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Feet without stress: High vowel deletion in Québec French

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Abstract
This paper investigates whether high vowel deletion (HVD) in Québec French is conditioned by prosodic structure. In Prosodic Phonology, prosodic constituents are typically assumed to be universal. However, the universality of certain constituents, such as the foot, has been questioned for languages like French, where prominence is only obligatory at the phrase level. We probe this issue by analysing HVD, a lenition process that is sensitive to prominence. We conducted two experiments. Experiment 1 examined the role of phrasal tone profile in HVD, while Experiment 2 examined whether word-internal constituency affects HVD. The results show that, while tone profile does not affect HVD, the process is preferred in dependent positions of iambic feet in even-parity forms. Odd-parity forms show no preference regarding HVD, suggesting that even- and odd-parity forms are parsed differently in Québec French.

1. Introduction

In the theory of Prosodic Phonology (e.g., Selkirk 1984; Nespor and Vogel 1986; McCarthy and Prince 1995), prosodic constituents are organised into a hierarchy where the phonological word (PWd), the domain in which lexical stress is computed, immediately dominates the foot, the domain in which stress is realised. Although these domains have been proposed to be universal (e.g., Inkelas and Zec 1995; Selkirk 1996; Vogel 2010), their existence in some languages has been questioned, particularly in those that lack lexical stress, for example French (Jun and Fougeron 2000) and Vietnamese (Schiering et al. 2010). Our focus in this paper is French. As we will see, the only obligatory position of prominence in French falls at the right edge of a higher domain, the accentual phrase or phonological phrase (henceforth PPh) (e.g., Dell 1984; Jun and Fougeron 2000). Coupled with rampant violations of word minimality, this has led some researchers to posit that French lacks the foot. However, other phonological patterns in the language, for example truncation (Scullen 1997), have led a different group of scholars to posit a foot for French. There is no consensus in the literature on

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French on the kind of evidence that should be brought to bear on the status of the foot and, thus, no resolution of the problem.

In this paper, we address a different pattern of behaviour that may speak to this question: variable high vowel deletion (HVD) in Québec French (QF), such as in [ʁɔbinɛ] ~ [ʁɔb̲inɛ] *robinet* 'tap' (where underlining marks the site of a deleted vowel). Across languages, vowel deletion is typically sensitive to prominence: it is unstressed vowels that delete (e.g., Crosswhite 2004). Earlier work by Verluyten (1982) has suggested that HVD in QF is regulated by alternating rhythm, but this finding has been challenged by Cedergren (1986). Part of the problem in identifying the factors at play is that the process applies variably and, thus, inconsistencies in the findings are difficult to interpret. Nonetheless, earlier literature has observed that HVD is disfavoured at domain edges, thereby suggesting a role for prominence. First, word-final high vowels do not delete (Verluyten 1982; Cedergren 1986; Couturier 1995); such vowels would be located in foot head position, if French were to build feet. Second, deletion of high vowels from word-initial syllables is dispreferred (Couturier 1995; Guzzo et al. 2016), a position that has been argued to be "psycholinguistically prioritised or perceptually prominent" (Beckman 1997, p. 2). Although the dispreference for HVD in both of these environments suggests that the process is sensitive to prominence of some type, two questions arise from this observation. One, are all domain-internal vowels equally non-prominent; if not, what factors are responsible for differences in rates of deletion observed? Two, if word-initial position disfavours deletion, does this coincide with the site of initial strengthening in French, which is realised as a high (H) tone?

In this paper, we report on two experiments which examine whether prominence in some way regulates the application of HVD: Experiment 1 investigates the role of the initial H tone; Experiment 2 investigates the role of word-internal rhythmic structure. We find that HVD does not interact with H tone. It does, though, motivate the presence of a right-aligned iambic foot. Further evidence for this comes from patterns of deletion demonstrating that footing is iterative. However, the conditions under which feet can iterate in French are nuanced: it is sensitive to the even/odd parity profile of strings.

We begin by discussing previous observations about the status of prosodic domains in French, focusing especially on the phonological phrase, the phonological word, and the foot. In section 3, we examine the findings of previous analyses of HVD in QF. We show that the role of prosodic structure in HVD is disputable, as not all of the analyses have found it to be a conditioning factor of the process. In section 4, we present the hypotheses that underlie our study. The two experiments that were designed to test these hypotheses are described in sections 5 and 6. Section 7 discusses the role of prosodic structure in QF given the results of both experiments.

2. Prosodic domains in French

In QF, like in other varieties of French, prominence is obligatorily assigned only at the right edge of a phonological phrase. As a result, in a PPh that has more than one lexical word, each of which is parsed as a PWd, only the rightmost PWd is assigned prominence (e.g., Dell 1984; Jun and Fougeron 2000, for European French; Thibault

and Ouellet 1996, for QF). The example in (1) shows that DPs with prenominal adjectives are parsed as one PPh in French (Jun and Fougeron 2000) and, thus, only the final syllable of *maison* is prominent, indicated in bold. Final prominence is acoustically manifested through longer durations and higher pitch relative to non-prominent syllables (e.g., Jun and Fougeron 2000, for European French; Lamontagne and Goad 2022, for QF).

(1) [la [ʒɔli]$_{PWd}$ [mɛ**zɔ̃**]$_{PWd}$]$_{PPh}$
la jolie maison
'the pretty house'

In most varieties of French, including QF, an optional H tone can be placed on the first syllable of the first lexical word (or PWd) of the PPh (Thibault and Ouellet 1996, for QF; Jun and Fougeron 2000, for European French). This means that in PPhs with a single long word, the optional left-edge H tone can fall on the same PWd that is assigned the obligatory final prominence, the phrasal H tone indicated by H* in (2-a). In contrast, in PPhs with two PWds, each PWd may be assigned a H tone, as shown in (2-b).

(2) a. H H*
[lə ʁefʁiʒeʁa**tœʁ**]$_{PWd}$]$_{PPh}$]
le réfrigérateur
'the fridge'

b. H H*
[lə [ʒɔli]$_{PWd}$ ʁefʁiʒeʁa**tœʁ**]$_{PWd}$]$_{PPh}$]
le joli réfrigérateur
'the pretty fridge'

In the literature on French, there is some disagreement on the inventory of prosodic domains employed in the language. Jun and Fougeron (1995, 2000, 2002) exclude both the PWd and foot from the hierarchical structure of domains they posit: syllables are organised into function words or lexical words which are, in turn, organised into Accentual Phrases (equivalent to PPh, as mentioned above). We will argue that HVD is sensitive to iteratively built feet which are combined into the PWd, as per the prosodic hierarchy; the domain in which HVD is computed is thus the PWd. In view of this, we briefly discuss the status of each of these constituents in French from earlier literature.

Jun and Fougeron's research focuses on prominence-related phenomena. In works which examine constraints on syllable and segmental well-formedness, empirical support has been provided for the PWd. For example, glide formation is observed PWd-internally in French, as shown in (3-a), but not across PWd boundaries (3-b) (Hannahs 1995; Lyche and Girard 1995). That the relevant domain is the PWd rather than the lexical word can be seen from the behaviour of derivationally-complex forms: suffixes that fall inside the PWd of their host trigger glide formation (3-c); while prefixes that form a PWd as a sister to the PWd of their host do not (3-d) (following Guzzo 2018).

(3) a. [ljø]$_{PWd}$, *[li.ø]$_{PWd}$
lieu
'place'

b. [ʒɔli]$_{PWd}$[ɑ̃fɑ̃]$_{PWd}$, *[ʒɔl]$_{PWd}$[jɑ̃fɑ̃]$_{PWd}$, *[ʒɔli]$_{PWd}$[jɑ̃fɑ̃]$_{PWd}$
joli *enfant*
'pretty child'

c. [kɔlɔnjal]$_{PWd}$, *[kɔlɔni.al]$_{PWd}$
coloni-al
'colonial'

d. [[səmi]$_{PWd}$[anɥɛl]$_{PWd}$]$_{PWd}$, *[səmjanɥɛl]$_{PWd}$
semi- *annuel*
'semi-annual'

Turning to the foot, evidence for this constituent in French is less clear. Aside from the absence of lexical stress, French does not have a minimal word requirement. In languages with feet, the minimal lexical word usually corresponds to a binary (bimoraic or disyllabic) foot (McCarthy and Prince 1990, 1995). Although French has a vowel length distinction, all oral vowels are realised as short word-finally (e.g., Walker 1984; Montreuil 1995; Côté 2012 and, as a result, numerous CV lexical words are attested (e.g., Scullen 1997); see (4).

(4) CV lexical words in French:

[ɡʁi]	*gris*	'grey'
[ʃu]	*choux*	'cabbage'
[ʒø]	*jeu*	'game'
[o]	*eau*	'water'
[pɛ]	*paix*	'peace'
[ʃɑ]	*chat*	'cat'

In contrast to this view, several researchers have proposed that French does have foot structure. Selkirk (1978) takes this position to account for patterns in the distribution of schwa. She proposes that every syllable with a full vowel corresponds to its own foot, while a syllable containing a schwa, which is prosodically deficient, attaches to the syllable to its left forming a trochee. A structure such as (CV.Cə)$_{Ft}$(CV)$_{Ft}$illustrates this parsing. The proposal in Selkirk (1978) has been further developed in subsequent analyses such as Montreuil (1995, 2002) and Bosworth (2017). A trochaic approach has also been proposed to account for the stress patterns observed in Early Old French – while word-final consonants in stressed syllables are taken to be onsets of empty-headed syllables, ('CV.CØ)$_{Ft}$, word-final syllables with a schwa are analysed as being in foot-dependent position, ('CV.Cə)$_{Ft}$ (Rainsford 2020).

Additional patterns observed in French have led other researchers to posit iambs (e.g., Charette 1991; Weeda 1992; Armstrong 1999; Goad and Buckley 2006). For example, an iambic analysis finds support from truncation – French has many disyllabic truncated forms, which exhibit final stress (Scullen 1997), as shown in (5).

(5) Iambs formed from truncation:

réfrigérateur	→ (fʁiˈgo)	‘refrigerator’
application	→ (aˈpli)	‘phone app’
adolescent	→ (aˈdo)	‘adolescent’
colocataire	→ (koˈlɔk)	‘housemate’

In this way, French appears to be like Japanese, where there are a number of sub-minimal lexical words, yet truncation yields binary outputs motivating the foot (Itô 1990). The evidence from truncation in French, however, is weakened by the presence of longer truncated forms (e.g., [paʁaˈno] for *paranoïaque* ‘paranoid’, [kɔlaˈbo] for *collaborateur/collaboratrice* ‘collaborator’), as well as monosyllabic truncated forms (e.g., [tʁi] for *triage* ‘triage’, [bak] for *baccalauréat* ‘baccalaureate’).

