Second mora phenomena in Central and Northern dialects of Finnish

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1 Introduction

Finnish is a Finno-Ugric language spoken by approximately 5 million native speakers, the great majority of whom live in Finland. The linguistic situation in Finland is somewhat unique; in addition to regional dialects, there are standard forms of the language that are in wide use despite not truly being the native language of any Finnish speakers. Notably, *kirjakieli* ('book language'), the written standard, is taught in schools throughout Finland, and used in contexts such as the news, political speeches, and written prose; additionally, standard *puhekieli* ('speech language') is used in popular television shows and films, as well as when two interlocutors are not from the same dialect region. However, the regional dialects of Finnish are still vigorous. Children acquiring Finnish first learn their regional dialects, and only learn the standard forms in school and through exposure to Finnish media. Despite formal teaching and exposure to standard forms of the language, even "standard" *puhekieli* is often colored by features from the speaker's regional dialect.

To date, most papers that focus on Finnish in generative linguistics deal with some type of standard Finnish: either *kirjakieli* or *puhekieli*, which approximates the Häme dialects, spoken in and around the urban centers of Helsinki and Tampere. In this paper, I will be focusing on second-mora lengthening (SML), a phonological phenomenon present in two major dialect groups of Finnish: Savo dialects, spoken in central-eastern Finland, and Pohjanmaa dialects, spoken in central-western Finland. I argue, in contrast with previous proposals, that SML in Finnish is not simply a phonetic lengthening due to the presence of an intonational contour, but rather that it reflects an initial moraic foot with some domain-final process of extension. The rest of this paper is organized as follows: in Sec. 2, I will provide a description of SML in both Finnish and other Finnic languages. In Sec. 3 I will discuss previous proposals and argue that an alternative analysis is necessary, which I will elaborate on in Sec. 4. Finally, in Sec. 5, I will make suggestions for future research and conclude the paper.

2 Background

In the most general terms, second-mora lengthening (SML) is precisely what the name implies: the lengthening of the segment in second mora position in Central and Northern Finnish (CNF). In this section, I will situate SML in a broader context, with three major components: first, a discussion of the phonological and prosodic systems of Finnish, as are relevant to SML; second, a description of the phenomenon in Finn*ish* dialects, as well as related phenomena in Finn*ic* dialects; and third, a brief overview of other dialectical phenomena that also affect the second mora position.

2.1 Finnish phonology and prosody

Although this paper concerns phonological variation across different dialects of Finnish, in the section that follows I will describe the segmental and prosodic phonology of Standard Finnish. Unless noted, the main ways in which the dialects of interest diverge from the prosodic phonology described below do not significantly affect the second mora environment discussed in this paper.

2.1.1 Segmental phonology

The segmental inventory of Finnish is given below in figure 1. Phonemes in parentheses are marginal, usually present in loans or limited phonological contexts.

	Labial	Labiovelar	Alveolar	Palatal	Velar	Glottal
Plosive	p (b)		t (d)		k (g)	
Fricative		(f)	s			h
Nasal	m		n			
Liquid			l, r			
Approximant		ʋ		j		

Figure 1: The consonant inventory of Finnish

	Front		Back
High	i	y	u
Mid	e	ö (ø)	o
Low	ä (æ)		a

Figure 2: The vowel inventory of Finnish

Finnish has been described as a "full-fledged quantity system" (Ylitalo 2009). That is, Finnish makes use of length contrasts in both consonants and vowels. All vowels contrast long and short forms; similarly, all core consonants contrast long and short forms, with the exceptions of /h, v, j/.[1] Example length contrasts are provided in example (1), below.

(1)
a.	muta	'mud'	d.	mutaa	'mud.PART'
b.	muuta	'else.PART'[2]	e.	muuttaa	'to move'
c.	mutta	'but'			

2.1.2 Stress

Although there is an extensive body of literature on Finnish stress, the majority of the literature is based on Häme judgments of stress, and not on the CNF dialects (Kiparsky 2003, Kager 1992, Karvonen 2005, Hayes 1995, Karttunen 2006). Primary stress is always on the first syllable, regardless of the segmental content or weight of that first syllable (see ex. (2)).[3] At least in Häme dialects, there is never a secondary stress on the second syllable, even when both the first and second syllables are heavy (see ex. (2-f)). There is also never stress clash between secondary stresses, which is one reason why Finnish feet are typically analyzed as syllabic, rather than moraic.

(2)
a.	ˈmu.ta	'mud'	d.	ˈmus.ta	'black'
b.	ˈmuu.ta	'else.PART'	e.	ˈmu.taa	'mud.PART'
c.	ˈmut.ta	'but'	f.	ˈmuut.taa	'to move'

Although the literature is more or less in complete agreement regarding primary stress, there has been much debate on how to assign secondary stress. Secondary stress, unlike primary stress, is highly dependent on weight, a trait that is unusual for a language with syllabic trochees.[4] Syllables that are heavy receive secondary stress, with preference given to CVV(C) syllables over CVC(C)

[1] There is one native word with a geminate /h/, *hihhuli* 'religious fanatic'.

[2] Abbreviations used in this paper: ILL 'illative', NOM 'nominative', PART 'partitive', PL 'plural,' SG 'singular'

[3] In CNF this may not be strictly true; see the following subsection, as well as Sec. 4 for further discussion.

[4] Secondary stress is also sensitive to the morphology independently of weight, though this fact is less relevant for the current paper.

syllables (ex. (3-b), (3-a)). If two syllables with equal weight are next to each other, the rightmost is stressed.[5]

(3)	a.	CVC-CVV	ˈho.ri.**son.**ˌ**taa**.li	‘horizontal’
	b.	CVV-CVC	ˈa.ka.ˌ**tee.mik**.ko	‘academic’
	c.	CVC-CVC	ˈkon.so.**nan.**ˌ**tis**.mi	‘consonantism’
	d.	CV#	ˈo.me.na; *ˈo.me.ˌna	‘apple’
	e.	Odd, CVC-final	ˈo.me.**nat** OR ˈo.me.ˌ**nat**	‘apple.PL’
	f.	Even, CVC-final	ˈra.vin.ˌto.**lat** OR ˈra.vin.to.ˌ**lat**	‘restaurant.PL’
	g.	Odd, CVV-final	ˈo.me.**naa** OR ˈo.me.ˌ**naa**	‘apple.PL’
	h.	Even, CVV-final	ˈra.vin.ˌto.**laa** OR ˈra.vin.to.ˌ**laa**	‘restaurant.PL’

All examples adapted from Karvonen (2005)

Secondary stress avoids the final syllable (3-d), unless that final syllable is heavy; in that case, whether the syllable be CVC or CVV(C), secondary stress is variably present. In odd-parity words, an additional secondary stress is possible, but does not affect the footing of the rest of the word (ex. (3-e), (3-g)). In even-parity words (ex. (3-f), (3-h)), this variation can cause a lapse on the third syllable. It is unclear if the variation reported by Karvonen (2005) refers to intra-speaker variability or inter-speaker variability.

