthening in the case of [r]-deletion (e.g. *beurre* 'butter' [bœː] (1;10.04)). Analyzing [r] as placeless and thereby syllabified in the coda of the head foot, Rose considered the lengthened vowel to fill the timing unit underlyingly associated with [r] and in this way to satisfy MAXHEAD(foot). Finally, Rose proposed consonant harmony to result from the ordering of LICENCE(F, Foot)[11], and featural faithfulness constraints. First, C_1VC_2V words

9 Although the examination of cross-linguistic data led Allen and Hawkins (1979) to question the universality of the trochaic bias, they considered there to be sufficient evidence in favour of a general rhythmic (and trochaic) constraint, which 'may make itself felt in a variety of more subtle ways throughout the child's developing language' (Allen and Hawkins, 1979, p. 933).

10 MAXHEAD(foot)$_{def}$: 'Every segment prosodified in the head of some prosodic category in the input has a correspondent in the head of that prosodic category in the output [...] PCat {foot, syllable, rhyme, nucleus, onset}' (Rose, 2000, p. 69).

11 LICENCE(F, Foot)$_{def}$: 'A feature F must be licensed by the head of a prosodic category PCat [...] {foot, syllable, rhyme, nucleus, onset}' (Rose, 2000, p. 77).

are subject to an obligatory right-to-left Labial harmony (e.g. *debout* 'standing' [bɑˈbuː] (1;03.23)), which is explained by the domination of LIC(Cor,Ft) on MAX(Cor): in the optimal output, the Coronal feature in the dependent undergoes Labial harmony. Second, in C_1VC_2 words, harmony does not apply (*livre* 'book' [liɸ] (1;07.27)). This is predicted on the hypothesis that word-final consonants in French are prosodified in the onset of a degenerate syllable, outside the domain of the right-headed foot.

The relation between Consonant Harmony and foot structure was criticized in Brulard and Carr's (2003) study of one French-English bilingual child (Tom); For Rose's analysis to hold, one would expect the bilingual child to exhibit two distinct patterns of Consonant Harmony. This prediction was not borne out as Tom failed to apply consonant harmony to his French lexis altogether. Rather, Brulard and Carr suggested that Consonant Harmony was linked to the syllabic shape of the word, more specifically application of Consonant Harmony was restricted to (English) words with a "iambic" template <CVC> or <CVCVC> (vs. non-application in <CVCV>).

In a later study of Clara plus a learner of European French, Rose and dos Santos (2004) abandoned the binary foot and adopted an unbounded foot, whose right edge is aligned with the right edge of the prosodic word (cf. Charette, 1991), as the domain of application. Goad and Buckley (2006) rejected in turn this analysis as it failed to account for cases where harmony crossed foot boundaries, e.g. Labial harmony produced by Clara in *grosse barbe* 'big beard' [bɛˈbæbˀ] at Stage (henceforth St.) 5.[12] Suggesting that harmony rather spreads from the prominent syllable leftward within the PPh, Goad and Buckley argued that stronger evidence for the binary iamb was to be found by looking at word minimality effects and the prosodic organization of function words. First, one-syllable lexical targets are in the majority of cases altered by Clara, via lengthening and/or addition of material, e.g. *Guy* [giː] (St.2), and [əˈgiː] (St.3), and two-syllable lexical targets are infrequently reduced, e.g. *maman* [məˈmæ] (St.1) and [məː] (St.3). Also note that the comparison of one- vs. two-syllable lexical targets indicates that final vowel lengthening is motivated by foot well-formedness rather than being a mere phrase-final effect: in the early stages, lengthening is observed in 68% vs. 25% of the cases of one- vs. two-syllable lexical targets. Second, trisyllabic lexical targets satisfy binarity by generally reducing to disyllables at the expense of the word-initial syllable, e.g. *abricot* [kɵˈko̞] (St.3).[13] Regarding lexical vs. functional material, the emergence of proclitics at Stage 3 in Clara's grammar allows a comparison of 3Lex (*abricot*) and 1Fct+2Lex (*un oiseau* [əwɐˈzʊː]): The avoidance/truncation of 3Lex vs. the 39% tolerance of an unfooted proclitic indicates that it is the binary foot (prosodic word) that places an upper bound on the lexical word, 'rather than, for example, all three-syllable constructions [are] shortened due to processing or other cognitive demands' (Goad and Buckley, 2006, p. 136).

