

Explaining Nonfinality: Evidence from Finnish

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1. Introduction¹

The notion that primary stress serves a demarcative function by signaling edges of morphological constituents is due originally to Trubetzkoy (1939) and was taken up further in Hyman (1977). From a functional standpoint, fixed primary stress located near morpheme or word edges helps the listener correctly identify such boundaries. Trubetzkoy's original observation was that in languages with fixed primary stress, the main-stressed syllable could be initial, final, penultimate, peninitial, or even antepenultimate, but that it is the *predictable* location of primary stress that serves as an indicator to the listener of the proximity of a word boundary. As Trubetzkoy noted, "... 'fixed accent' ... is actually only meaningful *within* a sentence" (Trubetzkoy 1969:278, emphasis mine).

In a study of the stress systems of over 300 languages, Hyman (1977) notes that cross-linguistically, the majority of languages with fixed stress have either initial or final primary stress, suggesting that stress serves a demarcative function best when it occurs at the very edge of the prosodic word. Hyman further observes that the distribution of languages with stress located one syllable in from the word edge shows an interesting asymmetry: there are many languages with penultimate stress, but very few with peninitial stress. Additionally, many languages have mechanisms for shifting stress from the final to the penultimate syllable, but not from the initial syllable to the peninitial syllable.

Expanding on Hyman (1977), Gordon (2000) provides an explanation for this asymmetry in terms of tonal crowding. Since final boundary tones are much more common than initial boundary tones cross-linguistically, final stress avoidance (i.e., penultimate stress) can be understood as resulting from the repulsion of the tone associated with stress from the final to the penultimate syllable. Stressed syllables are typically associated with a fundamental frequency peak, H* (Eek 1982), while intonational phrases are marked by a final low boundary tone, L%, resulting in tonal crowding on the final syllable of a word, as schematized below in (1):

(1) σ]
 / \
 H* L%

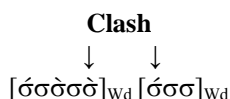
Penultimate stress can thus be understood as resulting from the repulsion of the tone associated with stress, H*, from the final to the penultimate syllable. Gordon (2000) ascribes the penultimate/peninitial asymmetry to the rarity of boundary tones in initial position compared to final boundary tones cross-linguistically. As described, the process of course applies only to phrase-final position. As Gordon (2000) points out, stress judgments are often elicited in isolation and thus final stress avoidance could be an artifact of final syllables being uttered simultaneously in word-final and phrase-final position. For those languages which truly have final stress avoidance in both phrase-final and word-final position, the extension of final stress avoidance from phrase-final to word-final position could have occurred via a type of analogy.

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In Optimality Theory (Prince and Smolensky 1993/2004), the prohibition of stress on final syllables is handled via the constraint NONFINALITY. Prince and Smolensky’s original definition of NONFINALITY is “No head of PrWd is final in PrWd” (Prince and Smolensky 1993/2004:56/68), which as defined only applies to primary stress, but subsequent researchers have expanded the definition to include the prohibition of secondary stress on final syllables as well. One criticism that might be leveled against NONFINALITY as defined is that it is largely formal in nature, and offers little explanatory value. The tonal crowding analysis of Gordon (2000), however, offers a principled phonetic explanation for the phenomenon.

Building on the tonal crowding analysis sketched above, I propose an additional, rhythm-based motivation for, and explanation of, NONFINALITY, based on evidence from Finnish. Primary stress in Finnish is initial, with secondary stresses generally occurring on alternate nonfinal syllables. In the grid-based analysis of Finnish stress of Karvonen (2005), the constraints NOCLASH (which prohibits adjacent stressed syllables) and NOLAPSE (which penalizes adjacent unstressed syllables) are responsible for much of the basic rhythmic stress pattern of the language. NONFINALITY thus seems like a rather ad hoc constraint, since its sole function is to prohibit stress on final syllables in an otherwise largely rhythmically-based stress system. In this paper, I argue that NONFINALITY in Finnish can be dispensed with and can instead be reinterpreted as clash avoidance at the *phrasal* level, as schematized below in (2):

- (2) Stress clash at the phrasal level



Since words are rarely uttered in isolation, most words will be immediately followed by a main-stressed syllable in Finnish, resulting in phrasal stress clash. This analysis thus uses a mechanism independently needed at the word level, NOCLASH, to account for the lack of stress on final syllables in Finnish. This results in a straightforward, grid-based analysis of Finnish stress, eschewing the largely formal constraint NONFINALITY and extending the notion of demarcative stress to include right-edge aligned secondary stress in the spirit of Trubetzkoy’s original observation.