2.1.3 A note on coda consonants, stress, and word minimality

Although the role of weight cannot be ignored in determining secondary stress, the moraic status of coda consonants in Finnish seems to lead a double life. The minimal word in Finnish has two vocalic moras (Karvonen 2005). They can be in two syllables (ex. (4-a)), or be contained within one syllable and either make up a long vowel (ex. (4-b)) or a diphthong (ex. (4-c)). However, both CV and CVC words can only serve as function words (ex. (4-d), (4-e)).

(4)	a.	CVCV	suku	‘family’
	b.	CV:	suu	‘mouth’
	c.	CVV	suo	‘swamp’
	d.	*CV	se	‘it’
	e.	*CVC	sen	‘it.GEN’

The restrictions on word minimality seem to indicate that coda consonants are not moraic. However, this treatment is not consistent through the rest of the language; as described above, CVC syllables are treated as heavy relative to CV syllables, but not relative to CVV syllables. In addition, coda consonants in the first syllable are affected by SML, which, by its name, suggests that the coda is moraic in this position. Thus, when in a stressed syllable, codas are moraic. Alternatively, codas are considered non-moraic when they are not in stressed syllables. This analysis is quite straightforward for codas in the first two syllables:

- Stress is always on the first syllable, with no clash;
- Thus, a coda in the first syllable is considered moraic;
- Function words are unstressed, and thus the coda is not moraic.

However, it is still unclear how to manage both secondary stress patterns with the same mechanism as preventing the coda in CVC words from becoming moraic under duress (i.e., under the addition of stress).

[5] Karvonen does not provide examples with adjacent CVVs, but the constraints presented in his analysis would predict no clash, with secondary stress on the second syllable. Unfortunately, many of these longer words are either morphologically complex or loan words, where Finnish length often corresponds with stress in the source language.

2.1.4 Finnish intonation

In contrast with the study of Finnish stress, much of the recent experimental literature on Finnish intonation seems to be based on the Pohjois-Pohjanmaa (Northwest) dialects. In one particularly thorough study, Suomi et al. (2003) investigated the effects of three levels of focus on pitch and duration. The main finding was that the pitch excursion increased from word-level accent to moderate accent to strong focus, but the overall contour of the intonational pitch accent was the same: a rise until the right edge of the first mora, followed by a fall during the second mora. This was the same regardless of word structure; thus, the fall occurred in the second syllable in CV.CVX words, and in the first syllable in CVV.CVX words (see Fig. 3). From this result, Suomi et al. (2003) concluded that intonational contours in Finnish are assigned to moras, rather than to syllables. The anchoring location for the intonational pitch accent (assumedly a H*, though Suomi did not make explicit claims regarding specification of the pitch accent) is, then, the first mora. Indeed, the "acoustic right edge" effect is reminiscent of tone in Thai, a tone language that uses the mora as the tone-bearing unit (TBU) (Morén and Zsiga 2006).

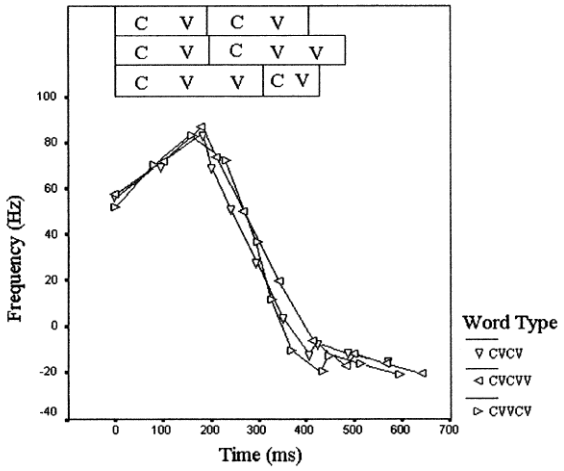


Figure 3: A figure from Suomi et al. 2003 that illustrates the acoustic right edge alignment for words with strong accent.

2.2 SML in Finn*ic* and Finn*ish* dialects

The so-called "half-long vowel" describes the extended duration of V_2 in $CV_1.CV_2(X)$ words in various Finnic languages. Second mora lengthening (SML) includes this phenomenon, and further generalizes it to a lengthening of the segment in second mora position—that is, both V_2 in a word-initial CV_1V_2 syllable and C_2 of a word-initial CV_1C_2 syllable, in addition to V_2 in $CV_1.CV_2(X)$. Although the descriptions of the other Finnic languages do not generalize the half-long vowel to the second mora position, it is almost certainly the case that the half-long vowel is related to (or part of) the SML phenomenon.

The half-long vowel has been documented as a feature of non-Häme dialects of Finnish since at least the late 19th century (Setälä 1882, cited in Ylitalo 2009):

> "...the vowel in an unstressed syllable following a light stressed syllable 'is stretched.' If the word receives sentence accent, the single vowel in question corresponds, according to Setälä, durationally to a double vowel, but in other instances the vowel has only one and a half times the duration of single vowels in other positions." (Ylitalo 2009)

Similar, though less detailed descriptions are also present for related languages. For example, half-long vowels and consonants are also mentioned by Kiparsky (1995) in his analysis of Livonian

stød, as well as by Gordon (2009) in his study of Ingrian prominence. In his study of Luuditsa Votic vowel reduction, Rozhanskiy (2015) does not seem to explicitly mention of the half-long vowel in $CV_1.CV_2$ words in Votic, but both durational data and an apparently phonologized system of final vowel reduction suggest that Votic also exhibits this phenomenon. For Estonian, Asu and Teras (2009) note that the "characteristic" V_1:V_2 ratio in $CV_1.CV_2$ words is 2:3; the half-long vowel has also been vaguely linked to *overlength* in Estonian, where vowels and consonants that have historically occupied the second mora position are meaningfully elongated (Prince 1980). That is, in Estonian, SML seems to have become phonologized and morphologized. Similarly, various dialects of Sámi exhibit overlength in the same position, possibly indicative of historical SML in Proto-Finno-Saamic (Engstrand 1987, Bye 1997).

Although there is not currently a consensus on the exact relationships between the Saamic and Finnic branches, the existence of the half-long vowel (and related phonologized structures) in other Finnic languages and overlength in second mora position in Saamic languages suggests that the structure behind SML is quite old. If Saamic languages do in fact demonstrate a reflex of SML, the feature has likely been present since before the split between the Saamic and Finnic branches, which is estimated to be around 2500 BCE (Abondolo 1998). The clearer cases of Livonian, Ingrian, Votic, and Estonian, where a half-long vowel has been documented, indicate that the feature is likely at least 1,000 years old (Abondolo 1998).