As the evidence against the trochaic bias hypothesis seemingly never ceases to increase[14], the mere existence of foot structure in French has been tested also in the acquisition literature: can the data be explained without making reference to the foot? Goad and Prévost (2011) set out to test whether

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[12] We refer to Goad and Buckley (2006:121) for a presentation of the stages observed and the corresponding age ranges.

13 The faithful trisyllable occurs as a competitor to the truncated form at Stage 4, e.g. *abricot* [pupæˈkoː], cf. Goad and Buckley (2006, p. 134).

[14] Aware of the southern varieties of Hexagonal French with a more robust realization of word-final schwas, Rose (2000) put forth the hypothesis that the children exposed to this variety could prosodify words like *père* 'father' [pɛrə] as a trochaic foot:

> The prediction is that if, in [ə]-dialects, trochaic footing is the option selected by the child, then we should witness patterns of consonant harmony different from those observed in Clara's outputs. In brief, a learner of a French dialect who believes that his/her language has trochaic footing must behave in the same way as the English children. (Rose, 2000, p. 267)

To the best of our knowledge, until this point no one has studied the prosodic shape in children acquiring southern French, and it could very well be the case that data from these children are best analyzed as trochaic – thus in favor of the trochaic bias hypothesis. Without real data in hand, however, we abstain ourselves from further speculation.

acquisition of prosodic structure is driven by Markedness (binary foot), or by the frequency patterns in the prosodically complex target language (subminimality, one obligatory prominence per phonological phrase). One of their study subjects, Charlex, a learner of Québec French, displays several characteristics of the cross-linguistically established iambic system, i.e. right-edge head prominence, quantity-sensitivity and optional stress iterativity. These observations led the authors to conclude that all prosodic constituents – including the foot – are available from the initial state, and that a markedness constraint like FootBinarity is respected.

A rejection of the foot projection in French was problematized by Goad and Buckley (2006), as without feet, early outputs should be reduced to the cross-linguistically preferred monomoraic (subminimal) CV, with retention of the final, prominent syllable only. Subminimal forms were in fact presented by Demuth and Johnson (2003) in their study of Suzanne, a young learner of Parisian French.[15] While Suzanne displayed no lower bound on the prosodic word (e.g. *pain* 'bread' [pa] (1;04)), an upper bound was placed as target trisyllables were truncated to disyllables. Although these orthographically transcribed data have been questioned because one cannot establish with certainty that vowel lengthening was not a repair strategy in Suzanne's grammar, they nevertheless – like the other above-mentioned papers – show that binarity clearly places an upper bound on the size of the lexical word. As in the case of non-concatenative morphology, this observation suggests that binarity is perhaps only relevant at the level of the prosodic word and does not make reference to the internal structure of the foot. Obviously, such a claim necessitates a re-examination of all the above-mentioned phenomena explained as relating to foot structure.[16] At this point it is also important to underline that, to our knowledge, lower boundary effects are only attested in Québec French child language, a variety that according to several scholars exhibits quantity-sensitivity (cf. Goad and Prévost, 2011, §3). If word minimality is not respected in European French child language, the necessity to postulate a (iambic) foot is weak at best.

4. Analysis

Given the evidence that we have surveyed, both in adult and child language data, the existence of the foot in French does not seem to be firmly grounded. Therefore, it seems reasonable to explore the simpler hypothesis that prosodic structure can be accounted for more directly without any reference to constituency. Following a line of research initiated by Prince (1983) and continued by Laks (1997) and Bonami and Delais-Roussarie (2006) among others, we adopt a 'grid-only' approach, whereby the rhythmic structure of language is analyzed as the result of levels of prominence on the metrical grid. We illustrate this model with data from European French drawn from the PFC programme (Durand et al., 2002, 2009).[17]

4.1 Framework

Our approach to metrical structure is integrated within the computational framework of Stratal Optimality Theory (Bermúdez-Otero, 2011). Contrary to standard OT, this model does not conflate all morphological levels into one stratum but imports important insights from Lexical Phonology (Kiparsky, 1982) into a constraint-based framework. The input to a given stratum n is the output of the stratum n-1. Stratal OT can be seen as a generalization of OT, whereby standard OT is simply a particular case where $n = 1$.