Although there is no broad consensus on the status of the foot in French, an important aspect of Selkirk’s (1978) analysis is that footing is not always associated with metrical prominence. Our analysis of high vowel deletion in QF will adopt this general idea: we will argue that HVD motivates the presence of a right-aligned iambic foot and, further, that footing is iterative, in the absence of stress. Our proposal builds on Verluyten (1982), who posits that HVD in QF is rhythmic: it preferentially applies in even-numbered syllables from the right word edge.

3. High vowel deletion in Québec French

In QF, there are a number of variable lenition processes that target high vowels. We compare devoicing and deletion, as researchers often question whether they are one and the same process.[1,2] Both are conditioned by linguistic and sociolinguistic factors (Cedergren and Simoneau, 1985); however, the linguistic factors do not substantially overlap, indicating that they are independent. Below, we introduce some of the constraints that regulate each process, as this will highlight the role of prosodic factors driving deletion in contrast to assimilatory factors driving devoicing.

Devoicing has a strict segmental conditioning: high vowels surface as devoiced between two voiceless consonants or either following or preceding a voiceless consonant (e.g., [ekḭpe] *équiper* ‘to equip’, but *[ʁɔbḭnɛ] *robinet* ‘tap’; Gendron 1966; Cedergren and Simoneau 1985; Bayles 2016). Deletion, on the other hand, is not conditioned by voicing; high vowels may delete following or preceding both voiceless and voiced consonants (Cedergren and Simoneau, 1985; Bayles, 2016; Garcia et al., 2017). Although the preceding consonant is an important predictor in HVD, it is manner of articulation that is most relevant: preceding obstruents favour the process, regardless of their voicing value (Dumas, 1977; Cedergren and Simoneau, 1985; Cedergren, 1986).

Studies have also found that syllable shape affects HVD, in ways that suggest that deletion and devoicing are independent processes. Dumas (1977) and Cedergren and

[1] Cedergren and Simoneau (1985) analyse a third high vowel lenition process observed in QF, namely reduction (defined as the shortening of the vowel to under 30 milliseconds). They ultimately conclude that reduction and deletion are manifestations of the same phonological phenomenon. A fourth high vowel lenition process is laxing, which may trigger other processes, including harmony (for a comprehensive examination of laxing, see Lamontagne 2020). We do not discuss either of these processes further.

[2] HVD is not unique to QF. It is also observed in varieties such as Parisian French (Bayles, 2016) and Acadian French as spoken in New Brunswick (Cichocki, 2023). However, HVD is described as a pervasive phenomenon in QF (see, e.g., Walker 1984; Dumas 1987), and, thus, this is the variety that we focus on.

Simoneau (1985) point out that HVD is preferred in CV syllables, and dispreferred in syllables with a complex onset or a coda. In addition, the shape of the consonant string that results from HVD seems to affect the likelihood of the process taking place. Cedergren and Simoneau (1985) note that HVD is avoided when it results in a long consonant string (such as in [administʁasjɔ̃] *administration* 'administration'). These restrictions do not hold of high vowel devoicing; although devoicing seems to be dispreferred in syllables with complex onsets, we conjecture that this is not because of the complex onset structure per se, but rather because the second member of such clusters is a sonorant and thus voiced. High vowel devoicing also applies before voiceless codas, presumably because vowels are shorter in this context, an optimal environment in which devoicing can take place. In addition, the profile of the resulting consonant cluster may impact HVD, although in diverging ways across studies. Garcia et al. (2017) observe that listeners judge HVD as dispreferred when the resulting consonant cluster mirrors a possible complex onset in QF (e.g., in [supi̥ʁe] *soupirer* 'to sigh', where [pʁ] is a possible onset cluster in the language), as deletion masks the original syllable structure. Lamontagne (2023), in contrast, finds that production data favour deletion over retention of high vowels between consonants of this profile.

Turning to prosodic factors, devoicing may target high vowels in adjacent syllables, which is not possible with deletion (Walker 1984); compare (6-a) and (6-b).

(6) a. Devoicing:
[klasi̥fikasjɔ̃]~[klasifi̥kasjɔ̃]~[klasi̥fi̥kasjɔ̃] *classification* 'classification'

b. Deletion:
[klasi̲fikasjɔ̃]~[klasifi̲kasjɔ̃], but *[klasi̲fi̲kasjɔ̃]

In addition, devoicing is possible word-finally, when the PWd-final high vowel is not at the right edge of a PPh,[3] although it is less frequent in word-final position than it is word medially (Walker 1984). In contrast, many studies have shown that HVD is blocked at the right edge of a PWd or PPh (e.g., Dumas 1977; Verluyten 1982; Cedergren and Simoneau 1985; Couturier 1995), as can be seen in (7).[4]

[3] In some varieties of French, such as Parisian French, PPh-final devoicing is possible, but the targeted vowel is typically followed by a fricative closure (Fagyal and Moisset 1999; Smith 2003). This type of devoicing is more frequent at the end of statements.

[4] Under some conditions, HVD may be possible in word-final position. For example, Couturier (1995) reports a few cases in phrase-final monosyllables when the phrase-level prominence had shifted to the left. Cichocki (2023) shows, in an analysis of HVD with preceding (affricated) coronal stops in Acadian French, that word-final HVD is possible when the targeted vowel is in phrase-medial position.

(7) HVD blocked:

a. word-finally in phrase-final position
[lə [tapi̲]$_{\text{PWd}}$]$_{\text{PPh}}$
le tapis ‘the carpet’

b. word-finally in phrase-medial position
*[lə [pətsi̲]$_{\text{PWd}}$[ɡaʁsɔ̃]$_{\text{PWd}}$]$_{\text{PPh}}$
le petit garçon ‘the little boy’

c. in composite structures with prefixes
*[[ɑ̃tsi̲]$_{\text{PWd}}$[katɔlɪk]$_{\text{PWd}}$]$_{\text{PWd}}$
anti-catholique ‘anti-Catholic’

Finally, studies that have examined words in isolation have found that HVD is dispreferred in the first syllable of a word, as shown in (8), either in production (such as Couturier 1995), or based on speakers’ judgements (such as Guzzo et al. 2016). Couturier (1995) points out that this dispreference may be connected to QF’s optional left-edge H tone, although he acknowledges that his data are insufficient to support this possibility.

(8) HVD dispreferred:

[bi̲ʒu]	*bijou*	‘piece of jewellery’
[pi̲mɑ̃te]	*pimenter*	‘to add spice’

Taken together, the data in (6)–(8) suggest that HVD is conditioned by word-level rhythmic structure: the process targets non-prominent syllables within the domain of the PWd. Accordingly, previous analyses (Verluyten 1982; Cedergren and Simoneau 1985; Cedergren 1986; Garcia et al. 2017) have proposed that metrical structure constrains HVD. However, they do not agree on the kind of metrical structure that is assigned to the PWd level in QF, as we detail below.

Verluyten (1982), based on data obtained by Hammond (1980), proposes that HVD preferentially applies in metrically weak syllables. In his proposal, a metrical rule maps the syllables in a given word to strong (S) and weak (W) nodes, which are assigned from right to left in alternating fashion. The resulting word-level rhythm is therefore iambic, the exception being words that end in a schwa, which is associated with a W node. Following from this, HVD is preferred in syllables associated with W, as shown in (9).

(9) Verluyten (1982): HVD preferred in W syllables

a. S W S
kɔ.mi̲.te *comité* ‘committee’

b. SW S W S
a.li̲.mɑ̃.ta.sjɔ̃ *alimentation* ‘nourishment’

In contrast, Cedergren and Simoneau (1985) and Cedergren (1986) argue that HVD is not conditioned by alternating rhythm in QF. Instead, HVD is possible due to the inherent metrical profile of high vowels. In their analyses, prominence is represented with a metrical grid (as in Prince 1983; Selkirk 1984). First, all syllables are assigned a demi-beat (DB), as shown in (10). Subsequently, all non-final syllables that do not contain a schwa or a high vowel are assigned a beat (called basic beat (BB)) at the immediately higher level. HVD, as well as schwa deletion, may apply to all syllables that are not aligned with a basic beat. This is exemplified in (10), where /i/ may be deleted in *animal* 'animal' and either /i/ or /y/ may be deleted in *constitution* 'constitution'. The word-final syllable is assigned an additional beat (according to Cedergren's 1986 Main Word Stress (MWS) rule) – since word-final high vowels do not delete, they are assigned a beat at each level of the representation, like other (non-schwa) final syllables.

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(10)  MWS            ×                     ×             ×
      BB         ×   ×            ×        ×           × ×
      DB         × × ×            ×  ×   × ×           × ×
                 a.ni̱.mal         kɔ̃s.t͡si̱.t͡sy̱.sjɔ̃        a.mi
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Cedergren and Simoneau (1985) and Cedergren (1986) consider HVD to be a result of variable phonetic effects that apply to vowels assigned only a demi-beat in the metrical grid. However, in their analyses, Cedergren and Simoneau (1985) and Cedergren (1986) do not include any predictors related to word-level rhythmic profile. Thus, it is unclear whether there is any rhythmic conditioning in the sociolinguistic data they examine that is consistent with Verluyten's proposal.

The idea that alternating rhythm conditions HVD in QF does find support in experimental data obtained by Garcia et al. (2017). Native speakers of QF judged the naturalness of the pronunciation of words with and without deletion of /i/. Garcia et al. found that HVD is favoured in even-numbered syllables from the right word edge, suggesting iterative iambic footing, in the spirit of Verluyten (1982). In addition, they observed an interaction between metrical structure and morphology, as HVD is favoured when the target vowel is at the left edge of a suffix and in foot-dependent position (e.g., [ɔʁgan-i̱ze] *organiser* 'to organise', [ɛksklyziv-i̱te] *exclusivité* 'exclusivity').