In Finnish, the half-long vowel is limited to a group of dialects ("CNF"—Central and Northern Finnish) that includes the Savo dialects in the east, the Ostrobothnian dialects in the west, and the far northern dialects spoken in Lapland. Dialects in Finland are traditionally divided into Western and Eastern dialects, based on the geographical distribution of historical phonological changes. For example, Western dialects have generally undergone a change from /d/ to /ɾ/ or /l/, while Eastern dialects have generally replaced /d/ with /j/ or ∅ (see ex. (5)). Additionally, Western dialects generally delete final vowels regardless of quality (with some restrictions on word length; see ex. (5)); in contrast, Eastern dialects typically constrain final vowel deletion to final /i/, with additional effects on the preceding consonant (see ex. (5)).

		Western	Eastern	Gloss
(5)	a. kädet	> käret	käet	'hand.NOM.PL'
	b. turusta	> turust	turusta	'Turku.ELA'
	c. lasi	> lasi	las^j	'glass'

However, the distribution of SML does not follow these dialectical divisions. SML is robustly present in two major dialect groups across the East/West divide: the Savo dialects (East), spoken by approximately 800,000 people in a large region in east central Finland, and the Northern Pohjois-Pohjanmaa (West) dialects, spoken by approximately 350,000 people on the central western coast of Finland (see Fig. 4 below). The Western Finnish dialects spoken in the Lapland region (the "Far North" dialects) also exhibit SML (Spahr 2012); however, due to the lack of experimental and corpus data available from these regions, as well as the general paucity of speakers, they are being excluded from the present paper. However, SML does not typically[6] present in the Häme dialects (also West), spoken by over 2,000,000 people in the major urban regions in the south of Finland. Based on the dialectical distribution of SML, as well as the presence of similar second-mora phenomena in other Finnic languages, I maintain that SML is not an innovation, but rather an old prosodic feature that was largely lost in the Häme dialects.

[6]There may be one citation of a manuscript in some paper from the 1980s that describes a return of the half-long vowel in Häme dialects in emotionally charged situations or when a word is in particular focus, but this particular reference is currently lost to the haze of early research.

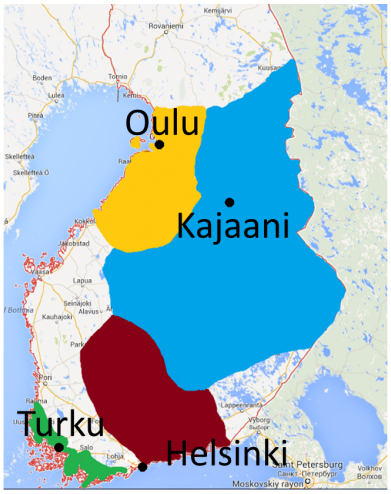


Figure 4: A map of Finland with four major dialect regions and their capital cities. Blue is the Savo region; yellow is Pohjois-Pohjanmaa. Red is the southern Häme dialects, classified as Western dialects, and green is the Turku region, another Western dialect.

2.3 SML: Empirical studies

There have recently been a number of phonetic studies (Suomi and Ylitalo 2004, Suomi 2009, Ylitalo 2009, 2004) that focus on the status of the half-long vowel in Northern Finnish. In these studies, Suomi and Ylitalo have generalized the environment of half-length to the second mora position, as opposed to just V_2 in $CV_1.CV_2(X)$ words—thus receiving the name second-mora lengthening (SML) (Suomi 2009). The effects of SML are summarized and exemplified below:

- Affects V_2 in initial CVV syllables, in both long vowels and diphthongs (ex. (6-a), (6-b));
- Affects C_2 in initial CVC syllables (ex. (6-c), (6-d));
- Affects V_2 in CV.CV words (ex. (6-e));
- Is not iterative—i.e., does not affect the second mora of every foot (ex. (6-f)).

(6)	a.	ka**a**to	> ka**a**ˑto	‘fall’	
	b.	ma**i**to	> ma**i**ˑto	‘milk’	
	c.	ka**t**to	> ka**t**ˑto	‘roof’	
	d.	sy**n**tyy	> sy**n**ˑtyy	‘be born.3SG’	
	e.	kat**o**	> kat**o**ˑ	‘deficiency’	
	f.	kuv**i**telma	> kuv**i**ˑtelma	*> kuv**i**ˑtelˑma	‘fantasy’

In the same study referenced in the intonation section above, Suomi et al. (2003) also examined the durational correlates of accent in Northern Finnish. In this study, participants read disyllabic target words (CV.CV, CVV.CV, and CV.CVV) in carrier phrases with three levels of accent (focus). The three carrier phrases are provided in the table below.

Accent Type	Carrier Phrase
Word Accent	Sanoin että **kato** PAHENTAA tilanetta, en sanonut että **kato** PARANTAA sitä. *I said that _____ WORSENS the situation, I didn't say that _____ IMPROVES it.*
Moderate Accent	Sanoin että **kato** pitää tilanteen edelleen KIREÄNÄ. *I said that _____ continues to keep the situation TENSE.*
Strong Accent	Sanoin että **KATO** pelotti, en sanonut että **KAATO** pelotti. *I said that $\_\_\_\_\__1$ frightened (me), I didn't say that $\_\_\_\_\__2$.*

Figure 5: Carrier phrases used by Suomi et al. (2003). Sample target words are given in blue (when the two words are not the same, the second is highlighted in red); capitalization is used to denote emphasis.

Suomi et al. (2003) found that both duration and pitch were affected by the type of accent. Specifically, there was an increase in both duration and pitch excursion with increasing degrees of accent (i.e., from word accent to strong accent); there was also an overall increase in vowel duration with increasing levels of focus. The table below gives a summary of the durations.[7] Interestingly, although the pitch excursion was dramatically different between the different levels of accent, the V_1:V_2 ratio did not fluctuate in a similarly drastic fashion: V_2 was 176%, 179%, and 184% the duration of V_1 in Strong, Moderate, and Weak accent tokens, respectively.

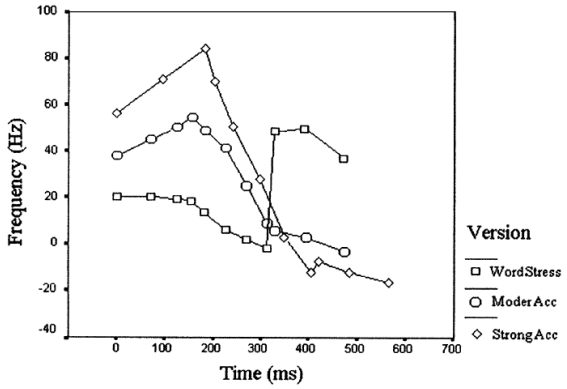


Figure 6: A figure from Suomi et al. 2003 illustrating the differences in pitch excursion between word accent, moderate accent, and strong accent.