With respect to the metrical grid, we assume that there are three tiers or 'lines' of prominences (see (8)) that are relevant at the word level (see Halle and Vergnaud, 1987; Laks, 1997). L_0 'mediate[s]

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[15] Suzanne was born in the late 19th century. The data were collected and published by her father, see Deville (1891), cited by Demuth and Johnson (2003).

[16] For a templatic (non-metric) approach to the trunction phenomenon, cf. Braud and Wauquier-Gravelines (2004).

[17] See www.projet-pfc.net.

the correspondence between the central line of phonemes and the stress line, line 1' (Halle and Vergnaud, 1987, p. 6). Put differently, only weight-bearing units – that is, units which are relevant for the computation of stress – are assigned a mark on L_0. L_0 thus captures the traditional notion of mora and represents the baseline of metrical structure. L_1 is the line where stress itself is assigned: units that receive a mark on this line correspond, everything being equal elsewhere, to foot heads. Lastly, L_2 is the level where lexical stress – whether it is distinctive or demarcative – is assigned. Only one unit per prosodic word can be assigned a mark on L_2.

(8) L_2:   ×

     L_1:   ×   ×

     L_0:   ×   ×   ×   ×

A key assumption of our approach is that the metrical grid is built cyclically: there are as many metrical lines as there are strata: each stratum stacks up a new layer onto the grid, assigns prominences on it and potentially makes eurhythmic adjustments to the tier immediately below, as a result of morphological/syntactic concatenation. We further assume that the constraint set in stratum n+1 is a strict superset of the constraint set n (i.e. $\text{CON}_n \subset \text{CON}_{n+1}$). In other words, a constraint that becomes active in a given stratum remains active (and may be freely re-ranked) in higher strata, leading to potential opacity effects. For the purpose of our discussion, we consider a grammar with three strata, although a full account of prosodic structure will obviously include several more (see for instance Bonami and Delais-Roussarie, 2006).

4.2 Footing without the foot

Let us now return to the analysis of the *loi de position* in southern French. Consider the word *hebdomadaire* 'weekly', which displays the three contexts exposed in (2) and whose metrical representation is given in (9):

(9) L_2 :   ×
     L_1 :   ×   ×   ×   ×
     L_0 :   ×   ×   ×   ×   ×   ×
          ɛ   b   d   o   m   a   d   ɛ   r   ə

Assuming a 'sonority view' of syllabicity (Goldsmith, 1990, pp. 104-105), we can state that French assigns L_0 prominences to all syllabic peaks and to all segments (if any) that are on the downward slope of the syllabic wave, down to (and excluding) the next trough. At L_1, only full vowels are assigned a mark, which captures the insight that schwa is prosodically weak – we will come back to that shortly. At the word level (L_2), only the rightmost prominence is assigned a mark, which characterizes the demarcative lexical stress of French. Given the representation in (9), a simple analysis of the *loi de position* emerges: a mid vowel is mid-open iff it is followed by a trough on L_1. It is mid-close otherwise. This analysis echoes Durand's (1976) original formulation of the trochee, the key difference being that we assume that mid-vowel lowering is triggered by a rhythmic trough on L_1 rather than by dependency relations and constituency. Regarding the genesis of the *loi de position*, Moreux (1985, p. 50) pointed out an interesting observation made by Straka (1964): Straka argues that a vowel is pronounced with greater energy in a closed syllable (when it is surrounded by consonants) and with lesser energy in a CV open syllable; furthermore, according to Straka, vowels tend to open as a factor of their strength (the stronger, the more open; the weaker, the more close).[18]

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18 It is worth mentioning that such an analysis can also explain high vowel laxing in Canadian French, which also occurs in closed syllables.

Moreux (1985, p. 50) rejected the possibility of such an analysis for the *loi de position* on the basis that, according to him, there is no phonetic evidence that an open syllable followed by a schwa should be treated as a closed syllable. Nevertheless, in this case, the mid-vowel is a local sonority optimum and is realized with greater energy than the following vowel, as is shown in (10) for the word *fête* 'party' [ˈfɛtə][19], and may be subject to lowering, a pattern which would have grammaticalized over time.