Since the analysis of Finnish stress I assume differs from the standard account in the literature, I first motivate it in Section 2, and show how rhythmic stress in Finnish can be analyzed using constraints that refer purely to the metrical grid, following Karvonen (2005). Finally, in Section 3, I show in greater detail how the lack of secondary stress on final syllables in Finnish can be understood as following from the word-level pressure for adjacent syllables to not both be stressed in Finnish as seen from the level of the phonological phrase.

2. Finnish stress

Primary stress in Finnish is without exception initial, as shown below in (3):²

- | | | | | |
|-----|--------|---------|------------|------------|
| (3) | kói.vu | ‘birch’ | má.ta.la | ‘low’ |
| | vá.paa | ‘free’ | lá.pi.o | ‘shovel’ |
| | sí.ka | ‘pig’ | hél.sin.ki | ‘Helsinki’ |

While the location of primary stress is straightforward and uncontroversial, secondary stress is more complex and is sensitive to three factors: rhythm, syllable weight, and morphology. In the purely rhythmic pattern of stress, which can be seen most clearly in monomorphemic words of all light

² Here and throughout, I follow the standard conventions of marking primary stress via an acute accent over the first vowel in the nucleus of a stressed syllable and secondary stress via a grave accent over the relevant vowel, and mark syllable boundaries with periods.

syllables, secondary stress falls on odd-numbered nonfinal syllables (counting from the left), except that in long (pentasyllabic and longer) odd-parity monomorphemic words, secondary stress may occur on either the antepenult or the penult (X = L (light) or H (heavy)):³

- | | | | | | | |
|-----|----|----------------|--------------|----|------------------|------------------|
| (4) | a. | ǞǞǞǞǞ | | b. | ǞǞǞǞǞ | |
| | | ér.go.nò.mi.a | ‘ergonomics’ | | kó.les.te.rò.li | ‘cholesterol’ |
| | | mí.nis.tè.ri.ö | ‘ministry’ | | fór.mal.de.hý.di | ‘formaldehyde’ |
| | | té.le.vi.si.o | ‘television’ | | án.tro.po.lò.gi | ‘anthropologist’ |

Outside the domain of the first two syllables of the word, heavy syllables, which in Finnish can be either CVV or CVC, disrupt the basic, alternating rhythmic stress pattern by attracting stress:

- (5) Heavy (CVV and CVC) syllables always attract stress

á.la.bàs.te.ri	‘alabaster’	ká.ta.ma.ràa.ni	‘catamaran’
tá.ber.nàak.ke.li	‘tabernacle’	só.si.a.lis.ti	‘socialist’
sýn.te.ti.sàat.to.ri	‘synthesizer’	ím.mu.ni.tèet.ti	‘immunity’

Morphology⁴ also can disrupt the basic rhythmic stress pattern. Light (CV) case endings and possessive suffixes appear to shift stress rightward (6), while in compounds the initial syllable of each constituent is always stressed (7):

- (6) Apparent rightward stress shift under suffixation

ó.pet.ta.jà. si	‘teacher-PX.2SG’ (cf. NOM-SG, ó.pet.tà.ja)
ká.le.va.là. na	‘Kalevala-ESSIVE’ (cf. NOM-SG, ká.le.và.la)
rá.vin.to.là. ni	‘restaurant-PX.1SG’ (cf. NOM-SG, rá.vin.tò.la)
ár.tik.ke.lì. ni	‘article-PX.1SG’ (cf. NOM-SG, ár.tik.kè.li)

- (7) Stress in compounds

píi.lè.vä	‘diatom <a type of alga>’ (pii = silicon, levä = alga)
má.ta.la.pài.ne	‘low pressure’ (matala = low, paine = pressure)