Accent Type	CV.CV		CVV.CV		CV.CVV	
	μ_1	μ_2	$\mu_1\mu_2$	μ_3	μ_1	$\mu_2\mu_3$
Strong Accent	78	137	198	57	78	199
Moderate Accent	58	104	143	50	64	144
Word Accent	56	103	144	53	62	154

The phenomenon is robust and preserved even in laboratory-elicited speech. Ylitalo (2004) elicited various *kirjakieli* forms from university-educated female native speakers of the Northern Finnish dialect. She found that even in this formal setting, the speakers still produced forms that

[7]Note that, although Northern Finnish does not actually allow words of the shape CV.CVV, the participants were using *kirjakieli*.

exhibited SML. She speculated that this preservation is due to the lengthening remaining sub-phonemic—that is, the lengthened segments are not long enough to be categorized with true long vowels. This is in contrast with dialectical features that *are* removed when using *kirjakieli*, such as those described in the following subsection.

2.4 Other second-mora phenomena

Although this paper is focusing specifically on SML, there are two additional dialectical features that are likely related to SML, and may provide evidence for the precise nature of SML: *yleisgeminaatio* ('primary gemination,' YG), and C_2C_3 vowel insertion (CCVI). Both features have been linked to SML (see Spahr 2012 for YG and Karlin 2014 for CCVI), due in large part to the extreme overlap in dialectical distribution—SML, YG, and CCVI all exist in CNF dialects, and are conspicuously absent in Häme dialects.[8] Additionally, both YG and CCVI affect approximately the second mora environment, which is suggestive of a link either with the root cause or the phonetic effects of SML.

In dialects with YG, words that are underlyingly CV.CVVX (ex. (7)a) or CV.CV+VX (ex. (7)b) are realized as CVC.CVVX. This process sometimes causes a merge of two distinct forms (compare ex. (7)c and ex. (7)d); it also occurs even when the affected consonant is not permitted to be underlyingly long, i.e., /h, v, j/ (ex. (7)d), which suggests that it is a post-lexical process. Gemination does not occur when the word is of shape CV.CVC (ex. (7)f).

		Underlying	**Northern**	**Häme**	**Gloss**
	a.	ˈva.paa	> ˈva**p.p**aa	ˈva.paa	'free.NOM'
	b.	ˈka.jaa.ni	> ˈka**j.j**aa.ni	ˈka.jaa.ni	'Kajaani (city)'
(7)	c.	ˈku.ka+an	> ˈku**k.k**aan	ˈku.kaan	'nobody.NOM'
	d.	ˈkuk.ka+an	> ˈku**k.k**aan	ˈkuk.kaan	'flower.ILL'
	e.	ˈpu.hu+u	> ˈpu**h.h**uu	ˈpu.**h**uu	'speak-3SG'
	f.	ˈpu.hu+n	> ˈpu.**h**un	ˈpu.**h**un	'speak-1SG'

It is unclear if this restriction in non-Häme dialects of Finnish is directly related to stress, or if it stems from other restrictions. A similar avoidance of feet with the form $(\sigma_{\mu}.\sigma_{\mu\mu})$ is also present for secondary stress (Kager 1992, Karvonen 2005), though secondary stress is simply shifted to the heavy syllable (WEIGHT-TO-STRESS PRINCIPLE), rather than creating a heavy syllable where a secondary stress is already laid down (STRESS-TO-WEIGHT PRINCIPLE), which would be more reminiscent of the gemination process described above.

CCVI is a phenomenon where words with shape $C_1VC_2C_3V$ are produced as $C_1VC_2\mathbf{v}C_3V$, where the inserted vowel receives the same quality as the first vowel:

(8)	a.	silmä	> sil**i**mä	'eye'
	b.	kahvi	> kah**a**vi	'coffee'
	c.	vanha	> van**a**ha	'old'

Insertion does not occur when the C_2 and C_3 consonants are homorganic (9-a) or a geminate sequence (9-b). The first consonant of the sequence must also be voiced[9] (9-d), otherwise no insertion occurs (9-c). Insertion also does not occur later in the word—it is restricted to second mora position (9-e). The final restriction is on rC sequences, which are inconsistent triggers, even within the same speaker (9-f).

[8] Interestingly, Rozhanskiy (2015) also noted a similar phenomenon in Votic, a Finnic language spoken in Russia, where /kala-a/ > [kal.laa] 'fish.PART'. The dialect of Votic described in that paper also exhibits the half-long vowel. Markus (2010) also describes a similar gemination process in Ingrian, again, another Finnic language with the half-long vowel.

[9] Phonetically—*kahvi* receives epenthesis because the /h/ voices before the sonorant /v/.

(9)	a.	syntyy	> sy**nt**yy	'be born.3SG'
	b.	katto	> ka**tt**o	'roof'
	c.	pitkä	> pi**tk**ä	'long'
	d.	helppo	> hel**e**ppo	'easy'
	e.	kuvitelma	> kuvitel**lm**a	'fantasy
	f.	kirkko	> kir**i**kko, ki**rkk**o	'church'

Karlin (2014) argued that the vowel insertion has its origins in an excrescent vowel between C_2 and C_3, caused by the extension of the second mora—in this case, C_2. Although there has been fairly extensive phonologization of the inserted vowel, there are still forms with extremely short, variable vowels that indicate a common history of excrescence.

3 Previous proposals for SML

3.1 Finnish

For the most part, the proposals for SML in Finnish have been largely speculative, without great investigation into the phonological implications. One characterization of SML has been as an additional "half mora" (Spahr 2012), though without argumentation as to what motivated the additional half mora, nor what a half mora represents. Not surprisingly, many of the other recent proposals have come from Suomi, who has investigated this phenomenon quite energetically in the last decade.

Suomi and Ylitalo (2004) discuss several proposals from history, as well as their own. One proposal (Karlsson, 1983) is that the half-long vowel serves to better differentiate CV.CV structures from CV(C/V).CV structures, as in the second type, the second vowel is quite short. Suomi and Ylitalo note that Karlsson did not make note of the potential harmful effects of this lengthening with respect to contrast—namely, that CV.CVV structures are now less differentiated. Suomi and Ylitalo also note that this analysis does not make reference to stress, despite the apparent phonetic effects of a bimoraic stress domain.