(10) Spectrogram, pitch (solid line) and intensity (dashed line) for *fête* [ˈfɛtə] (11ald1m, Douzens)

fête

0   0.7396

Time (s)
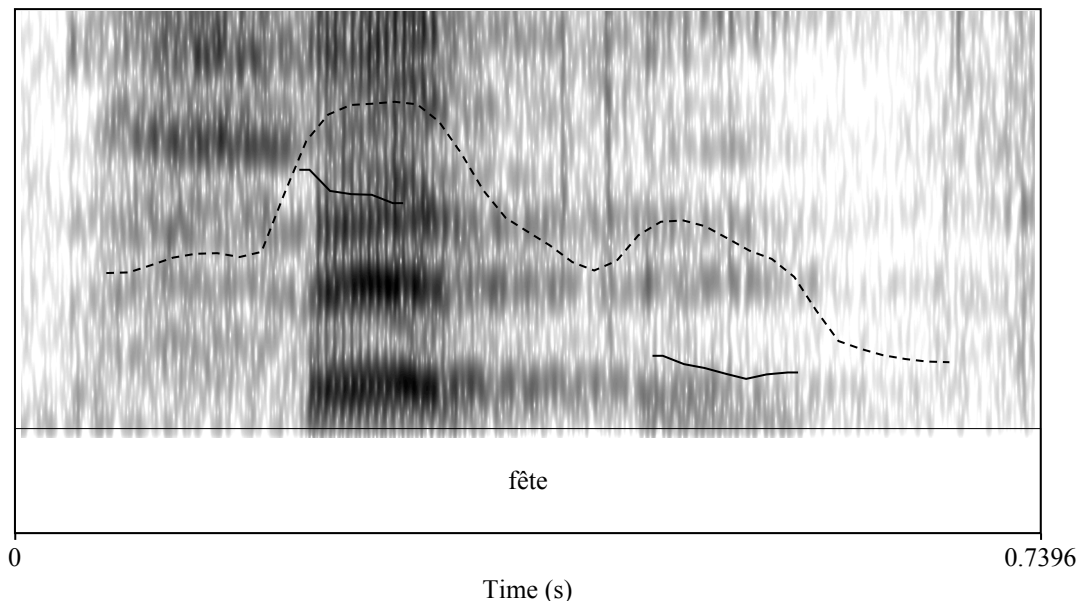
In order to account for the relationship between the segmental tier and the metrical grid, we make use of connection constraints (van Oostendorp, 2000), which require that there be a mapping between segmental information and suprasegmental structure. While the original proposal is couched within an X-bar framework, nothing prevents importing its insights into a grid-only framework. Departing only slightly from van Oostendorp's proposal, we adopt the constraint CONNECT(L_1,V) which we formulate as follows: "a vocalic node which dominates some vocalic feature V is associated with a mark on L_1". In other words, full vowels project a mark on L_1 whereas empty vowels (i.e. schwas) do not, which formally captures the insight of Durand's and Selkirk's analyses (see §2.1). Furthermore, our analysis relies on the following constraints, stated informally:

- LAXV: An L_1 peak dominates [lax] if it is followed by a trough on L_1.
- *LAX: Vowels are not [lax].
- *HIGHLAX: High vowels are not [lax][20]

Let us consider the assignment of stem-level metrical structure:

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[19]   This example is taken from the Douzens corpus, a variety of southern French close to the dialect described by
       Durand (1976) and displaying the *loi de position*.
20 We assume that this constraint is undominated in this grammar fragment.