Standard accounts of Finnish stress (Setälä 1898, Laurosela 1922, Sadeniemi 1949, Harms 1964, Carlson 1978, Hanson and Kiparsky 1996, Alber 1997, Elenbaas 1999, Kiparsky 2003, Karttunen 2006, Anttila 2007) all assume that in odd-parity words such as those in (4), all secondary stress peaks are aligned to the left edge of the word, based on existence of words like *érgonòmia* ‘ergonomics’ in (4a). On this account, the rightward stress shift illustrated in (6) in forms with case endings and possessive suffixes such as *ópettajäsi* ‘teacher-PX.2SG’ requires a morphological account, and the secondary stress in long monomorphemic words such as *kólesteròli* ‘cholesterol’ in (4b) requires an additional explanation. One possible solution that has been proposed for the forms in (4b) is lexical specification of stress (Sadeniemi 1949, Kiparsky 2003).

The current proposal, following Karvonen (2005), turns the standard analysis of secondary stress in Finnish on its head by assuming that the default rhythmic stress pattern includes a *right*-aligned nonfinal secondary stress peak. Evidence for this view comes from the existence of words like those in (4b) such as *kólesteròli* ‘cholesterol’, which I argue represent the default rhythmic stress pattern, contra standard accounts of Finnish stress, which assume that *érgonòmia* words represent the default

³ Syllable weight only affects stress outside the initial two syllables of the word in Finnish (i.e., outside the initial foot). Finnish is thus a partially quantity-sensitive language.

⁴ Although syllable weight and morphology have an impact on the location of secondary stress, the focus of this paper is on the rhythmic stress pattern in Finnish, and the generalizations made here also hold true when the influences of syllable weight and morphology are considered. See Karvonen (2005) for more discussion.

rhythmic pattern. On this analysis, the rightward stress shift seen in the forms with case endings and possessive suffixes in (6) thus reflects the default rhythmic stress pattern, and the influence of morphology is epiphenomenal. The antepenultimate *érgonòmia* pattern then requires a separate explanation, which I attribute to a more general pattern of stress avoidance on final hiatal sequences. The main point here is that not only is the rightmost-but-not-final pattern of secondary stress in Finnish supported empirically, but it can also be shown to serve a demarcative function in the language. Since words which contain a final stressed syllable result in stress clash on the phrasal level, a sequence of a secondary stress followed by an unstressed syllable can be understood as serving to demarcate the right edge of the prosodic word in Finnish. In the following section, I sketch an Optimality-Theoretic analysis of rhythmic stress in Finnish, using constraints that refer only to the metrical grid.

2.1. Rhythmic stress

In uncovering the pattern of rhythmic stress in Finnish, it is important to only examine words with all light syllables (outside the first two syllables of the word) which are also monomorphemic, so that the effects of quantity sensitivity and morphology can be controlled for. The basic generalizations for monomorphemic light-syllabled words up to four syllables in length are as follows:

- (8)
- Initial main stress
 - No final stress
 - No adjacent stresses
 - No lapses of two unstressed syllables

For rhythmic stress in Finnish, I adopt the following constraints that refer directly to the metrical grid (Prince 1983 and Selkirk 1984) instead of the metrical foot (see Gordon 2002 for a similar proposal):⁵

- (9) Rhythmic constraints

LEFTMOST (cf. Cohn and McCarthy's (1998) RIGHTMOST)

Align(PrWd, L; Head(PrWd), L)

A level 2 grid mark is aligned to the left edge of the prosodic word (the main-stressed syllable is initial in the prosodic word).

NONFINALITY (see Prince and Smolensky 1993/2004)

A final syllable lacks a level 1 grid mark (the final syllable of a word is stressless).

NOCLASH (Prince 1983, Selkirk 1984, Kager 1994)

Adjacent syllables with level 1 grid marks (stresses) are prohibited.

NOLAPSE (cf. Elenbaas 1999, Elenbaas and Kager 1999, Gordon 2002)

A sequence of two adjacent syllables lacking level 1 grid marks is prohibited (two adjacent unstressed syllables are prohibited).