Suomi and Ylitalo instead propose that the additional length on the second mora is necessary in order for the intonational gesture to be fully realizable. They suggest that, in order to maintain the uniformity of the rise-and-fall contour, the second syllable in a CV.CV word must be longer than the second syllable in a CVV.CV word:

> "In CV.CV words the mean duration of the first syllable was 186 ms, that of the second syllable 218 ms, yielding a mean total word duration of 404 ms. In CVV.CV words the corresponding figures were 308, 120 and 428 ms. Speculating that if the second syllable in CV.CV were as short as the second syllable in CVV.CV, the total duration of CV.CV would be only 306 ms, practically the duration of the first syllable in CVV.CV. This would mean that either the tonal movements in CV.CV would have to be much faster than they actually are, or they would have to be less extensive than they actually are, or—if the tonal movements started at word onset and then continued as they have actually been observed to do, for as long as there is segmental material to carry them—about half of the fall part of the tonal rise-fall gesture would be truncated." (Suomi 2009)

However, there is some confusion here as to *what* elements need to have the same duration. If the intonational contour is indeed realized over two moras, it should only be necessary that the first two moras be approximately the same duration—and in this case, where CV.CV (two moras, two syllables) is 404 ms, and CVV (two moras, one syllable) is 308 ms, the extra length on the second syllable in CV.CV seems excessive. Of course, if one only considers the durations of the nuclei, thus removing the confound of the additional C, we arrive at much more similar figures: 140 ms for CV.CV, and 146 ms for CVV. However, this consideration of the bimoraic domain, rather than a mixed disyllabic-bimoraic domain, is no true motivation for the second mora to be lengthened—if it were *not*, in both cases, the durations would likely still be the same.

Suomi also argue that voiceless codas do not undergo as much lengthening as voiced codas, but this data is inconsistent at best—and if some active intonational gesture were causing the lengthen-

ing, one would expect *no* lengthening on the voiceless codas, as they cannot carry pitch information. Furthermore, the intonational fall is only present in Strong Accent environments, as Suomi note; however, a comparable amount of lengthening exists in both moderate and word accent conditions, where there is a much smaller pitch excursion. If intonation were truly the root cause of SML, one would not predict the existence of SML when there is no intonational contour—it would have to be some phonologized process. However, the consistency of duration and pitch contour in the first two moras lends some support for a bimoraic domain, which Suomi was in fact investigating in the same paper.

3.2 Estonian

A more phonological approach has been taken by Prince (1980) for Estonian, which has both a half-long V_2 in $CV_1.CV_2$ words, as well as overlong segments where there was historically a second mora. However, Estonian, unlike Finnish, has phonologized overlength (but not the half-long vowel), in that there are oppositions such as [kaa:lu] 'scale (weight)' [kaa.lu] 'scale.GEN' [kalu˙] 'fish'. Also unlike Finnish, Estonian is reported to allow stress on adjacent syllables if they are both heavy—that is, if the first syllable is of Q(uantity)3 and the second is of Q2. Thus, unlike Finnish, Estonian is a fairly clear-cut case of moraic footing throughout the word.

Prince (1980) proposed a bimoraic foot with domain-final lengthening for Estonian in order to account for Q3 and the half-long vowel, but pushed the contrast between Q2 and Q3 onto various morphological processes. The difference between Q3 the half-long vowel, then is a matter of where the foot falls: within one syllable, or two:

Figure 7: Prince's (1980) proposal for Estonian Q3 and the half-long vowel, with [kaa:lu] on the left, and [kal˙] on the right.

Prince argued that the domain-final lengthening could either *create* duration, such as the half-long vowel, or, in the case of a word like CV.CVC, use what was already there, and count the extra coda as satisfying the requirement for a longer weak element. For Finnish, Prince argued that there was a similar process, though predicted that there would not be lengthening in a CV.CVC word. By extension, a CV.CVV word should also be acceptable, but this (as has been described above) is not a permissible form in CNF dialects, and indeed in multiple Finn*ic* dialects. It is also not true that V_2 is not lengthened in CV.CVC words in Finnish. One could speculate that Estonian may actually be a case of a trimoraic, maximally disyllabic foot, with contrastive footing similar to that proposed by Prince, but that is a matter for a different paper.

4 A new analysis of SML

In this section, I will present my analysis of SML. The analysis involves two steps: first, the formation of an initial moraic foot, and second, the extension of the second mora. I will present two possibilities for the process of extension, one that involves a templatic mora, and one that is merely a phonetic elongation of the second mora.

Finally, although traditionally, YG and SML have not been treated as part of the same phenomenon, the extreme geographical overlap is suggestive of a relationship between the two. Thus,

while it is not typical to create an analysis of SML that accounts for YG, the analysis I present here provides a mechanism whereby YG would occur in the dialects with SML.

4.1 Building a moraic foot

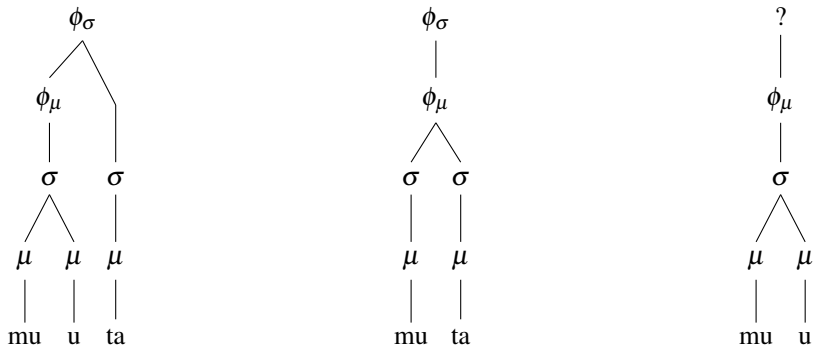
One of the difficulties with SML is that, despite the clear reference to the second mora position, a level of moraic parsing is not really proposed in either the stress or intonation literature. For stress, weight is regarded as relevant for the assignment of secondary stresses, which indicates that the mora is important; however, all analyses to date have maintained that feet are constructed with syllables, not moras (Karvonen 2005). The mora leads a phantom life in the intonation literature as well; typically, descriptions of Finnish intonation focus on the syllable, with the word "mora" conspicuously absent despite references to the length of the first syllable. Suomi and Ylitalo (2004), however, also posit that there is some sort of bimoraic "stress domain" in Finnish, with support from data that indicates that the durations of segments outside the first bimoraic domain are quite short in comparison with those inside the bimoraic domain, even when they would be inside an initial syllabic trochee.