(11) The *loi de position* (Stratum 1)

/sErsO/	CONNECT(L_1,V)	LAXV	*LAX

a. L_1:   ×
      L_0:   × ×   ×
         s ɛ r s o
	*!		*

☞ b. L_1:   ×   ×
      L_0:   × ×   ×
         s ɛ r s o
			*

c. L_1:   ×   ×
      L_0:   × ×   ×
         s e r s o
		*!	

d. L_1:   ×   ×
      L_0:   × ×   ×
         s ɛ r s ɔ
			**!

e. L_1:
      L_0:   × ×   ×
         s ɛ r s o
	!		*

Candidate (e) is harmonically bounded by (a) as (e)'s violations are a strict superset of (a)'s. It cannot surface as a winner under any ranking. Candidate (a) is suboptimal because it violates the relatively high-ranking faithfulness connection constraint. Candidate (c) is metrically impeccable but violates the constraint that requires a vowel to be open if it is followed by a trough on L_1. Candidate (d) is similar to (b) but incurs an additional gratuitous violation of the general markedness constraint that prevents lax vowels from surfacing. The *loi de position* is thus the result of the satisfaction of several constraints bearing on the prosodic structure of the lexicon. As we shall see, however, this pattern may be rendered opaque in higher strata because of structural pressures requiring adjustments on the metrical grid.

Regarding the assignment of lexical stress, we assume that each layer contains edge-enhancement constraints which require that a given edge be aligned with rhythmic prominence. These constraints can be formalized as follows:

(12)   EDGE(L_n, E): the leftmost/rightmost unit on L_n is a peak.
        where E ∈ { L(eft), R(ight) }

These constraints strongly resemble traditional alignment constraints found in the OT literature (McCarthy and Prince, 1993) but they are formally more stringent in that they are only able to refer to local information on a given tier. Given this constraint schema, demarcative stress in French can be understood as the result of a high-ranking EDGE(L_2, R) "the rightmost unit on L_2 is a peak" (crucially, in the unmarked case, EDGE(L_2, R) >> EDGE(L_2, L)).

Let us now turn to the case of 'defooting' effects: consider the phrase *des recherches généalogiques // humoristiques* 'genealogical research // for fun' realized by speaker 11ald1 (Douzens), pronounced [de rø'ʃɛrʃə ˌʒeneˌalo'ʒikə // 'yːmorisˌtikə]. Let us first consider how the postnominal adjective *généalogiques* /ʒEnEalOʒikə/ is prosodified. As in (11), Stratum 1 assigns a prominence on all syllabic peaks but the final schwa.

14

(13) Computation of stress for *généalogiques* (Stratum 2)

	*CLASH(L_1)	MAX(L_1)	EDGE(L_2,R)	EDGE(L_2,L)
☞ a. L_2:　　　　　× 　　 L_1:　×　×　× 　　 L_0:　×　×　×　×　× 　　　ʒenealoʒikə		**	*	****
b. L_2:　　　　　× 　 L_1:　×　×　×　×× 　 L_0:　×　×　×　×　× 　　ʒenealoʒikə	*!***			****
c. L_2:　　　　× 　 L_1:　　×　× 　 L_0:　×　×　×　×　× 　　ʒenealoʒikə		***!	**	***

Candidate (c) is harmonically bounded by (a) since the additional violations it incurs yield no improvement in harmony elsewhere. The position of MAX(L_1) in the constraint hierarchy is thus not crucial: echo accent will surface whenever *CLASH(L_1) dominates faithfulness to L_1 peaks (i.e. MAX(L_1)), thus creating a 'perfect grid' (regular alternation of peaks and troughs).

Consider now the realization of *humoristiques* [ˈyːmorisˌtikə] in the previous example. The initial syllabic peak is realized with a clear pitch accent, as shown in (14), and is about twice as long as the rightmost peak (117 vs. 56ms).

(14) Spectrogram and pitch for *(recherches) généalogiques humoristiques* (11aldg, Douzens)

(... recherches) généalogiques　　　humoristiques.