The constraint LEFTMOST ensures primary stress on the initial syllable, and NONFINALITY (to be dispensed with shortly) prohibits final stress, while the constraints NOCLASH and NOLAPSE work together to yield the binary, alternating peak-and-trough pattern of stressed and unstressed syllables. All light-syllabled monomorphemic words of up to four syllables in length must satisfy all of the constraints in (9), as shown in the tableau below in (10), where any option besides stressing the first and third syllable in a quadrisyllabic word violates at least one of these constraints:

⁵ While not denying the existence of the metrical foot, the current analysis shows how the foot need not directly be referred to in constraints. The current analysis uses constraints that refer to the metrical grid only.

(10) Rhythmic constraints produce binary, alternating stress

/kalenteri/	LEFTMOST, NOCLASH, NONFINALITY, NOLAPSE
☞ a. ká.len.tè.ri	
b. ká.lèn.te.ri	*! NOCLASH, NOLAPSE
c. ká.len.te.ri	*! NOLAPSE
d. ká.len.te.ri	*! NONFINALITY, NOLAPSE
e. ka.len.te.ri	*! LEFTMOST, NOLAPSE
f. ka.lén.te.ri	*! LEFTMOST, NOLAPSE

In odd-parity words, lapses are tolerated in order to satisfy the prohibition against final stress and adjacent stressed syllables. This is shown in the following tableaux for trisyllabic and pentasyllabic words:

(11) Lapse tolerated to avoid final stress

/matala/	NONFINALITY	NOLAPSE
☞ a. má.ta.la		*
b. má.ta.là	*!	

(12) Lapse tolerated to avoid stress clash

/kolesteroli/	NOCLASH	NOLAPSE
☞ a. kó.les.te.rò.li		*
☞ b. kó.les.tè.ro.li		*
c. kó.les.tè.rò.li	*!	
d. kó.lès.te.rò.li	*!	

As the tableau in (12) shows, however, two output candidates satisfy the constraint ranking proposed thus far: candidate (a), which has penultimate stress, and candidate (b), which has a secondary stress on the antepenult. In pentasyllabic words, there are thus two logically possible locations for the unparsed or “prosodically trapped” syllable (in the terms of Mester 1994):

- (13) a. X̂ X Ì L L **L**
 b. X̂ X **L** Ì L L

To my knowledge, all previous work on Finnish stress has unanimously assumed that the left-aligned stress pattern in (13a) represents the default rhythmic pattern of stress. This assumption is based upon the examination of only a few words, such as *érgonòmia* ‘ergonomics’. As shown in Karvonen (2005), however, when a richer set of pentasyllabic words is examined, they partition neatly into two groups with stress on either the antepenult or penult, as shown below:

(14) Pentasyllabic words with secondary stress on the **antepenult**: X̂ X Ì L L

ér.go.nò.mi.a	‘ergonomics’
mí.nis.tè.ri.õ	‘ministry’
té.le.vi.si.o	‘television’
díp.lo.mà.ti.a	‘diplomacy’
póst.po.si.ti.o	‘postposition’
bý.ro.krà.ti.a	‘bureaucracy’
fó.no.lò.gi.a	‘phonology’
kó.a.li.ti.o	‘coalition’
íns.ti.tù.ti.o	‘institution’
kré.ma.tò.ri.o	‘crematorium’

kón.di.tò.ri.a	‘bakery, coffee shop’
skán.di.nà.vi.a	‘Scandinavia’
mé.lan.kò.li.a	‘melancholy’
ín.do.nè.si.a	‘Indonesia’

(15) Pentasyllabic words with secondary stress on the **penult**: $\acute{X} X L \grave{L} L$

kó.les.te.rò.li	‘cholesterol’
mág.ne.to.fò.ni	‘tape recorder’
fór.mal.de.hý.di	‘formaldehyde’
tá.na.na.ri.ve	‘Finnish name for Antananarivo, capital of Madagascar’
bí.ha.ra.mù.lo	‘city in Tanzania’
kó.re.o.grà.fi	‘choreographer’
lék.si.ko.grà.fi	‘lexicographer’
dó.de.ka.èd.ri	‘dodecahedron’
í.ko.sa.èd.ri	‘icosahedron’
tés.tos.te.rò.ni	‘testosterone’
ó.li.go.pò.li	‘oligopoly’
dér.ma.to.lò.gi	‘dermatologist’
kón.kvis.ta.dò.ri	‘conquistador’
á.sa.hi.kà.wa	‘Asahikawa (city in Japan)’