For varieties of Finnish with SML, I propose that the prosodic word is headed by a moraic trochee. With an initial moraic foot, a reference to the second mora of the prosodic word is simplified to a reference to the end of the moraic foot domain. It is still unclear, however, is if there is a moraic foot *in addition to* a syllabic foot at the head of the prosodic word. That is, when the first syllable is bimoraic, is the second syllable simply unparsed (10-b)? Is it skipped over for secondary stress due to some constraint against syllabic clash that affects the whole word—which would be suggestive of a moraic foot residing within a syllabic foot (10-c)? Or does secondary stress in CNF indeed start with the first syllable after the moraic foot (10-d)? Unfortunately, the only evidence that could resolve this problem would be stress judgments from native speakers of CNF, which are lacking in the literature.[10]

(10) a. pilaantuu > pi**l**ˑlaan.tuu 'go bad.3SG'
b. ˈ[pil]$_{\mu}$.laan.ˌ(tuu)$_{\sigma}$
c. ˈ([pil]$_{\mu}$.laan)$_{\sigma}$.ˌ(tuu)$_{\sigma}$
d. ˈ[pil]$_{\mu}$.ˌ(laan.tuu)$_{\sigma}$

In the absence of these stress judgments, I will assume a bimoraic foot nested within a syllabic foot, illustrated in Fig. 8; or, as an alternative, a grid representation that parses over the syllable. Using two methods of footing eliminates the need to specify a lapse when the initial syllable is bimoraic—if there is a syllabic foot in addition to the moraic foot, the "lapse" is simply the weak member of the syllabic foot. If we use two levels of feet, the structure is somewhat interesting; each foot type must look past one layer in order to find the units it is composed of. That is, the moraic foot must look past the syllable layer in order to find its two moras, which may be in one or two syllables; similarly, but not quite symmetrically, the syllabic foot must look past the moraic foot level in order to find two syllables—which may be wholly contained within a moraic foot (as in Fig. 8b) or which may contain the moraic foot and an additional syllable that is left unparsed by the moraic foot (as in Fig. 8a).

[10]From a personal correspondence with a native speaker of Northern Finnish, I have the report that *pillaantuu* would be stressed as [ˈpil.laan.tuu], with no stress clash and no evidence for moraic feet (and, in this case, the optional final secondary stress is left out).



(a) muu.ta (b) mu.ta (c) muu

Figure 8: A tree-based model of a moraic foot nested within a syllabic foot.

Word minimality also lends some evidence for a moraic foot. As described in Sec. 2.1, a word in Finnish has minimally two vocalic moras; the moras may be in either one syllable or two. Thus, the minimal word in Finnish is actually a moraic foot, where coda consonants in monosyllables do not count as moraic for reasons already discussed. Fig. 8c demonstrates this word minimality, where the syllabic foot is either degenerate (as may be suggested by the possibility for word-final secondary stress if that syllable is heavy) and only has one syllable, or not present at all.

In this analysis, I am limiting the moraic parsing to the head of the prosodic word, rather than proposing a distinct metrical system for CNF that creates moraic trochees. There are two major reasons for this, both of which are unfortunately clouded by doubts regarding CNF judgments of stress:

1. **No stress clash**: The alternating pattern and lack of stress class on adjacent heavy syllables indicate that there is syllabic parsing throughout the word, rather than moraic parsing.

2. **Non-iterativity**:[11] SML does not affect the second mora of every foot.

4.1.1 The moraic foot and YG

For this moraic foot, I also propose that the edges of the moraic foot must align with syllable edges, as is typical for moraic trochees. That is, the moraic foot may be contained within one syllable ((11-a) - (11-c)), or may span two syllables ((11-d) - (11-e)), but one syllable may not be split by the moraic trochee boundary (11-f).

(11)	a.	CVV.CV	[kaa].to		
	b.	CVC:V	[kat].to		
	c.	CVC.CV	[kes].to		
	d.	CV.CV	[ka.to]		
	e.	CV.CVC	[ka.dun]		
	f.	CV.CVV	*[ka.to]o	>	[kat].too

The formation of the moraic foot is only problematic in one case, CV.CVVX—which is precisely the environment that is forbidden in CNF dialects, and remedied by YG. In this case, the word is repaired to CVC.CVVX.

[11] Both of these features are actually the reverse from Estonian, which is reported to allow adjacent heavy syllables to bear stress (Prince 1980), both at the head of the prosodic word (i.e., in the first two syllables, where primary stress is assigned), as well as in later syllables, where only secondary stress is relevant. Estonian also is reported to have overlong segments in the second mora position of each foot. Estonian seems to be a case where moraic footing has taken over the parsing for the whole word.

Figure 9: Forming a legal bimoraic foot with /vapaa/. On the left, the illegal structure, where the second mora has two parents, and the repaired structure on the right, with a geminated /p/.

It remains unclear why it should be the consonant that should be made moraic, rather than the first vowel extended to yield CVV.CVV (i.e., va.paa *> vaa.paa). For this analysis, I will simply posit that in the formation of the moraic foot, when the parsing encounters a problem regarding a syllable boundary, the moraic foot simply takes what comes next.

4.2 SML: An initial trimoraic foot

Although the formation of a prosodic-word-initial moraic foot simplifies the reference to the second mora, there still remains the problem of elongating that second mora. One way to approach SML is to view the additional duration as reflective of a templatic mora. This interpretation is tempting, especially given the parallel but fully contrastive system in Estonian. Under this analysis, the Finnish prosodic word is headed by a recursive, ternary foot, where the third member is actually a mora:

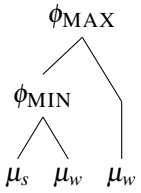


Figure 10: The structure of the trimoraic foot, a bimoraic foot with a third mora added recursively.

The third mora has two major restrictions:

1. **The third mora must take its segmental content from the second mora**.
2. **The third mora must be in the same syllable as the second mora**.

These two restrictions reflect the apparent "lengthening" effect on the second mora. That is, the templatic third mora is not fulfilled by some default segment or CV syllable. The second restriction additionally reflects the still unsatisfactory status of a word like /koko-ko/ 'the whole thing?', where the third mora (and third syllable) is quite literally a copy of the second mora (and second syllable). This word, however, would still be realized as [koko˙ko], rather than [kokoko].

It is important to note that the recursive foot is built using the already-built bimoraic foot, whose major restriction was to respect syllable integrity. That is, although a word like /vapaa/ would satisfy both of the above conditions, it has already been rebuilt as [vap].paa, and thus, the coda /p/ must be copied into the templatic mora.

Figure 11: An illustration of the bimoraic foot with a recursive third mora. On the left, /kato/, realized as [katoˑ]; on the right, the first syllable of /vapaa/, realized as [vap:].

4.3 SML: Phonetic domain-final lengthening

It is also possible to treat the extra duration as phonetic lengthening, as opposed to a full mora. There are multiple reasons to favor such an approach, most stemming from evidence (or lack thereof) that speakers acknowledge the lengthened segment as long—particularly in CV.CV words. First, although SML is apparently a marked feature of CNF dialects, when native speakers of these dialects speak or read Standard Finnish out loud, they do not remove SML from their speech (Ylitalo 2004). This is in contrast to other dialectical features, such as YG (/vapaa/ > [vappaa]) and vowel insertion (/kolme/ > [kolome]), both of which are readily identified and removed. Second, and relatedly, although Finnish speakers are generally very conscious of their dialects and will often spell their dialect phonetically (including features such as YG, vowel insertion, and vowel quality changes), speakers of SML dialects do not include SML in their phonetic spellings of their dialects. For example, the following is an orthographic representation of the Oulu (Pohjois-Pohjanmaa) dialect:

> Sitte het**i** ku mää tul**i**n sinne si**ss**ään ni... Että se tu**ll**ee tollee, ja si**ss**ään ja a**lak**aa huutelee...