0　　　　　　　　　　　　　　　　　　　1.877

Time (s)
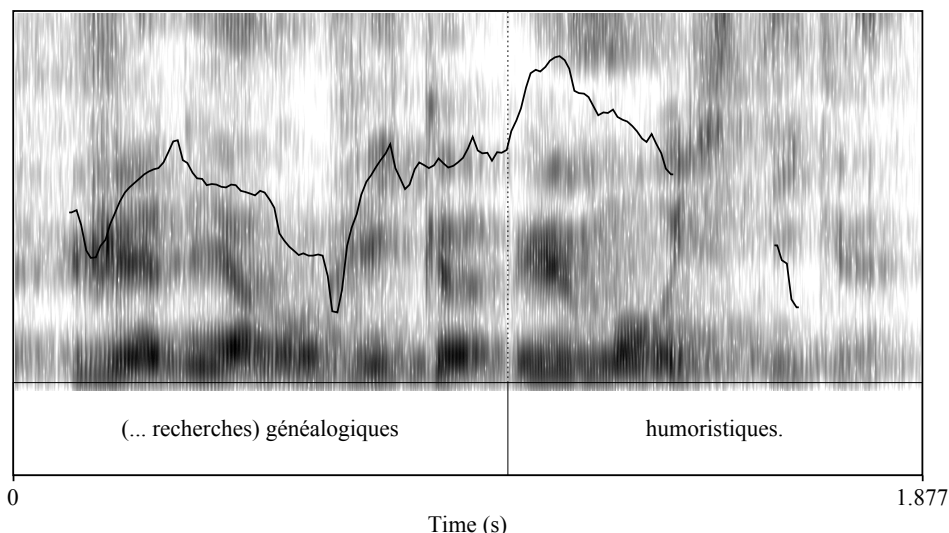
This prominence is driven by pragmatic factors at the phrase level which can become active in Stratum 3.[21] This initial prominence is a pitch accent which is different from lexical stress (see Ladd, 2008 [1996], pp. 50-51). While the initial accent is a global peak at the phrasal level, lexical stress remains a local peak on L_2 (/i/ is louder than the following schwa: mean intensity 64.8dB vs.

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[21]　Well aware of the increased complexity of the intonational system once pragmatic factors become involved, we confine ourselves to this example, which, in our view, is of a different nature than the optional H tone present in Swiss French (see §4.3).

59.8dB).

(15) Phrasal pitch accent in *humoristiques* (Stratum 3)

	EDGE(L_3,R)	WEIGHTTOSTRESS	H/STRESS(L_3)	DEP(L_2)
☞ a. L_3: × L_2: × × L_1: × × × × L_0: ×× × × × × y:moristikə | H				*
b. L_3: × L_2: × × L_1: × × × × L_0: × × × × × ymoristikə		*!	*	*
c. L_3: × L_2: × L_1: × × × × L_0: × × × × × ymoristikə	*!		*	

4.3 Accentual prominences in Swiss French

It has long been established that optional, non-final prominences of a non-emphatic character are present in French, typically implemented by pitch prominence (cf. for instance Di Cristo, 1998). Non-final prominences in Swiss French are particularly interesting, as they are observed not only in the initial or the penultimate syllable of phrase-final polysyllables (Schwab et al., 2009), but also in functional material (cf. Type 4 in Andreassen and Lyche, 2008), as illustrated by the example in (16). Further, the distribution and the phonetic implementation of non-final prominence have proven subject to diatopic variation. Schwab et al. (2009) observed that at the level of f_0, speakers from Nyon (canton of Vaud) produced penultimate prominence on disyllables in conclusive sequences that was not present in the data from Neuchâtel (PFC survey point north of Vaud). Further diatopic variation was attested in Schwab et al. (2012), where prominences were acoustically analyzed as differently implemented in Neuchâtel and Martigny (PFC survey point in Valais, east of Vaud): while penultimate syllables perceived as prominent were significantly longer in the production of the two groups of Swiss French speakers compared to Parisian ones, a rise in f_0 was not only equally high in the speakers from Martigny and Paris, but also significantly higher than in the speakers from Neuchâtel. In sum, although penultimate prominences seem to be a pan-romand feature, the low-level constraints defining their acoustic properties differ across varieties.

The example in (16) illustrates a sequence of two utterances by a speaker from Nyon, which contains several penultimate prominences, at the level of the traditional intonational phrase: *Venir* **chez** *lui ou l'arrêter dans* **la** *rue. Tu vois, si tu es* **connu** *par exemple* (prominences are emphasized in bold face). As can be seen in the speech signal, these accents are associated with a high tone. Although they are realized on the penultimate syllable of polysyllabic words, as in *connu*, they may be realized on a clitic when the lexical word is monosyllabic, as in **chez** *lui* and **la** *rue*. This proves that this pitch accent is located at the phrasal level, which corresponds to Stratum 3.