It should be noted that, even though different studies have considered the role of metrical structure in HVD, only a subset included predictors relating to it, namely Couturier (1995), Guzzo et al. (2016) and Garcia et al. (2017). However, these studies differ in the metrical properties that were considered. On the one hand, Couturier (1995) examined HVD in all positions in the word (including word-finally) and in words located in various phrasal positions, but while he considered predictors such as number of syllables in the word, he did not include syllable structure. Guzzo et al. (2016) and Garcia et al. (2017), on the other hand, investigated HVD in words in isolation given predictors such as word-internal rhythm, number of syllables and (resulting) syllable structure, but while some of their items had multiple deletion sites, they did not probe which positions favoured deletion in such items. Regarding other studies

that have proposed a metrical approach for HVD, such as Cedergren and Simoneau (1985), Cedergren (1986), and Verluyten (1982), predictors relating to metrical structure were not quantitatively examined. Although Cedergren and Simoneau (1985) and Cedergren (1986), in their analyses of sociolinguistic data, included several predictors relating to segmental profile, they did not control for metrical predictors such as number of syllables in the word and position of the word in the phrase. In the case of Verluyten (1982), who examines sociolinguistic data first studied by Hammond (1980), it is unclear whether any segmental or (additional) metrical predictors constrain the patterns that were observed.

In summary, while some previous studies investigated the role of certain metrical constraints on HVD, they did not include other prosodic predictors that may also have an effect on the process. One such predictor is the left-edge H tone, which may hinder HVD when associated with a word-initial deletable vowel. Another issue to be considered is that, because these studies examined real words, phonotactic profile could not be strictly controlled for, which could mask some effects related to the metrical conditioning of HVD. We address these concerns in two experiments, which are detailed in the following sections.

4. Hypotheses

As is clear from the preceding, any conclusion arrived at regarding the prosodic conditioning of HVD is uncertain. The lack of consensus, we believe, stems principally from the finding that HVD applies variably. Consequently, linguistic and sociolinguistic factors can militate against deletion, even if the prosodic context is one that could favour deletion. Another consideration is that there may be competing prosodic constraints at play. Consider a word like *limitation* [li.mi.ta.sjɔ̃] 'limitation' which, according to Verluyten, has the rhythmic profile WSWS. If HVD is sensitive to rhythm, the initial W syllable *li* should be the favoured site for HVD, relative to the following S syllable *mi*; *li*, however, falls in the preferred location for the left-edge H tone if *limitation* is the first lexical word in a phrase. Thus, *li* could resist deletion relative to *mi* for this reason.

In order to tease apart these potentially competing prosodic factors, we report on two experiments, which test the role of each factor independently. We forward two hypotheses as follows:

Hypothesis 1: HVD is conditioned by the tonal profile of the PPh. HVD is dispreferred in the PWd-initial syllable of the leftmost PWd in a PPh, as this syllable is normally associated with a H tone.

Hypothesis 2: HVD is conditioned by word-internal constituency. HVD is dispreferred in odd-numbered syllables from the right-edge of the word, as these syllables fall into foot-head position in iambic feet.

Hypothesis 1 is addressed in Experiment 1; hypothesis 2, in Experiment 2. Specific predictions that stem from each hypothesis are discussed in sections 5.2 and 6.2 below.

5. Experiment 1: HVD and phrasal prominence

To our knowledge, virtually all previous research on HVD has examined words in isolation. The one exception we have found is Couturier (1995), who looked at words both in isolation and in various positions in sentences and found that they displayed comparable behaviour with respect to HVD.[5] The restriction to isolated words stems from the observation that HVD does not cross PWd boundaries. For example, in a phrase like *joli sens* [ʒɔli sɑ̃s] 'beautiful meaning', PWd-final [i] is not a candidate for deletion, although the same vowel is in the quasi-segmentally parallel *la licence* [la lisɑ̃s] 'the licence'. Because previous research has observed that HVD is delimited by the phonological word, any potential role that the left-edge H tone may play in regulating the process has not been examined, given that it is assigned as part of the tonal profile of the phonological phrase. We aim to fill this gap with Experiment 1.[6]

Recall from section 2 that prominence assignment in QF occurs at the level of the PPh. It is thus possible that lenition phenomena such as HVD are constrained by the prosodic profile of the PPh rather than the PWd. In Experiment 1, we examine this possibility. Specifically, we employ a judgement task using auditory stimuli to investigate whether QF speakers' preferences regarding HVD are influenced by phrase-level tonal profile, where, in addition to the obligatory H tone at the end of the PPh, another H tone is associated with the left edge of the first lexical word in the domain (shown earlier in (2)). If HVD is constrained by phrase-level prominence, then it should be avoided in syllables that would normally receive a H tone. To illustrate, word-initial HVD should be rated worse overall in determiner + noun strings (e.g., [la mi̱tɔlɔʒi] 'the mythology'), because the deletable vowel (underlined) is in the first syllable of the noun which, as the first (and only) PWd in the phrase, is typically assigned an initial H tone. In contrast, HVD should be rated better in determiner + adjective + noun structures (e.g., [la ʒɔli mi̱tɔlɔʒi] 'the beautiful mythology'), because the deletable vowel is not assigned a H tone, as the initial H tone appears on the first syllable of the preceding adjective. This experiment is detailed in the subsections that follow.

5.1. Methods

5.1.1. Participants

Participants were 22 native speakers of QF, all of whom grew up in the Greater Montréal area or surrounding regions. None of the participants were bilingual from childhood, but some had knowledge of other languages, including English, at varying levels of proficiency. Participants' mean age was 31.5, ranging from 18 to 60. No participant reported any hearing impairments.

5.1.2. Stimuli

The target items were 10 two-syllable and 10 four-syllable nouns with /i/ in the initial syllable. These items were placed in three types of phrases: one containing only the

[5] Couturier (1995) notes that, for target words embedded in sentences, there is a tendency for deletion to apply more often when the vowel is relatively far away from the right edge of a major phrasal boundary. However, there are no statistics nor proportions reported which illustrate the tendency he noted.

[6] Preliminary results of this experiment appear in Anonymous (2018).

noun (N), one with determiner + noun (DN), and another with determiner + adjective + noun (DAN); see (11), where the deletable vowel is again underlined. The adjective in the DAN condition was always [ʒɔli] 'pretty, beautiful', to avoid responses that could be influenced by the phonological shape of the adjective rather than the target noun. The determiner was indefinite [œ̃], [d͡zy] or [de] for masculine nouns and definite [la] for feminine nouns; masculine definite [lə] was not used to avoid schwa (see further below). The target nouns were produced with and without deletion of /i/. In total, there were 120 target phrases. A list of stimuli is provided in Appendix A.

(11) Types of phrases in Experiment 1:

a. Noun only (N)
[vi̲zaʒ] 'face'
[mi̲tɔlɔʒi] 'mythology'

b. Determiner + noun (DN)
[œ̃ vi̲zaʒ] 'a face'
[la mi̲tɔlɔʒi] 'the mythology'

c. Determiner + adjective + noun (DAN)
[œ̃ ʒɔli vi̲zaʒ] 'a pretty face'
[la ʒɔli mi̲tɔlɔʒi] 'the beautiful mythology'

The stimuli were further constrained, based on the findings of earlier literature (see section 3). Beginning with syllable profile, the deletable vowel was invariably located in a CV syllable; recall that HVD does not apply in closed syllables nor in syllables containing a complex onset. Deletion never yielded a well-formed complex onset or, by extension, coda+onset profile because this has been shown to impact the process. Finally, the last syllable of the target noun was either CV or CVC, which has not been reported to impact HVD. Turning to segmental profile, the deletable vowel was always /i/, as this is the most commonly deleted high vowel in QF (Verluyten 1982). The consonant preceding /i/ was never /s, z/ or /t, d/, the latter of which are affricated to [t͡s, d͡z] before high front vocoids in QF (Walker 1984), since these consonants seem to particularly favour lenition in the language (Dumas 1977; Cedergren and Simoneau 1985). Finally, no schwas were included anywhere in the stimuli. As schwa is commonly deleted in all positions in French (Côté 2007), a preference for schwa deletion could lead to lower rates of acceptance of HVD in the same stimulus.

Each phrase was recorded in two ways, with and without deletion of the noun's first /i/. In stimuli where the high vowel is deleted, of course, no H tone can be realised on that syllable. This has implications for how both types of stimuli should be produced to ensure symmetry across pairs of phrases that will be included in the analysis. Accordingly, phrases with and without HVD were all recorded without the phrase-initial H tone. If the initial H were produced in stimuli where the high vowel is deleted, then it would need to be realised on the following syllable, and the pitch contours over the phrases in the two types of stimuli would not be parallel. Since the initial H tone is

optional in QF (Thibault and Ouellet 1996), productions without it are entirely naturalistic. Thus, in this experiment, we examine how deletion of the vowel that could be assigned a H tone impacts speakers' judgements about the naturalness of HVD.

The experiment also included 203 distractors, which corresponded to forms with and without deletion of non-high vowels in the same three types of phrases (e.g., [kɔ̲pɛ̃] 'friend', [œ̃ kɔ̲pɛ̃] 'a friend', [œ̃ ʒɔli kɔ̲pɛ̃] 'a beautiful friend'), forms with and without deletion of non-high vowels in word-medial position (e.g., [ama̲tœʁ] *amateur* 'amateur'), as well as forms with and without a change of voicing in word-medial fricatives (e.g., [vwazɛ̃] ~ [vwasɛ̃] 'neighbour'). Each participant judged a total of 323 items. Because this experiment involved participants rating the naturalness of phrases containing one to three words, rather than words in isolation, real lexical items were used.

The stimuli were recorded by a female native speaker of Québec French from the Montréal area with training in linguistics and phonetics. Given that the stimuli were produced naturally, they were later checked in Praat (Boersma and Weenink 2024) to ensure no acoustic signatures of vowels were present in the items categorised as having undergone deletion.

5.1.3. Procedure

The experiment was designed using Praat. Participants were asked to rate the naturalness of each item they heard using a four-point scale with endpoints labelled *completely unnatural* (1) and *completely natural* (4). The stimuli were presented both auditorily and orthographically. Participants were provided with the orthographic forms to ensure that they were able to retrieve the items they were judging from the lexicon. This was particularly important in the case of the distractors, since deletion of non-high vowels and changes in fricative voicing could potentially lead participants to assume that they were judging different words and phrases than the intended stimuli. Each test item was preceded by a beep, and the order in which the stimuli were presented was pseudo-randomised. The stimuli were presented in three blocks, and participants could take a short break between blocks. The total time of each testing session was approximately 45 minutes. Testing took place in a sound-attenuated booth at XXX University. Participants were compensated for their time.[7]

5.2. Predictions

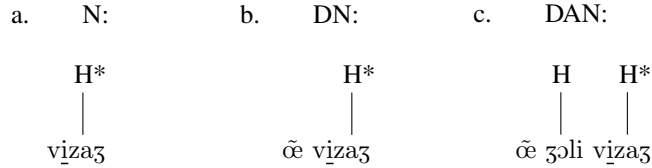
Recall from section 4 that we hypothesised that phrase-level tonal profile conditions HVD: the process is less likely to apply to a high vowel in the first syllable of the leftmost lexical word in a phrase because vowels in this position normally bear a H tone. In our experiment, only nouns have a deletable high vowel in the initial syllable. However, nouns vary in length and in the type of material that precedes them (as shown in (11)); consequently, HVD should not be equally accepted in all combinations of word size and phrase type that we manipulate.