Which in standard *puhekieli* would be rendered as:

> Sitten het**i** kun mä tul**i**n sinne si**s**ään niin... Että se tu**l**ee tollee, ja si**s**ään ja a**lk**aa huutelee...[12]

Here the rendering of the Oulu dialect includes YG (blue), as well as CCVI (red), but does not make note of SML (bold), despite a general awareness of differences in vowel length—for example, the pronoun *mä* 'I' is written dialectically as *mää*, which is a well-known feature of the Oulu dialect.[13]

The final reason for suspecting phonetic lengthening, rather than a third mora, is that speakers of Häme dialects do not interpret the lengthened segment as a long vowel. This is not to say that speakers of different dialects do not notice prosodic differences; however, they do not seem to categorize them as *quantitative* differences. Thus, there is a failure to interpret the extra duration as a long vowel both from within the CNF dialects, as well as from outside the CNF dialects.

One reason for this failure to acknowledge the additional duration may lay in where the category boundary is for short vs. long vowels in Finnish. Ylinen et al. (2005) ran a perceptual study on vowel length with both native and non-native speakers of Finnish. The tokens manipulated length in either the first syllable or the second syllable, but not both. They also included an allowance for SML, even though the participants were likely not all from dialectical regions with the feature.[14] For both tokens that were at the /tuku/ end of the spectrum, V_2 was longer than V_1 (70 ms vs. 104 ms for first syllable manipulation, and 95 ms vs. 117 ms for the second syllable manipulation);

[12] "Then right as I was going in, then... that they would come in and start shouting..." (translation mine)

[13] From personal experience, speakers of the Savo dialects will correct from [o.pet.ta.man] to [o.pet.ta.m**aa**n] if they think you have been confused by their sentence—and also write this distinction.

[14] Although the study did not give details regarding the dialects spoken by the participants, the experimenters are all from Helsinki (Häme dialect) and likely sampled from the local university population.

speakers nonetheless judged these tokens as good examples of /tuku/ (see Fig. 12 for more details on the tokens). They found that the category boundary for the native speakers in the second syllable (i.e., the token most relevant for CV.CV' words) was at 162 ms (or at 170% the duration of V_1). This is comparable to the production data in Suomi and Ylitalo's (2004) study, where the duration of the second syllable nucleus was 124 and 159 ms for CV.CVV.CV and CV.CVV.CVV words, respectively.[15] In contrast, the duration of V_2 in CV.CV.CV words was just 83 ms—just 140% the duration of V_1 at 57 ms.

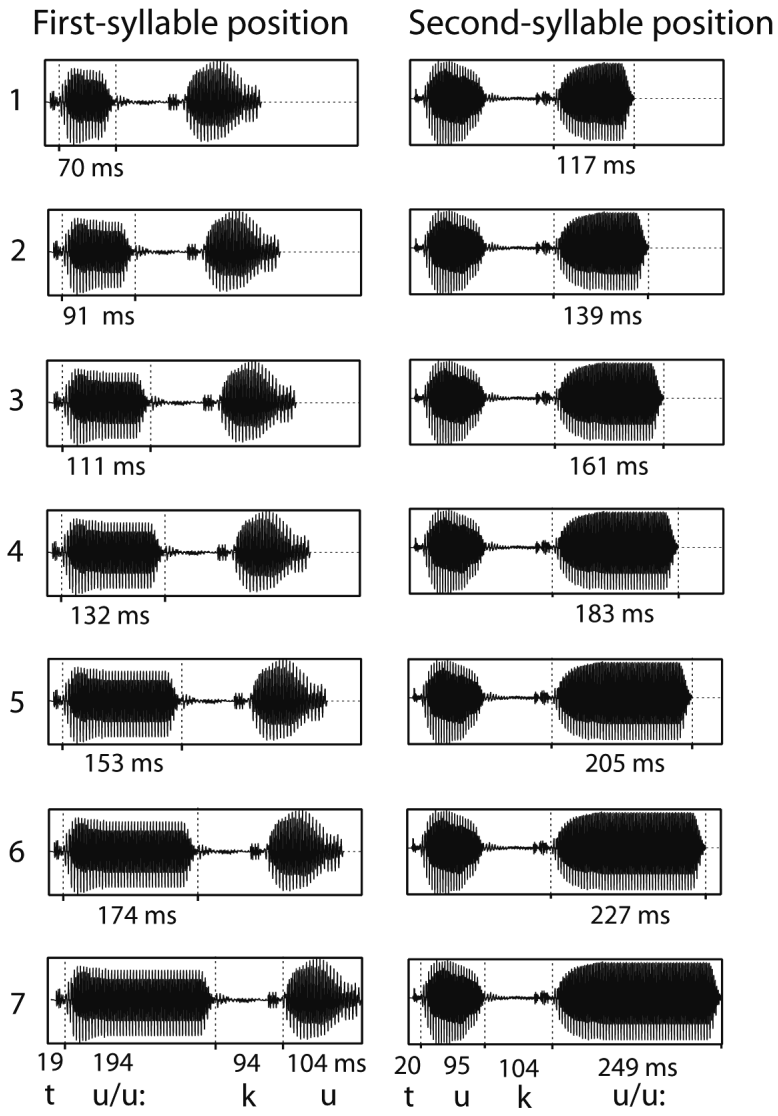


Figure 12: The tokens used for determining where the category boundary was between long and short vowels (Ylinen et al. 2005).

Thus, it is entirely possible that the extra duration is not, in fact, reflective of an additional mora. In this phonetic extension analysis, after the moraic foot is formed, the second element is then lengthened, which is more or less a domain-final lengthening. If the domain-final element is lengthened, there is no need to posit either of the two restrictions necessary for the recursive trimoraic foot: the extra duration has no choice but to be in the same syllable and of the same

[15] As produced by native speakers of Northern Finnish.

quality of the second mora.

Figure 13: The bimoraic foot with lengthening on the second (domain-final) mora, denoted by a $+$.

The last piece of this puzzle is some kind of justification for *why* there is domain-final lengthening, when the domain-final position is the weak position—especially in the case of CV.CV words, where the unstressed syllable's nucleus is lengthened. One possibility is that the additional length on this foot marks it as prominent above the other feet. That is, the extra length marks the primary prominence of the entire foot, rather than the prominence of the second mora. This would be some kind of "local culminativity," where stress and increased duration are not necessarily on the same syllable, but are within the same foot (see Zsiga and Zec (2012) for the dissociation of tone and stress in Serbian). However, this claim is speculative and requires further investigation.