(16) Spectrogram of penultimate rises in *chez lui – la rue – connu* (svaje1g, Nyon)

| Venir sonner chez lui | ou l'arrêter dans la rue. | Tu vois, si tu es connu | par exemple. |

0   3.486
Time (s)
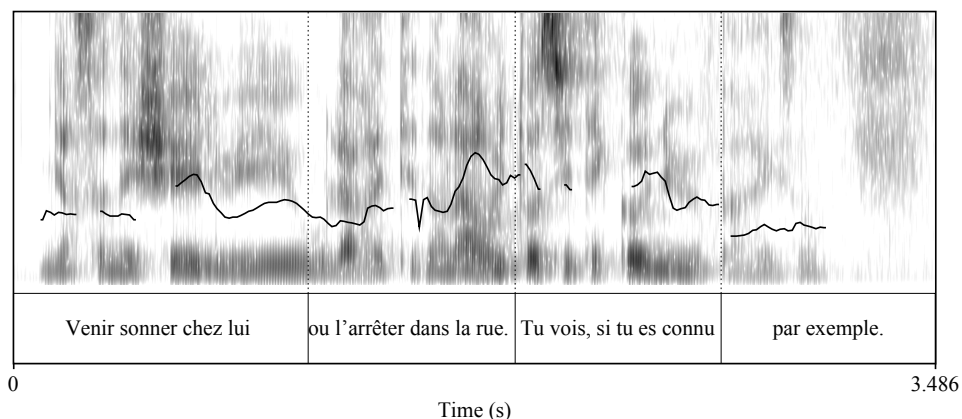
To formalize this phenomenon, we assume that a floating constraint PENULTIMATESTRESS may become dominant in Stratum 3, in which case it is responsible for adding a prominence on L2, which characterizes the stress pattern found in Swiss French. This constraint crucially dominates the constraint preventing clitics from receiving an L_2 prominence and the anti-clash constraint. When PENULTIMATESTRESS is dominated by *CLASH(L_2) and/or *STRESSEDCLITIC(L_2), candidate (c) surfaces as the optimal candidate with only the obligatory final prominence. In any case, the combined effect of *STRESSEDCLITIC constraints ensures that the clitic cannot receive an L_3 level prominence under these conditions. The situation where PENULTIMATESTRESS(L2) is dominant is summarized in (17).

(17) Penultimate pitch accent in *chez lui* (Stratum 3)

	*STRESSED CLITIC(L_3)	PENULTIMATE STRESS(L2)	*CLASH(L_2)	*STRESSED CLITIC(L_2)	H/STRESS[22]
a. L_3: × L_2: × × L_1: × × L_0: × × ʃe lɥi	*!		*	*	**
☞ b. L_3: × L_2: × × L_1: × × L_0: × × ʃe lɥi | H			*	*	*
c. L_3: × L_2: × L_1: × × L_0: × × ʃe lɥi		*!			**

One may wonder whether the penultimate accent we have described is not simply the result of the well-known NONFINALITY constraint, which requires that stress does not fall on the last peak. NONFINALITY would predict stress to fall only on the penultimate peak and would simply shift the final prominence into non-final position. One clear proof that this prediction is incorrect is the fact that in this variety, penultimate accent interacts with other stress related phenomena in very intricate

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[22] A candidate with a high tone associated with the rightmost peak would be characteristic of an interrogative modality and would be suboptimal in this case.

ways. For instance, we observe the co-occurrence of the penultimate H tone and the optional bell-shaped contour restricted to lexically long and post-lexically lengthened (thus accentuated) vowels in IP-final position (Sertling Miller, 2007; Andreassen and Lyche, 2008), as in *décevante* 'disappointing (fem.)' [dɛsvɑ̃:t] produced with an LHL-contour by the speaker svaab1g (Nyon). Note that this bell-shaped contour can also be found independently of penultimate pitch accent. As a further example, consider the word *déclarées* 'declared (fem. pl.)' realized [deklarej͡] (svarb2), shown in (18), where the optional penultimate H is realized alongside the final underlyingly long vowel.