[7] The research undertaken (Experiments 1 and 2) was approved by and complied with the ethical standards set by the Research Ethics Board of XXX University for experiments involving human participants.

The phrases with two- and four-syllable nouns included in Experiment 1 differ with respect to whether and where the left-edge H tone may appear, as shown in (12) and (13), respectively. In all examples, the deletable vowel is underlined, and H* denotes the obligatory phrase-final prominence (as in (2)).

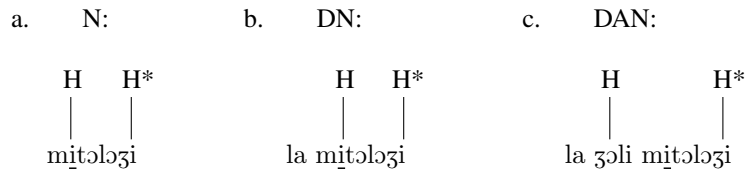
In the three types of phrases with two-syllable nouns, there is no H tone associated with the noun's deletable high vowel. In the structures for N and DN in (12a-b), the initial syllable of the noun is not assigned a H tone since the phrase-final syllable must bear H* and adjacent H tones are not permitted in French. In the case of DAN in (12c), the left-edge H tone is associated with the initial syllable of the adjective, not the noun.

(12) Two-syllable nouns:



In the three types of phrases with four-syllable nouns, on the other hand, the deletable vowel may be associated with a H tone, depending on the type of phrase involved. Specifically, the deletable vowel is associated with a H tone in both N and DN in (13a-b), but not in DAN (13c). In N and DN, the initial H tone would normally be assigned to the first syllable of the noun, which should thereby hinder the application of HVD in both cases. However, in DAN, the initial H tone would normally be assigned to the first syllable of the adjective, similar to what is observed in DAN with two-syllable nouns (12c).

(13) Four-syllable nouns:



Taking together the tonal profile of phrases with two- and four-syllable nouns, we predict that HVD should overall be dispreferred in four-syllable nouns, since in two types of phrases with four-syllable nouns (namely, N and DN), the deletable vowel may be associated with a H tone. In contrast, in two-syllable nouns, the deletable vowel cannot be associated with a H tone, regardless of the type of phrase. This is expressed as Prediction 1.1:

Prediction 1.1: HVD will be dispreferred in four-syllable nouns relative to two-syllable nouns, since the deletable vowel in four-syllable nouns (in N and DN) may be associated with a H tone.

Following from this, we predict that type of phrase should condition HVD preferences only for four-syllable nouns. In this case, HVD should be dispreferred in phrases where the deletable vowel may be associated with a H tone, namely, in N and DN. This is expressed as Prediction 1.2:

> **Prediction 1.2:** For four-syllable nouns, HVD will be dispreferred in both N and DN relative to DAN, since the deletable vowel in N and DN (but not in DAN) may bear a phrase-initial H tone.

In summary, if phrase-level tonal profile constrains HVD, the process should be rated as less natural in constructions with four-syllable nouns relative to constructions with two-syllable nouns, as well as in N and DN (relative to DAN) with four-syllable nouns. We present our results below.

5.3. Results

Figure 1 shows participants' judgements of items with HVD by *number of syllables* (two vs. four) and *type of phrase* (N, DN, and DAN). As previously mentioned, participants rated the items based on a 4-point scale, where 1 corresponded to *completely unnatural* and 4 corresponded to *completely natural*. The patterns in Figure 1 suggest that HVD is overall more natural in four-syllable nouns, regardless of the type of phrase.

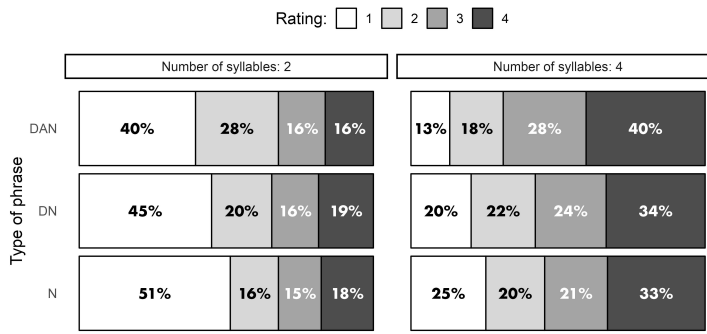


Figure 1. *Participants' judgements of items with HVD in the word-initial syllable by* number of syllables *and* type of phrase*, where 1 (white) corresponds to* completely unnatural *and 4 (dark grey) corresponds to* completely natural.

The data were analysed using a Bayesian hierarchical ordinal regression using the `brms` package (Bürkner 2017) in R (R Core Team 2024) with default priors (flat) for main effects and for thresholds (student *t*). The model included *type of phrase* as well as *number of syllables* as main effects, in addition to by-participant random slopes (for both variables) and intercepts and by-item random intercepts. The model in question was run using 8,000 iterations, 4 chains, and 2,000 warm-up steps, which guaranteed

a satisfactory effective sample size of at least 4,500. Finally, our chains were visually inspected and our R values were checked to ensure that the model had converged. We ran models with and without an interaction between *type of phrase* and *number of syllables*. We compared the models using their WAIC values (Widely applicable information criterion; Watanabe 2013) — as both models performed similarly, we report the model without interaction.

Figure 2 shows the posterior distributions of credible effect sizes for each predictor variable. On the right, the mean effect size for each posterior as well as its 95% credible interval (CrI) is displayed (in the distributions that follow, which are all approximately Gaussian, this is synonymous with the highest density interval, or HDI). Simply put, parameter values closer to the peak of the distribution are more likely given the data than parameter values that are distant from the peak. Effects must be interpreted relative to words with two syllables and N phrases, which represent our reference levels. Finally, Figure 2 also displays the region of practical equivalence around zero (ROPE). If an entire CrI were to be found within said region, we would conclude that a null effect has been found. This is not the case here. As we can see in the figure, words with four syllables favoured a higher rating by participants relative to words with two syllables, as indicated by the positive posterior distribution in the figure. Neither type of phrase (DN or DAN) shows a statistically credible effect relative to N in our model.

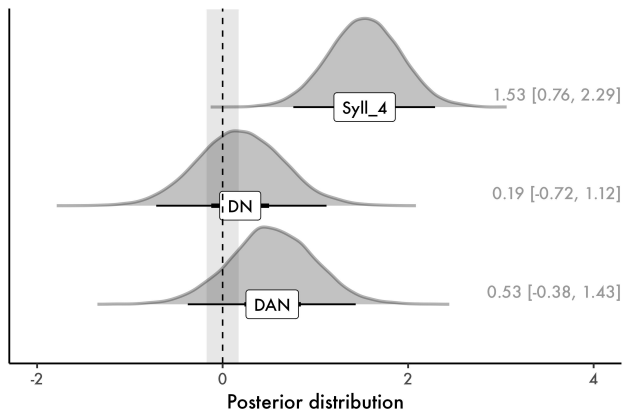


Figure 2. *Posterior distributions of effect sizes with associated means and 95% credible intervals (CrI). Shaded area surrounding zero represents the region of practical equivalence (ROPE).*

These results do not confirm our predictions about the role of the left-edge H tone on HVD, since, as shown in Figure 1, all types of phrases for two-syllable nouns and all types of phrases for four-syllable nouns have similar ratings. Regarding participants' preferences, they are not in the direction we predicted, as HVD is overall preferred in longer nouns, regardless of phrase type and, in consequence, whether or not the deletable vowel may be associated with a H tone.

5.4. Interim discussion

In Experiment 1, we examined whether HVD is conditioned by phrase-level tonal profile. As per Hypothesis 1, HVD would be dispreferred in positions that are normally associated with a H tone. We expected the process to be rated as more natural in all three types of phrases with two-syllable nouns (N, DN, and DAN), and in DAN with four-syllable nouns. Although the phrases with two-syllable nouns were all rated similarly, HVD in them was rated as considerably less natural compared to all types of phrases with four-syllable nouns. As mentioned in the previous subsection, these results do not support our hypothesis.

Two possibilities seem viable to explain these patterns. First, it could be the case that HVD is constrained by word length, being favoured in longer words. Recall that the target nouns included in this experiment displayed HVD in the word-initial syllable. It could be that HVD in the first syllable of a shorter word is more likely to be judged as unnatural, as the listener has only one additional syllable on which to rely to identify the lexical word in question. This implies that HVD in two-syllable nouns may be more onerous for the listener since it requires lexical retrieval to be achieved with less surface material.

An alternative possibility is that these patterns of preference are conditioned by metrical structure. Assuming an iambic structure that applies from right to left, it is possible that HVD is dispreferred when it applies in the dependent syllable of the head foot in the PWd, that is, in the foot where main prominence is located. In two-syllable words, where the deletable vowel is always in the head of the domain, HVD is rated as worse than in four-syllable words, where the deletable vowel is never in the head foot. This is exemplified by the structures in (14), where Hd-Ft corresponds to *head foot*.

(14) a. H*
|
(vi̲zaʒ)$_{\text{Hd-Ft}}$

b. H H*
| |
(mi̲tɔ)$_{\text{Ft}}$(loʒi)$_{\text{Hd-Ft}}$

In sum, Experiment 1 suggests that HVD in QF is not constrained by phrase-level tonal profile. However, the role of word-level metrical structure is still unclear. Although the results suggest that the status of the foot (head vs. non-head) may affect the application of HVD, further investigation is needed to probe the extent to which the process is conditioned by metrical structure. We explore this issue further in Experiment 2.