5 Conclusions and future research

In this paper, I have provided an analysis of SML that posits a moraic foot at the head of the prosodic word. I have also proposed two possible mechanisms for the apparent second mora lengthening: either the addition of a mora through a recursive foot, or a process of domain-final lengthening which then lengthens the second mora. A moraic foot at the head of the prosodic word accounts for a reference to the second mora, which is not reliably in a specific syllable, as well as a moraically parsed anchoring point for intonational contours. A moraic foot at the head of the word also accounts for some durational patterns found by Suomi et al., where segments outside that initial bimoraic domain are reduced, even when they are still within the first syllabic foot. However, there is still room for further research, especially regarding how to proceed with the two proposed analyses.

5.1 Phonetic or phonological?

The two analyses that I have given above differ mainly in the degree of phonologization assumed for the extended duration of the second mora. The first, with a recursive trimoraic foot, attributes the extended duration to the addition of another mora, while the second describes a more phonetic process layered on top of a prosodic structure. I have already presented some evidence for each side; in this section, I will discuss some alternative sources of evidence that could potentially push the analysis one way or the other.

One point in favor of a trimoraic analysis may come from the retention and acquisition of this feature. As described in Sec. 2, the half-long vowel, if not SML, is a widespread feature through at least the Finnic languages, if not also through the Saamic languages. Although this feature has been lost in some cases and phonologized in others, the "half-long vowel" persists in these languages. It is tempting to think that an initial prosodic structure would be more permanent than a phonetic lengthening, especially when the lengthening goes against the habits of many trochaic languages. However, it is also possible that a phonetic lengthening may have been reinterpreted as a trimoraic foot, or even vice versa. Clearly, given the status of overlength in Estonian, phonologization, and even morphologization, are not an impossibility.

On the other side, CCVI in Finnish may provide some evidence for simply lengthening the weak

element of the moraic foot. As argued by Karlin (2014), SML is the root cause of CCVI: the attempt to extend the duration of C_2 in CVC_2C_3V words fails due to articulatory constraints, resulting in a gap between the two consonants where there is no constriction. This is a textbook example of excrescence due to underlap. Although this process seems to have been largely phonologized, where the excrescent vowel has been reinterpreted as a purposeful vowel, the Savo dialects still show some inconsistency in production for some tokens, especially hC sequences—even within speaker, some instances have no vowel at all, while others have a very short vocalic period. If this vowel does indeed have excrescent origins, that would push this analysis of SML in the direction of a phonetic lengthening, rather than a full *gemination* of that coda consonant.

5.2 Future research

As has been constantly stated throughout this paper, much of the status of the moraic foot hinges on stress judgments from CNF speakers—but these are, unfortunately, lacking in the literature. Indeed, it appears that there are several studies of the correlates of stress in non-Häme dialects, but only studies of stress judgment from Häme dialects. One potential study that immediately springs to mind is a more comprehensive survey of stress judgments, from speakers of various dialects, with careful note of their language background. From there, it would be more informative to proceed with collecting data to examine the correlates of stress. Stress judgments would also provide a better basis for examining the recursivity of SML—first, in order to be recursive at all, there would have to be moraic feet built through the whole word, rather than just at the head of the prosodic word; from there, a closer look at the second mora would be possible.

Finally, there is the question as to what purpose SML serves in the language. If it does in fact mark that particular foot as the head of the word, perhaps there could be some kind of perceptual study to examine this possibility. Such a study may have to involve nonce words, constructed in such a way that strings of syllables could be divided into words in two ways. From there, the words could be manipulated to exhibit greater and lesser degrees of SML, and speakers could make judgments as to which words they are hearing. However, such a study would only be relevant if it turned out the SML was not, in fact, recursive.

References

Abondolo, Daniel Mario. 1998. *The Uralic Languages*. Taylor & Francis.

Asu, Eva Liina, and Pire Teras. 2009. Estonian. *Journal of the International Phonetic Association* 39:367–372.

Bye, Patrik. 1997. A generative perspective on overlengthin Estonian and Saami. In *Estonian prosody: Papers from a Symposium*, 36–70.

Engstrand, Olle. 1987. Durational patterns of Lule Sami phonology. *Phonetica* 44:117–128.

Gordon, Matthew. 2009. Prominence and gemination in Ingrian. *Linguistica Uralica* 81–100.

Hayes, Bruce. 1995. *Metrical stress theory: Principles and case studies*. University of Chicago Press.

Kager, René. 1992. Shapes of the generalized trochee. In *Proceedings of the West Coast Conference on Formal Linguistics*, volume 11, 298–312.

Karlin, Robin. 2014. (handout) Finnish dialectical epenthesis: two distinct types of vowel insertion.

Karttunen, Lauri. 2006. The insufficiency of paper-and-pencil linguistics: the case of Finnish prosody. *ROA-818* .

Karvonen, Daniel Howard. 2005. Word prosody in Finnish. Doctoral dissertation, University of California Santa Cruz.

Kiparsky, Paul. 1995. Livonian stød. Citeseer.

Kiparsky, Paul. 2003. *Finnish noun inflection*. na.

Markus, Elena. 2010. Primary and secondary geminates in Ingrian. *Linguistica Uralica* 38–52.

Morén, Bruce, and Elizabeth Zsiga. 2006. The lexical and post-lexical phonology of Thai tones. *Natural Language & Linguistic Theory* 24:113–178.

Prince, Alan S. 1980. A metrical theory for Estonian quantity. *Linguistic Inquiry* 511–562.

Rozhanskiy, Fedor. 2015. The length of final vowels with respect to case syncretism in Luuditsa Votic. *Linguistica Uralica* 51:2.

Spahr, Christopher E. 2012. Dialectal gemination in Finnish: Phonetics/phonology interplay in moraic theory. *Toronto Working Papers in Linguistics* .

Suomi, Kari. 2009. Durational elasticity for accentual purposes in Northern Finnish. *Journal of Phonetics* 37:397–416.

Suomi, Kari, Juhani Toivanen, and Riikka Ylitalo. 2003. Durational and tonal correlates of accent in Finnish. *Journal of Phonetics* 31:113–138.

Suomi, Kari, and Riikka Ylitalo. 2004. On durational correlates of word stress in Finnish. *Journal of Phonetics* 32:35–63.

Ylinen, Sari, Anna Shestakova, Paavo Alku, and Minna Huotilainen. 2005. The perception of phonological quantity based on durational cues by native speakers, second-language users and nonspeakers of Finnish. *Language and Speech* 48:313–338.

Ylitalo, Riikka. 2004. Toisen tavun vokaalin puolipidennyksestä Oulunseutulaisten puheessa. *Virittäjä* 108:414.

Ylitalo, Riikka. 2009. *The realisation of prominence in three varieties of standard spoken Finnish*. Oulun Yliopisto.

Zsiga, Elizabeth, and Draga Zec. 2012. Contextual evidence for the representation of pitch accents in standard Serbian. *Language and speech* 0023830912440792.

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