(18) Spectrogram and pitch for *(toutes) déclarées* [deklarej͡] (svarb2g, Nyon)

(...) toutes	déclarées

0   0.9392

Time (s)
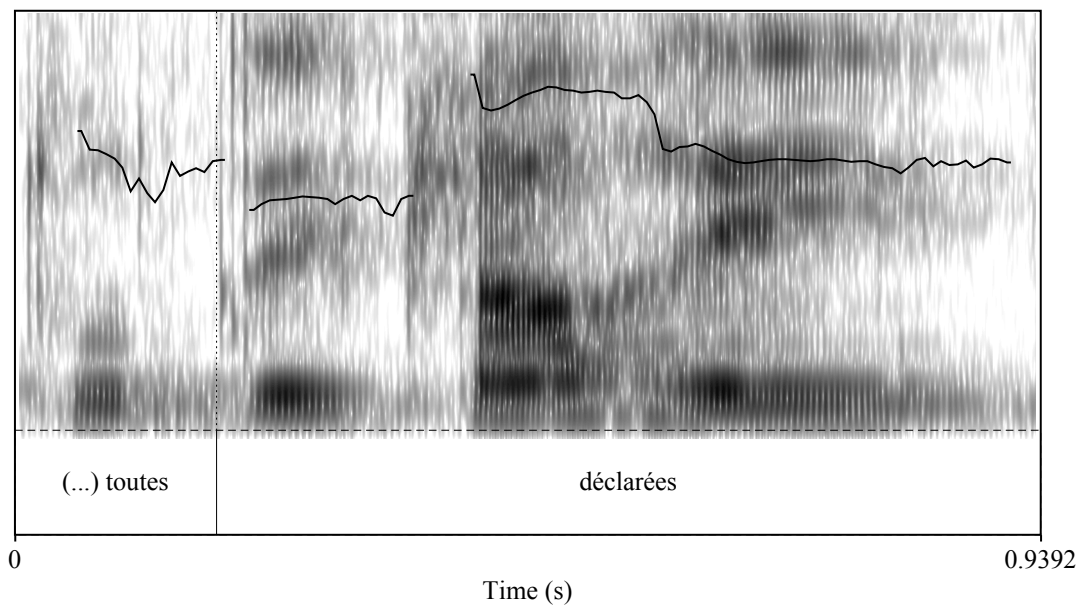
The underlying long vowel is realized as a diphthong in stressed position, which is typical to this variety, but this does not preclude a high tone from appearing in pretonic position.[23] The metrical structure of the optimal candidate at the outcome of the grammar can thus be as represented in (19):

(19) Metrical structure of *déclarées* with penultimate accent and diphthongized lexically long vowel

L_3:						×	
L_2:					×	×	
L_1:		×			×	×	
L_0:		×			×	×	×
	d	e	k	l	a	r	e	j

$$|$$
$$H$$

5. Concluding remarks

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[23] The diphthongisation [j] – which is a suffixal derivation originally borrowed from Franco-Provençal (Knecht, 1985) – solely targets lexically long vowels corresponding to the orthographical representations <-ie> and <-ée>.

This paper has sought to reassess the status of the foot in the phonology of French, both in child and adult language. We have seen that both iambic and trochaic feet have been argued to account for (parts of) the prosodic structure of the language for phenomena such as the behaviour of schwa, stress assignment, non-concatenative morphology and acquisition. Under closer scrutiny, however, neither the trochaic nor the iambic approach is fully satisfactory and they are clearly incompatible.

We have argued in favor of a view of grammar that abandons constituency and relies instead on the sole metrical grid. We have shown that a model that builds up the grid in a stratified way is able to account for opacity effects, by stating potentially conflicting generalizations at different levels. For instance, the *loi de position* and the 'trochaic foot' can be viewed as the result of the prosodic weakness of schwa in the lexicon. These generalizations may be obfuscated in higher strata due to rhythmic and/or pragmatic constraints. As the data drawn from Swiss French have made it clear, stress is a multi-faceted phenomenon that can involve different types and levels of prominence. Specifically, our model is able to formally capture the difference between emphatic and non-emphatic non-final accent at the phrase level. Further research on the issues that we have touched upon will make it possible to refine the model that we have outlined.

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