6. Experiment 2: HVD and word-internal constituency

As mentioned, previous research has found mixed results with respect to the role of metrical structure in HVD in QF. The proposal in Verluyten (1982), that HVD is favoured in even-numbered syllables from the right edge of the word, consistent with iambic footing, was later challenged by Cedergren (1986) based on sociolinguistic data, but supported by Garcia et al. (2017) in a judgement task with auditory stimuli. Although the study reported in Garcia et al. (2017) controlled for the syllabic profile of the target words (i.e., target /i/ was always in a non-final open syllable and was preceded

by a singleton, non-affricated onset), it included a number of additional potential predictors, such as resulting phonotactic profile and morphological status of the deletable vowel (i.e., in the stem or in a suffix), which may conceal or amplify the effects of metrical structure on the process. In addition, Garcia et al. (2017) had participants judge individual words with or without deletion, and, although some of the items included in their experiment had more than one deletable vowel, they were not analysed separately to probe the positions in which HVD would be preferred. As a result, it is impossible to determine whether HVD in a given position in the word would be judged to be better relative to HVD in another position in an item with a similar shape. To address these concerns, as well as further explore the possibility that HVD is constrained by the head foot domain, we conducted a judgement task where participants had to choose between two alternative pronunciations of nonce words, which were designed following a strict phonotactic template.

6.1. Methods

6.1.1. Participants

Participants were 39 native speakers of QF, all of whom grew up in the Greater Montréal area or surrounding regions.[8] Some of the participants reported having knowledge of other languages (including English) at various proficiency levels, but none were bilingual from childhood. The mean age of participants was 27.3, ranging from 18 to 63. None of the participants reported any hearing impairments.

6.1.2. Stimuli

The target stimuli were nonce words with four, five, or six syllables. The target words had two high vowels (always /i/), and were recorded in two ways, each time with deletion of one of the high vowels. In four-syllable words, the deletable vowel was in syllable position 2 or 3 (counting from the right edge of the word). In some five-syllable words, the deletable vowel was in position 2 or 4, while in others, it was in position 3 or 4. In six-syllable words, the deletable vowel was located in position 4 or 5. In contrast to the stimuli in Experiment 1, the initial syllable was never targeted for deletion, as our objective was to examine whether HVD is conditioned by alternating rhythm without the influence of any possible predictors associated with word edges. Forty-eight nonce words were assigned to each of the four conditions, totalling 192 target items. A sample of the target stimuli is given in Table 1 below (a full list is provided in Appendix B).

The syllables in the target stimuli were invariably CV, and the target vowels were always preceded and followed by voiced consonants, to avoid judgements based on the perception of vowel devoicing instead of deletion. In addition to target /i/, the stimuli included the following vowels: /e, ɛ, a, ɔ, o/. Other high vowels, as well as nasal vowels and schwa, were avoided. In target items with four and six syllables, as well as in five-syllable items where deletion was either in position 3 or 4, the deletable vowels were in adjacent syllables.

The portions of the target stimuli containing the deletable vowels were built based on specific templates, to avoid judgements that could stem from consonant quality

[8] One additional participant was excluded due to significant exposure to another dialect of French.

rather than position in the word. For example, in four-syllable words, template [binib] alternated with [nibin], which resulted in the deletable vowels (in syllable 2 or 3) being placed in identical phonotactic contexts (e.g., [dabinibo], [kanibinɛ]). In five-syllable items with deletion in position 2 or 4, the deletable vowels were preceded and followed by the same segments (e.g., [kɛbinabino], [ʃɔnibanibe]). As these examples indicate, each template was duplicated such that the consonants were in the inverse order across pairs of stimuli (e.g., [binib] ~ [nibin], [binVbin] ~ [nibVnib]). Each template was repeated (with different preceding and following segments) three times per condition.

Table 1. *Examples of target items in Experiment 2 across four conditions, varying by number of syllables and position of deletion. The deletable vowels are underlined.*

4-syllable words Deletion: 2 or 3	5-syllable words Deletion: 2 or 4	5-syllable words Deletion: 3 or 4	6-syllable words Deletion: 4 or 5
[dabi̲ni̲bo]	[kɛbi̲nabi̲no]	[tabi̲ni̲bɔfɛ]	[kɔbi̲ni̲beʃɔʁa]
[kani̲bi̲nɛ]	[ʃɔni̲bani̲be]	[ʃɔni̲bi̲neʁo]	[pɛni̲bi̲nɔfɛpa]
[fɛgi̲vi̲ga]	[lɔgi̲vagi̲ve]	[tɛgi̲vi̲gɔʁa]	[ʁagi̲vi̲gɔʒɛle]
[ʁɔvi̲gi̲va]	[ʁavi̲gɛvi̲go]	[lavi̲gi̲vɔʁɛ]	[tɛvi̲gi̲vɔʒape]

The fillers were designed based on the target stimuli, by substituting one of the target high vowels by /a/. To avoid adjacent low vowels in some of the fillers, an /a/ that was present in the original target item was replaced by another non-high vowel (/e, ɛ, ɔ/). The total number of fillers was also 192.

The stimuli were recorded by a male native speaker of QF from the Montréal area with training in linguistics and phonetics. Parallel to Experiment 1, no left-edge H tone was produced in the test items to prevent participants from making judgements based on the surface tonal profile. The stimuli were checked in Praat (Boersma and Weenink, 2024) to ensure no traces of the deleted vowel were present.

6.1.3. Procedure

The experiment was developed in Open Sesame (Mathôt et al. 2012). Participants were presented with two auditory versions of the same word in sequence, each with deletion of a different vowel (e.g., [dabi̲nibo] vs. [dabini̲bo] for the item [dabinibo]). There was a pause of one second between the two stimuli. While participants were listening to both stimuli, the corresponding orthographic form was displayed on the screen. The orthographic forms of the test items were determined following the sound-letter correspondence conventions observed in French, and were checked by a native speaker of QF. Participants were told that they would be listening to (and reading) new words introduced into French. They were asked to decide which of the two pronunciations that they heard for each new word sounded more natural.

There were three versions of the task. Each version started with a practice block containing six filler items (identical across versions), to familiarise participants with the procedure. The 192 experimental items were equally divided across the three versions (64 each). Each version of the experiment also included all the remaining fillers

(i.e., 186), for a total of 256 stimuli per version.[9] The stimuli were presented in three blocks. Participants were encouraged to take a short break between blocks.

The experiment took approximately 45 minutes. Participants were tested in a sound-attenuated booth at XXX University, and were compensated for their time.

6.2. Predictions

For Experiment 2, we hypothesised that HVD would be preferred in foot-dependent position over foot-head position. This hypothesis was based on previous findings supporting the metrical conditioning of HVD (Verluyten 1982; Garcia et al. 2017). Although Experiment 1 was designed to test a different hypothesis, that HVD is modulated by the left-edge H tone of the French prominence system, the experiment instead yielded results that are consistent with Hypothesis 2: assuming that deletion is regulated by metrical structure, it was found to be dispreferred in the dependent position of the head foot. However, an alternative interpretation of the findings was also available, that deletion is more common in longer words. The four types of stimuli included in Experiment 2 were designed to further probe this issue. Our predictions are as follows.

If HVD is sensitive to iteratively built iambic feet, we predict that deletion should be more common in the three types of stimuli where the vowel targeted for deletion is in foot dependent position as compared to foot head position; that is, deletion in position 2 in four-syllable words, relative to position 3; and deletion in position 4 in five- and six-syllable words, relative to positions 3 and 5, respectively. This is expressed in Prediction 2.1, where A > B indicates that deletion in strings of shape A is predicted to show a statistically credible effect relative to deletion in strings of shape B (bold marks the foot head; underlining marks the location of the deleted vowel):[10]

Prediction 2.1: HVD in foot dependent position will be favoured over HVD in foot head position.

4-syllable words:	$(\sigma\boldsymbol{\sigma})(\underline{\sigma}\boldsymbol{\sigma}) > (\sigma\underline{\boldsymbol{\sigma}})(\sigma\boldsymbol{\sigma})$
5-syllable words (deletion in position 4 or 3):	$\sigma(\underline{\sigma}\boldsymbol{\sigma})(\sigma\boldsymbol{\sigma}) > \sigma(\sigma\underline{\boldsymbol{\sigma}})(\sigma\boldsymbol{\sigma})$
6-syllable words:	$(\sigma\boldsymbol{\sigma})(\underline{\sigma}\boldsymbol{\sigma})(\sigma\boldsymbol{\sigma}) > (\sigma\underline{\boldsymbol{\sigma}})(\sigma\boldsymbol{\sigma})(\sigma\boldsymbol{\sigma})$

If French builds iambic feet across the word, one foot in the PWd will be the head foot. As French displays final prominence, it is the rightmost foot that will be marked as the head foot. In Experiment 1, we found that HVD is preferred in the dependent position of the non-final foot in four-syllable words compared to the dependent position of the only foot in two-syllable words. An interpretation of this finding is that deletion is disfavoured in the head foot. In Experiment 2, one comparison enables us to further test this interpretation.

[9] One five-syllable word with deletion in position 3 or 4 from one version of the experiment was excluded from the analysis due to a technical issue.

[10] We have left the initial syllable in five-syllable words as unfooted. An alternative parsing is $(\boldsymbol{\sigma})(\sigma\boldsymbol{\sigma})(\sigma\boldsymbol{\sigma})$, where the initial syllable forms a foot on its own. As the status of the initial syllable, as unfooted or parsed into a degenerate foot, is not decisive for our predictions, we do not discuss it further here. We return to the issue of how five-syllable words are parsed in QF in section 7.

For five-syllable words with HVD in position 2 or 4, both deletion sites are in foot-dependent position, but the former is in the head foot while the latter is not. Thus, if the head foot protects vowels from deletion, then we predict that HVD will be favoured when the vowel targeted for deletion is outside this foot:

Prediction 2.2: HVD will be favoured when the vowel targeted for deletion is outside the head foot.
5-syllable words (with deletion in position 4 or 2): $\sigma(\underline{\sigma}\boldsymbol{\sigma})(\sigma\boldsymbol{\sigma}) > \sigma(\sigma\boldsymbol{\sigma})(\underline{\sigma}\boldsymbol{\sigma})$

Table 2 summarises our predictions for each condition in Experiment 2. We report our results in the subsection that follows.