The crucial difference between these two sets of words is that the antepenult words in (14) end in a final hiatal CV.V sequence, while those in (15) with penult stress (which incidentally have received scant attention in the literature on Finnish stress), lack a final hiatal sequence and end in a final CV.CV sequence. Even more remarkably, both four- and six-syllable words with final CV.V sequences avoid penult stress, with the result that four-syllable words have only a single, primary stress:

(16) Four- and six-syllable words with final –CV.V sequences: $\acute{X} X L L$ and $\acute{X} X L \grave{L} L L$

sín.fo.ni.a	‘symphony’ (cf. ká.len.tè.ri ‘calendar’)
pró.so.di.a	‘prosody’
á.te.ri.a	‘meal’
kó.me.di.a	‘comedy’
kómp.pa.ni.a	‘company’
fán.ta.si.a	‘fantasy’
ób.ser.va.tò.ri.o	‘observatory’
lá.bo.ra.tò.ri.o	‘laboratory’
dé.kom.po.sì.ti.o	‘decomposition’
kón.ser.va.tò.ri.o	‘conservatory’
dér.ma.to.lò.gi.a	‘dermatology’
gý.ne.ko.lò.gi.a	‘gynecology’
bíb.li.o.grà.fi.a	‘bibliography’

The antepenultimate pattern in (16) is completely unexpected on the standard analysis of Finnish stress, which would predict surface patterns such as *áteria* and *óbservàtorìo* which avoid all lapses and satisfy all the rhythmic constraints. The actual stress patterns of these words fare very poorly from a syllable parsing perspective, since they incur *two* lapses, illustrating that some other factor is responsible for the pattern. The current proposal, as detailed in Karvonen (2005), differs from the standard analysis of Finnish stress by arguing that the pentasyllabic words with a right-aligned nonfinal secondary stress peak in (15) (“*kólesteròli*” words) represent the default rhythmic pattern of stress in Finnish, while the stress pattern in the antepenult forms in (14) and (16) (“*érgonòmia*” words) results from a special kind of word-final stressed hiatus avoidance.

2.2. Word-final hiatus

What unites the words with antepenultimate stress in (14) and (16) is that all of them end in a final hiatal sequence. Why should stress be prohibited on the penult in such words? Gordon (1999) suggests that since vowels and consonants differ in intensity, a preceding consonant gives a vowel a “perceptual boost”. With two heterosyllabic vowels adjacent to one another, no such boost is available, rendering it difficult for the hearer to perceive a final onsetless syllable as a distinct syllable. Also, the vowel in the penultimate syllable in all the words in (14) and (16) is the high vowel ‘i’. It is well known that high vowels are the shortest of vowels (Lehiste 1970), which lends further support to the idea that they are nonoptimal locations for stress, and in fact the stress retraction to the antepenult in such forms could be considered a kind of response to tonal crowding.⁶ Although the explanation here is preliminary and clearly requires further investigation, the generalization remains that stress on the penult is uniformly prohibited in words with final hiatal sequences and must be due to some mechanism common to only these words. In what follows, I assume some such explanation for the antepenultimate forms and focus only on words without final hiatus.

3. Right-aligned secondary stress (demarcative stress)

There is abundant evidence, then, that the default rhythmic pattern of stress in Finnish contains a right-aligned nonfinal secondary stress peak, as exemplified by words like *kólesteròli*. Following Karvonen (2005), we can assume that an alignment constraint is responsible for this pattern:

- (17) ALIGN-R (PrWd, level 1 grid mark) (McCarthy and Prince 1993)
Align a level 1 grid mark with the right edge of the prosodic word.

Right-aligned non-final secondary stress can thus be modeled simply by ranking NONFINALITY over ALIGN-R:

- (18) Right-aligned, but nonfinal stress

/kolesteroli/	NONFINALITY	ALIGN-R
☞ a. kó.les.te.rò.li		*
b. kó.les.te.ro.li	*!	