Table 2. *Predictions for Experiment 2 based on number of syllables in stimuli and position of deletable vowel (underlined).*

# of syllables	Deletable site	HVD preferred in	HVD dispreferred in
4	3 or 2	Position 2 [dabin̲ibo]	Position 3 [dab̲inibo]
5	4 or 3	Position 4 [tab̲inibɔfɛ]	Position 3 [tabin̲ibɔfɛ]
6	5 or 4	Position 4 [kɔbin̲ibɛʃɔʁa]	Position 5 [kɔb̲inibɛʃɔʁa]
5	4 or 2	Position 4 [kɛb̲inabino]	Position 2 [kɛbinab̲ino]

6.3. Results

Figure 3 shows participants' preferences for HVD by number of syllables in the item and position of the deleted high vowel. The figure suggests that, in four- and six-syllable items, participants preferred HVD in foot-dependent positions, that is, in positions 2 and 4, respectively. On the other hand, in five-syllable items, positions 3 and 4 (second panel) and positions 2 and 4 (rightmost panel) were chosen as the preferred sites for HVD at very similar rates.

To analyse these results, we ran two Bayesian logistic regressions, one for the data in the first three panels, and one for the data in the last panel. The first regression models participants' preferences for HVD in foot-head vs. foot-dependent position, to test Prediction 2.1. The second regression models participants' preferences for HVD in the head foot vs. in a non-head foot, to test Prediction 2.2.

We start by discussing the first model. In this regression, participants' preferences (*foot-head position*=1 vs. *foot-dependent position*=0) are modelled as a function of

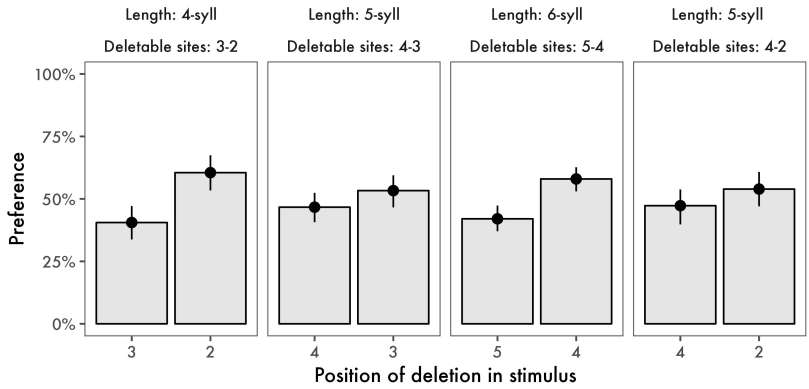


Figure 3. *Participants' preferences for HVD by number of syllables and position of deletable vowel.*

number of syllables. By-participant random intercepts and slopes (*number of syllables*) were also included, as were by-item random intercepts. The results of this model can be examined in Figure 4. As we can see, both four- and six-syllable words have entirely negative 95% CrIs. Negative effects indicate a dispreference for stimuli where deletion occurs in foot-head position relative to five-syllable words, our intercept (5-syll*). For five-syllable words, in contrast, the posterior distribution includes zero in its 95% CrI, which indicates that 0 log-odds (i.e., a probability of 50%) is a statistically credible effect given the data. Overall, the posterior distributions in Figure 4 confirm the trend observed in Figure 3 for both four- and six-syllable words. Finally, no credible difference exists between four- and six-syllable words, which is unsurprising given the patterns observed in Figure 3 and their respective posterior distributions shown in Figure 4. These results partially support Prediction 2.1, as HVD is preferred in foot-dependent position in two of the three conditions under analysis.

Returning to Figure 3, the final panel suggests that no credible difference exists between positions 2 and 4 in five-syllable words. We ran a second Bayesian logistic regression to confirm if this is the case. This second regression is an intercept-only model with by-participant and by-item random intercepts including only five-syllable words with deletion in position 2 or 4; recall that both are in foot-dependent position but differ as to whether they are in the head foot (position two) or in a non-head foot (position 4). The posterior distribution comparing deletion in both positions supports the observation that participants' responses for such positions are not statistically different: = 1.04, 95% CrI = [–0.18, 0.73]. This result does not support Prediction 2.2, as zero is a relatively credible parameter value for the intercept in our model (between the lower threshold of our 95% CrI and the peak of the posterior distribution for the intercept).

In summary, a robust effect was found for both four- and six-syllable words whereby participants disfavour deletion in foot-head position, which is partially consistent with Prediction 2.1. Contrary to Prediction 2.1, however, this same finding was not observed for five-syllable words, as these words show similar preferences for deletion in both

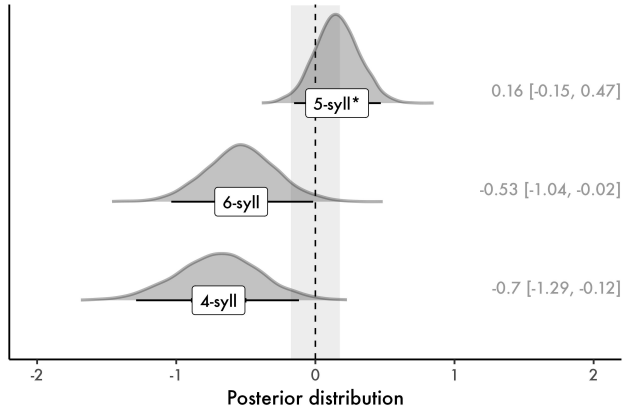


Figure 4. *Posterior distributions of effect sizes (in log-odds) with associated means and 95% credible intervals (CrI). Shaded area surrounding zero represents the region of practical equivalence (ROPE). Both distributions must be interpreted as differences relative to the intercept (five-syllable words, represented with an asterisk in the figure).*

positions under investigation. In addition, there is no statistically credible evidence in the data that participants disprefer HVD in the head foot of the word, contrary to Prediction 2.2. We discuss these findings in the next subsection.

6.4. Interim discussion

In Experiment 2, we tested two predictions related to Hypothesis 2, namely, that HVD is dispreferred in the head position of an iambic foot (Prediction 2.1), and that HVD is dispreferred when the vowel targeted for deletion appears inside the head foot (Prediction 2.2). Prediction 2.1 was tested with three types of items: four-syllable words (with deletion in position 2 or 3), five-syllable words (with deletion in position 3 or 4), and six-syllable words (with deletion in position 4 or 5). Prediction 2.2 was tested based on five-syllable words (with deletion in position 2 or 4).

Prediction 2.1 was partially confirmed by our results, as in four- and six-syllable words, HVD was clearly dispreferred in foot-head position (positions 2 and 4, respectively). However, in five-syllable words (the intercept in Figure 4), participants chose positions 3 and 4 at similar rates. This is contrary to Prediction 2.1, as only the second of these deletion sites (position 4) is in foot-dependent position.

One question that arises is why five-syllable words behave differently from four- and six-syllable words in this respect. An important distinction between the two types of words is that the former constitute odd-parity strings and the latter even-parity strings. If syllables are parsed iteratively into disyllabic feet in QF, only in the latter case can binary feet exhaustively encompass all syllables in a word. Differences in the parsing of even- and odd-parity words may explain the contrasting results for four- and six-syllable words on the one hand, and for five-syllable words on the other. We will return to this issue in the general discussion.

Regarding Prediction 2.2, this prediction was not confirmed by the results of Experiment 2; participants chose deletion in positions 2 and 4 at similar rates in five-syllable words, even though position 2 was internal to the head foot while position 4 was not. This distinction was tested given the results of Experiment 1. Recall from Experiment 1 that participants disfavoured initial deletion in two-syllable words, for which two possible explanations were entertained (section 5.4): deletion in short words is unnatural because there is less information available to recover the target word or because the head foot protects vowels from deletion. The results from Experiment 2 suggest that the position of the foot-dependent high vowel relative to the most prominent syllable in the domain does not affect speakers' judgements. Nevertheless, the results for five-syllable words with deletion in position 2 or 4 are consistent with the general thrust of Hypothesis 2: when presented with words where deletion is in two different foot-dependent positions, participants show no particular preference. We discuss the implications of our results for QF metrical structure in the next section.

7. General discussion and conclusion

We conducted two experiments to investigate whether HVD in QF is conditioned by prosodic factors. In Experiment 1, we tested Hypothesis 1, that HVD is sensitive to the tonal profile of the PPh. Specifically, we examined whether HVD in initial position is dispreferred in phrasal contexts where the deletable vowel is associated with a H tone. In Experiment 2, we tested Hypothesis 2, that HVD is regulated by word-internal constituency. We probed whether deletion is dispreferred in foot-head position as well as in the head foot of the PWd.

Our results for Experiment 1 indicate that word size rather than type of phrase constrains HVD, as participants dispreferred deletion in all types of phrases with two-syllable nouns. In other words, deletion was preferred in initial position in longer nouns (with four syllables), regardless of type of phrase (N, DN or DAN). These results contradicted our predictions, according to which HVD would be dispreferred in contexts where the initial syllable of the noun could be associated with a H tone (that is, in four-syllable nouns in N and DN phrases) and, thus, Hypothesis 1 was not supported. We considered two possible explanations for participants' behaviour, namely, that HVD is dispreferred in two-syllable words because deletion in shorter words could compromise lexical retrieval; and that HVD is dispreferred in two-syllable words because the only foot in the PWd where the deletable vowel would be located corresponds to the head foot.

We tested the latter possibility in Experiment 2, as part of the hypothesis that HVD is overall conditioned by word-internal constituency. The results for Experiment 2 do not confirm the prediction that HVD is dispreferred in the head foot of the PWd, as participants rated the naturalness of five-syllable target words with deletion in position 2 or 4 very similarly. Nonetheless, as both syllables in such words could be in foot-dependent position, these results are in line with the hypothesis that HVD is conditioned by word-internal constituency. Regarding the other items included in Experiment 2, participants disfavoured HVD in foot-head relative to foot-dependent position, as predicted, but this

dispreference was observed only in four- and six-syllable words, not in five-syllable words.

Taken together, the results for Experiments 1 and 2 suggest that HVD in QF is prosodically conditioned. This conditioning stems from PWd-internal metrical structure, and not from the assignment of PPh-level prominence. The question we must address is what type of metrical structure holds in QF to capture the deletion patterns we have observed. The patterns for four- and six-syllable words in Experiment 2 suggest that HVD is sensitive to alternating rhythm, which we formally express using feet.

We explore four options for the construction of feet. The first three options, which we show do not work, involve multiple feet for all word shapes under consideration: multiple iambs, multiple trochees, or both iambs and trochees. These options largely cover the range of what we would expect for French, based on earlier literature. The last option differs from the others in that it proposes distinct parsings for even- and odd-parity forms.

Option 1 is in Table 3: disyllabic iambs are iteratively built from the right edge of the word, as shown under the column entitled expected deletion preferences. Option 1 expects HVD to be preferred in even numbered syllables from the right word edge, that is, in foot-dependent position; and that this preference extends beyond the rightmost foot, because footing is iterative, even though there is no evidence for this from stress (heads of binary feet are in bold in all following tables).

For four- and six-syllable words, as well as for five-syllable words with deletion in position 4 or 2, the representations that result from this parse capture the findings from Experiment 2, as shown by a match between the symbols (> or =) in the expected deletion preference and attested pattern columns. In the former column, A > B indicates that deletion in strings of shape A is preferred over strings of shape B for the foot parse under consideration, whereas = indicates no preference; in the latter column, A > B indicates that deletion in strings of shape A showed a statistically credible effect relative to deletion in strings of shape B, whereas = indicates the absence of a credible difference.

In contrast to the three word shapes just discussed, for five-syllable words with deletion in position 4 or 3, iteratively built iambs fail to capture the experimental findings: the expected deletion preference is the same as that observed for four- and six-syllable words, yet the attested pattern is that where HVD is equally favoured in foot-dependent and foot-head positions. Indeed, it appears that for five-syllable words, and perhaps for all odd parity words, HVD is not sensitive to iterative footing.

In view of this, we turn to Option 2, which assumes that HVD is regulated by trochees iteratively built from the right word edge. Recall that Selkirk (1978) proposes that all syllables with a full vowel or a coda form a foot in French, while syllables containing schwa, which is prosodically deficient, are parsed with the preceding syllable, thereby forming a trochee.

This analysis for schwa was extended to high vowels by Bosworth (2017) to capture the observation that high vowels, like schwa, can be weakened, undergoing laxing or deletion in QF. As weakening can be observed in various non-final positions within the PWd, Bosworth proposes that non-final syllables with high vowels must be footed with another syllable, optimally with the preceding syllable (e.g., (kami)(zɔl) *camisole*

Table 3. *Option 1: Iterative iambic footing.*

# of σs (HVD site)	Expected deletion preferences	Attested patterns
4 (3 or 2)	(da**bi**)(ni̲**bo**) > (da**bi̲**)(ni**bo**)	dabini̲bo > dabi̲nibo
6 (5 or 4)	(kɔ**bi**)(ni̲**be**)(ʃɔ**ʁa**) > (kɔ**bi̲**)(ni**be**)(ʃɔ**ʁa**)	kɔbini̲beʃɔʁa > kɔbi̲nibeʃɔʁa
5 (4 or 3)	ta(bi̲**ni**)(bɔ**fɛ**) > ta(bi**ni̲**)(bɔ**fɛ**)	tabi̲nibɔfɛ = tabini̲bɔfɛ
5 (4 or 2)	kɛ(bi̲**na**)(bi**no**) = kɛ(bi**na**)(bi̲**no**)	kɛbi̲nabino = kɛbinabi̲no

'slip'), alternatively with the following syllable, for example, when in word-initial position (e.g., (nyme)(ʁo) *numéro* 'number'). Adjacent syllables containing high vowels form a trochaic foot, expanding on Montreuil's (2002) analysis for schwa.

Bosworth (2017) predicts that word-internal high vowel weakening can take place in foot head or foot dependent position, but she proposes that it is preferred in the latter position. The foot parses and expected deletion preferences in Table 4 are consistent with her assumptions.[11]

Table 4. *Option 2: Iterative trochaic footing.*

# of σs (HVD site)	Expected deletion preferences	Attested patterns
4 (3 or 2)	(da)(**bi**ni̲)(bo) > (da)(**bi̲**ni)(bo)	dabini̲bo > dabi̲nibo
6 (5 or 4)	(kɔ)(**bi**ni̲)(be)(ʃɔ)(ʁa) > (kɔ)(**bi̲**ni)(be)(ʃɔ)(ʁa)	kɔbini̲beʃɔʁa > kɔbi̲nibeʃɔʁa
5 (4 or 3)	(ta)(**bi̲**ni)(bɔ)(fɛ) < (ta)(**bi**ni̲)(bɔ)(fɛ)	tabi̲nibɔfɛ = tabini̲bɔfɛ
5 (4 or 2)	(**kɛ**bi̲)(**na**bi)(no) = (kɛbi)(nabi̲)(no)	kɛbi̲nabino = kɛbinabi̲no

As under Option 1, four- and six-syllable words are correctly expected to pattern together under iterative trochaic footing. Option 2 also fails to correctly capture five-syllable words with deletion in position 4 or 3; in this case, the expected pattern is the inverse of that under Option 1.

We thus turn to consider Option 3, that footing reflects the accentual arc or hammock pattern of prominence observed in French (Fónagy 1979). In phrases containing one PWd, a trochee would be located at the left edge of the PWd, the head of which is signalled via the left-edge phrasal H tone, and an iamb would be located at the right edge of the PWd, the head of which is signalled by final prominence (Goad and Buckley 2006).

[11] Analyses of HVD in QF usually do not assume that syllabification is affected when deletion applies (Verluyten 1982; Garcia et al. 2017; see section 3). Bosworth (2017) instead assumes that onsets are resyllabified as codas following HVD (e.g., (kami)(zɔl) *camisole* 'slip' → (kam)(zɔl)). For consistency with the other possible interpretations of the patterns discussed in this section, the examples in Table 4 do not display resyllabification.

Table 5. *Option 3: Footing reflects accentual arc.*

# of σs (HVD site)	Expected deletion preferences	Attested patterns
4 (3 or 2)	(**da**bi)(ni̲**bo**) = (**da**bi̲)(ni**bo**)	dabini̲bo > dabi̲nibo
6 (5 or 4)	(**kɔ**bi)ni̲be(ʃɔ**ʁa**) = (**kɔ**bi̲)nibe(ʃɔ**ʁa**)	kɔbini̲beʃɔʁa > kɔbi̲nibeʃɔʁa
5 (4 or 3)	(**ta**bi̲)ni(bɔ**fɛ**) = (**ta**bi)ni̲(bɔ**fɛ**)	tabi̲nibɔfɛ = tabini̲bɔfɛ
5 (4 or 2)	(**kɛ**bi̲)na(bi**no**) = (**kɛ**bi)na(bi̲**no**)	kɛbi̲nabino = kɛbinabi̲no

Option 3 captures the observation that HVD is rarely observed in word-initial and -final positions, which would always be heads of feet under this analysis. It also expects deletion to be equally preferred in all word-internal syllables. In so doing, it correctly expects all five-syllable words to pattern together, regardless of deletion site, as shown in Table 5, but it fails to capture the finding that four- and six-syllable words, and perhaps all even parity words, prefer deletion in even-numbered syllables from the right word edge. Finally, recall that the results from Experiment 1 do not support the idea that the initial H tone is associated with the head of a foot, since HVD is not conditioned by tonal profile. We thus reject the possibility that initial prominence in the accentual arc corresponds to a foot head and return to the assumption that feet in QF are built from the right edge only, as under Options 1 and 2.

Both iambic and trochaic analyses (Options 1 and 2) appropriately expect four- and six-syllable strings to pattern as if they are sensitive to the contrast between foot head and foot dependent. However, no particular preference for five-syllable words with deletion in position 3 or 4 was observed, which cannot be captured under either of these options. The same lack of preference holds for five-syllable words with deletion in position 2 or 4, although in this case, none was expected and this was correctly captured by both footing options.

We suggest that the way forward is for both types of five syllable words, regardless of deletion site, to be examined through the same lens, in contrast to four- and six-syllable words. More concretely, we propose that even- and odd-parity strings be parsed distinctly, as shown for Option 4 in Table 6. Even-parity forms are exhaustively parsed, as every syllable can be contained within a binary iambic foot. Odd-parity forms cannot be exhaustively parsed. Because one syllable is inevitably left unparsed in such forms (unless degenerate feet are accepted), we assume that foot construction stops once the head foot is built at the right edge of the word. It follows that HVD should be preferred in foot-dependent positions in even-parity forms, but that no preference regarding deletion site should be observed for HVD in odd-parity forms.[12]

Our analysis selects iambs over trochees for the following reason. An analysis based on trochees, as applied to French, assumes binary constituency only when high vowels (or schwas) are present. Similar to the analysis in Cedergren (1986), where all high

[12] An alternative to the proposal that odd-parity words contain a single binary foot at the right edge is that they employ an unbounded foot (cf. Prince 1985). These two proposals make the same predictions for the data under examination and, thus, we do not attempt to arbitrate between them.

Table 6. *Option 4: Iambic footing, iterative in even parity strings and noniterative in odd parity strings.*

# of σs (HVD site)	Expected deletion preferences	Attested patterns
4 (3 or 2)	(da**bi**)(ni̲**bo**) > (da**bi̲**)(ni**bo**)	dabini̲bo > dabi̲nibo
6 (5 or 4)	(kɔ**bi**)(ni̲**be**)(ʃɔʁ**a**) > (kɔ**bi̲**)(ni**be**)(ʃɔʁ**a**)	kɔbini̲beʃɔʁa > kɔbi̲nibeʃɔʁa
5 (4 or 3)	tabi̲ni(bɔ**fɛ**) = tabini̲(bɔ**fɛ**)	tabi̲nibɔfɛ = tabini̲bɔfɛ
5 (4 or 2)	kɛbi̲na(bi**no**) = kɛbina(bi̲**no**)	kɛbi̲nabino = kɛbinabi̲no

vowels are associated only with a demi-beat and are therefore susceptible to deletion (see (10)), a trochaic analysis depends on the position of high vowels in a word for feet to be formed. As a result, a trochaic analysis is unable to make predictions about the application of weakening processes, since all weak segments (such as high vowels and schwas) are equally susceptible to such processes, regardless of their position within the PWd.

The analysis we have provided captures the attested patterns for HVD, but it rests on two assumptions that could be challenged: (i) QF requires distinct parsing mechanisms in even- and odd-parity words; and (ii) QF builds feet iteratively in even parity words, even though there are no prosodic cues to word-internal prominence outside of the final foot. In the following paragraphs, we motivate these assumptions more broadly.

The analysis we provided for QF in Table 6 entails that even- and odd-parity words involve different parameter settings (or constraint rankings) for foot construction. Specifically, Iterativity must be set differently for words of different shapes. Since the number of syllables in a word depends on factors such as its morphological composition, the difference in footing cannot be stored in the lexicon instead.