Primary stress in Finnish is invariably initial and thus serves as a clear word boundary marker, signaling to the listener the beginning of a new word. Experimental evidence by Iivonen, Niemi, and Paananen (1998), who found that 73% of F0 peaks occur on primary stressed syllables in Finnish, corroborates this claim. We might then wonder whether secondary stress could serve a similar demarcative function, by marking the *end* of a word. As we have seen, final stress in Finnish is prohibited, so the closest a secondary stress peak can come to the right edge of the prosodic word is on the penultimate syllable. In an even-parity word such as *mónopòli* ‘monopoly’, secondary stress will always occur on the penultimate syllable due to maximal parsing, but in odd-parity words like *kólesteròli* ‘cholesterol’ and *érgonòmia* ‘ergonomics’, we have seen that secondary stress occurs on the penult or antepenult. As shown in the previous section, the antepenult forms are exceptional, and the retracted stress in such forms is due to a separate mechanism. With the antepenult forms set aside, the picture is much clearer, and shows that words in Finnish have a rightmost-but-not-final secondary stress peak. The alignment constraint ALIGN-R thus is not just a pure alignment constraint, rather it serves to *demarcate* the right edge of the prosodic word, just as initial primary stress in Finnish serves to demarcate the beginning of the word. However, in the familiar Optimality-Theoretic way, ALIGN-R is a violable constraint, and right-edge demarcation is imperfect, due to the prohibition on final stress in Finnish. The suggestion here is that like primary stress, secondary stress can serve to demarcate

⁶ Thanks to Adam Albright for bringing this important point to my attention.

word boundaries, and the reason for right alignment of secondary stress in Finnish is precisely due to the pressure to demarcate the end of the prosodic word.

So why is final stress avoided in Finnish? As mentioned earlier, the prohibition against final stress (NONFINALITY) in Finnish can be understood as avoidance of stress clash at the phrasal level, since words are rarely spoken in isolation:

(19) Stress clash at the phrasal level



Since main stress in Finnish is always initial, a word that is non-final in an utterance will always be followed by a word beginning with a stressed syllable. The configuration in (19a), with final stress on the first word in the utterance, results in stress clash at the phrasal level, while the configuration in (19b) with penultimate stress avoids stress clash by retracting the potential final stress to the penult, even at the expense of creating a lapse word internally. We can thus dispense entirely with NONFINALITY in Finnish and replace it by NOCLASH, redefined as follows:

(20) NOCLASH revisited

NOCLASH

Adjacent syllables with level 1 grid marks (stresses) are prohibited (both at the word and phrasal level).

The alignment constraint ALIGN-R is thus subordinate to the anti-clash constraint NOCLASH, since misalignment is tolerated in order to avoid clash at the phrasal level, as shown below:

(21) Right-aligned, but nonfinal secondary stress

	/kolesteroli/	NOCLASH	ALIGN-R
☞ a.	kó.les.te.rò.li]wd [^ˈ σ...		*
b.	kó.les.tè.ro.li]wd [^ˈ σ...	*!	
c.	kó.les.tè.ro.li]wd [^ˈ σ...		**!

Viewed in this way, NONFINALITY in Finnish thus is really nothing more than the same basic preference for alternating, rhythmic stress and avoidance of stress clash seen at the word level (where it is encoded in the constraint NOCLASH) as viewed from the level of the next highest prosodic constituent, the phonological phrase. Rhythmic stress in Finnish can thus be derived from the interaction between just two kinds of constraints: alignment constraints, which align word edges (such as LEFTMOST and ALIGN-R); and constraints requiring adjacent grid marks to be non-identical, namely, NOCLASH and NOLAPSE, with no need for NONFINALITY as an independent constraint.

4. Conclusion

This paper has claimed that the constraint NONFINALITY is unnecessary and lacks explanatory value in the analysis of Finnish stress, and that the prohibition on final stress in the language can be shown to follow from the same high-ranking constraint against stress clash within the prosodic word (NOCLASH), when viewed from the perspective of the phonological phrase. From an empirical standpoint, I have also shown that the rhythmic pattern of stress in Finnish contains a right-aligned nonfinal secondary stress peak, contra previous accounts of Finnish stress. This claim is not only supported by the data, but I also suggested that such a right-aligned nonfinal secondary stress peak is motivated by pressure to serve a demarcative function, by signaling to the listener the right edge of the prosodic word. Further research will examine how this understanding of NONFINALITY as stress clash avoidance at the phrasal level can be extended to other languages as well and how the demarcative notion of stress can be expanded to include penultimate secondary stress peaks.

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