We suggest that there is nothing unusual about QF in this respect, as distinct parses are required for other aspects of stress computation across languages. In Yidiɲ, for example, even- and odd-parity strings require different foot shapes. Footing is iambic in odd-parity forms and trochaic in even-parity forms (Dixon 1977; Hyde 2012), as shown in (15-a) and (15-b), respectively (examples adapted from Dixon 1977, pp. 4–5 and Hyde 2012, p. 410. The difference in foot shape is supported by lengthening effects: lengthening targets the head foot in iambic forms only; trochaic forms do not display lengthening, consistent with cross-linguistic preferences (see Hayes 1985, 1995). The patterns observed in Yidiɲ are thus consistent with the idea that the parser must know how many syllables a word has before feet are built.

(15) Yidiɲ

a. Iambic feet:

galina → (gaˈliː)na	‘go.PURP’
gudagudaga → (guˈda)(guˈdaː)ga	‘dog.REDUP.ABS’

b. Trochaic feet:
galiŋ → (ˈgaliŋ) ‘go.PRES’
gudagagu → (ˈguda)(ˈgagu) ‘dog.PURP’

Wargamay presents a similar situation to Yidiɲ. In Wargamay, where stress is trochaic, the peninitial syllable of odd-parity forms (where the head foot is) is lengthened, but no lengthening is observed in even-parity forms; see (16) (examples adapted from Dixon 1981, p. 20, Hyde 2012, p. 411). In this case, for lengthening to apply, the parser must know if the head foot is left-aligned, which depends on the word having an even or odd number of syllables.

(16) Wargamay
Lengthening in odd-parity forms:
a. gaˈgara → ga(ˈgaˑra) ‘dilly bag’
b. d̪uˈʈagaj-ˌmiri → d̪u(ˈʈaˑgaj)(ˌmiri) ‘Niagara Vale.FROM’
No lengthening in even-parity forms:
c. ˈgigʸaˌwulu → (ˈgigʸa)(ˌwulu) ‘freshwater jellyfish’

Concerning assumption (ii), we have proposed that QF builds feet iteratively in even parity words, even though there are no prosodic cues to word-internal prominence outside of the final foot. Seminole/Creek resembles QF in this respect: feet must be built iteratively, but as a pitch accent language, only the head foot receives prominence (realised as a H tone; Haas 1977). Our analysis follows Hayes (1985). In words where all syllables can be parsed into binary right-headed feet, the H tone falls on the final syllable, as shown in (17-a). In words where this syllable cannot be parsed into a binary foot, the H tone instead falls on the penult, (17-b). To obtain this difference in the location of the H tone, feet must be built iteratively from the left edge, even though the heads of non-final feet are not cued in any way.

(17) Seminole/Creek (examples adapted from Hayes 1985):

a. (taːs)(kitá) ‘to jump (sg. subj.)’
(isi)(mahi)(citá) ‘one to sight at one’
(iŋ)(kosa)(pitá) ‘one to implore’

b. (ano)(kicí)ta ‘to love’
(taːs)(hokí)ta ‘to jump (dual subj.)’
(iti)(wana)(yipí)ta ‘to tie each other’

In short, Seminole/Creek is similar to QF in that feet must be built iteratively so that a phonological process may correctly apply: H tone assignment in Seminole/Creek, HVD in even-parity forms in QF.

In summary, we propose that HVD in QF is sensitive to alternating iambic rhythm, but only in even-parity forms, which are fully parsed. In odd-parity forms, where feet are not built exhaustively, no preference between deletion within or outside the foot is observed. The present analysis departs from previous accounts of HVD that considered the role of prosodic structure in that it assumes that (a) the process is conditioned by alternating rhythm (contra Cedergren 1986; Bosworth 2017), (b) two types of parsing are available for QF words (contra Verluyten 1982; Bosworth 2017; Garcia et al. 2017), and (c) word size and word edges influence the process (contra Cedergren 1986; Verluyten 1982). It should be noted, however, that neither of our experiments included words with schwas. Both high vowels and schwa are subject to deletion in QF, although the mechanisms regulating deletion may be different for each of them. Future research is needed to determine how HVD interacts with the presence of word-internal schwas, and whether deletion targeting schwas has a similar prosodic conditioning.

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A. Target stimuli from Experiment 1 (orthographic forms)

Two syllable words		
visage	un visage	un joli visage
bijou	un bijou	un joli bijou
figure	la figure	la jolie figure
guitare	la guitare	la jolie guitare
niveau	un niveau	un joli niveau
piment	un piment	un joli piment
village	un village	un joli village
guichet	un guichet	un joli guichet
mirage	un mirage	un joli mirage
piscine	la piscine	la jolie piscine
Four-syllable words		
fidélité	la fidélité	la jolie fidélité
bicarbonate	du bicarbonate	du joli bicarbonate
binoculaire	des binoculaires	des jolies binoculaires
figuration	la figuration	la jolie figuration
minorité	la minorité	la jolie minorité
mythologie	la mythologie	la jolie mythologie
finalité	la finalité	la jolie finalité
vitalité	la vitalité	la jolie vitalité
physionomie	la physionomie	la jolie physionomie
visitation	la visitation	la jolie visitation

B. Target stimuli from Experiment 2 (phonetic forms)

4-syllable words Deletion: 2 or 3	5-syllable words Deletion: 2 or 4	5-syllable words Deletion: 3 or 4	6-syllable words Deletion: 4 or 5
dabinibo	kɛbinabino	tabinibɔfɛ	kɔbinibeʃɔʁa
sɛbiniba	sɔbinɛbina	sɛbinibaʁe	tabinibɔsade
lɔbinibe	ʃabinɔbinɛ	ʁɔbinibeʃo	ʒabinibelɔka
kanibinɛ	ʃɔnibanibe	dɛnibinase	sɔnibinateʒɛ
ʒɛnibino	kanibɛnibo	ʃɔnibineʁo	ʒɛnibinɔpalo
kɔnibina	kɛnibɔniba	lanibinɔdɛ	pɛnibinɔfɛpa
kabizibe	tɔbizabizɛ	kɛbizibɔlɛ	lɛbizibefɔtɛ
ʃɔbizibɛ	kabizɛbizo	ʒɔbizibade	fabizibɔʁɛto
kɛbizibo	fɛbizɔbiza	ʁɛbizibɔfa	lɛbizibadeʁo

4-syllable words Deletion: 2 or 3	5-syllable words Deletion: 2 or 4	5-syllable words Deletion: 3 or 4	6-syllable words Deletion: 4 or 5
ʁɛzibiza	kɔzibazibɛ	tɔzibizaʒe	ʁɛzibizɔʒadɛ
lazibize	ʃazibɛzibo	fɔzibizake	tɛzibizafeso
kazibizɛ	fazibɔzibe	lɛzibizɔpa	kɔzibizɔʃɛte
paginigo	fɛginagine	paginigeʒo	pɔginigaʁesɛ
lɛginiga	paginɛgina	sɔginigape	fɔginigeʒɔʁɛ
ʒɔginige	saginɔginɛ	ʒɛginigɔta	pɔginigapeʃa
ʒaniginɛ	ʁɛniganige	pɔniginase	ʁɛniginɔkaʒe
pɛnigino	pɔnigɛnigo	faniginɔpɛ	ʒɔniginepɔʁe
dɔnigina	ʒanigɔnige	lɛniginɔʒa	fɛniginɔlɛʃo
tɔgimige	ʒɔgimagimɛ	pɛgimigɔla	lɔgimigadeʃɛ
sagimigɛ	dɔgimɛgima	ʒɔgimigedo	dagimigɔʃake
ʃɛgimigo	sɛgimɔgime	ʁagimigɔsɛ	ʃagimigepɔfɛ
tɛmigima	fɔmigamigɛ	damigimeko	ʁɔmigimatepɛ
lamigime	samigɛmigo	ʃamigimɔtɛ	ʃɛmigimɔlafo
sɔmigimɛ	dɛmigɔmiga	tɔmigimeto	kamigimɔpɛko
dagivigo	lɔgivagive	tɛgivigɔʁa	ʁagivigɔʒɛle
fɛgiviga	pagivɛgivo	ʒagivigɔʃɛ	dɔgivigeʁɔse
ʁɛgivige	tɛgivɔgiva	pɔgivigale	ʒɛgivigafeʁa
pavigivɛ	sɔvigavigɛ	dɔvigivaʃe	lɔvigivaʃedɛ
sɛvigivo	ʁavigɛvigo	ʃɛvigivɔsa	tɛvigivɔʒape
ʁɔvigiva	dɛvigɔviga	lavigivɔʁɛ	savigivɔkɛla
dɛgizige	ʃɔgizagizɛ	tagizigefo	lagizigɔsɛpa
fɔgizigɛ	dɔgizɛgizo	ʒɛgizigaʁe	ʃɔgizigefɔʒa
ʁagizigo	lagizɔgize	fɔgizigeso	dɛgizigɔpasɛ
pɔzigiza	pɛzigazige	ʒazigizɔkɛ	ʁɔzigizedɔfɛ
lɛzigize	ʁɔzigɛziga	pɛzigizɔda	sɛzigizɔʃape
fazigizɛ	pazigɔzigɛ	kɔzigizeto	tazigizɔlɛka
ʃanivino	sɛnivanivo	ʃɛnivinɔʁa	sɛnivinɔfake
pɛnivina	ʃɔnivɛniva	pɔnivinale	fɔnivineʃɔpɛ
kɔnivine	ʃanivɔnivɛ	ʒanivinɔpɛ	tɛnivinɔʃɛko
ʒɔvinivɛ	tɛvinavine	tavinivɔʁɛ	ʒavinivɔsɛta
ʁavinivo	davinɛvino	lɔviniveko	dɛvinivɔsaʒe
kɛviniva	ʃɛvinɔvina	kɛvinivɔta	kavinivɔʒeto
tamizime	sɔmizamizɛ	samizimɔfɛ	fɛmizimɔdase
damizimɛ	tamizɛmizo	ʃɔmizimeto	samizimɔtɛʁo
fɛmizimo	ʒɛmizɔmize	ʁɛmizimaʒe	tɔmizimaselo
lɛzimiza	ʁɔzimazime	fɔzimizelo	ʁɔzimizɔdɛfa
ʁazimize	pazimɛzima	lazimizɔka	fazimizesɔʁɛ
kɔzimizɛ	fazimɔzimɛ	pɛzimizake	fɛzimizeʒɔde