Fenno-Swedish Quantity:
Contrast in Stratal OT

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Abstract

Compared to more familiar varieties of Swedish, the dialects spoken in Finland have rather diverse syllable structures. The distribution of distinctive syllable weight is determined by grammatical factors, and by varying effects of final consonant weightlessness. In turn it constrains several gemination processes which create derived superheavy syllables, in an unexpected way which provides evidence for an anti-neutralization constraint. Stratal OT, which integrates OT with Lexical Phonology, sheds light on these complex quantity systems.

1 The weight of stressed syllables

1.1 Light stressed syllables[1]

The bimoraic minimum: Sweden vs. Finland. In most Swedish dialects of Sweden (here referred to as *West Swedish* for short), stressed syllables are minimally bimoraic: they must contain at least a long vowel (-VV-) or a closed syllable (-VC-).[2] Words like (1a) are therefore impossible. Because word-final consonants are weightless ("extrametrical") in Swedish, the two-mora minimum also excludes monosyllabic words with -VC rhymes (see (1b)):

(1) a. *[ro], *[ro.da], *[ro.a], *[no.gra]
b. *[ro(d)]

The Swedish dialects of Finland present a more varied picture. Only parts of Åland have the two-mora minimum (e.g. Brändö and Kumlinge in the northeastern part of the island, Sundberg 1993:131 ff.). All other Fenno-Swedish dialects allow light (i.e. monomoraic) stressed syllables as a distinctive syllable type:

(2) [daga], [dagar] 'days', [viku] 'week', [veliŋ] 'gruel', [suvel] 'food eaten with bread, sowl', [somar] 'summer', [stygu] 'hut', [päron] 'potato(es)', [hakon] 'the chin', [hole] 'the hole', [segla] 'to sail', [tala] 'to talk', [sita] 'to sit', [myky][3] 'much', [stad̬gari] 'steadier', [snidit] 'askew', [ʧyvu] 'twenty'

Fenno-Swedish, then, has a lexical contrast between stressed CV, CVC, and CVV syllables:[4]

(3) a. [baka] 'bake' (99), [baaket] 'after' (adv.) (114), [bakkan] 'the hill' (114)
b. [vaten] 'water' (102), [maaten] 'the food', [natten] 'the night' (70)
c. [betär] 'better' (51), [fleetor] 'braids' (43), [tvettar] 'washes' (51)

Even though stressed CV *syllables* are allowed, *words* of the form CV are categorically excluded in all the dialects (except for function words, on which see below).[5] As for words of the form CVC, the dialects are divided. Most allow them:[6]

[1]The information on Fenno-Swedish dialects given here is based primarily on the 29 transcribed dialect texts in Harling-Kranck 1998, with accompanying tapes, as well as on the brief grammatical sketches of the dialects provided there. Page references below are to that work, unless otherwise specified. For supplementary information on particular points I have consulted the additional dialect monographs cited below. Special thanks are due to Mikael Reuter, for valuable discussion of Helsinki Swedish, and for generously providing me with a copy of his unpublished thesis (Reuter 1982).

[2]Except where otherwise stated, the generalizations stated here hold for phonological words. Each member of a compound constitutes a separate phonological word.

[3]Here and throughout I ignore dialectal variation in pronunciation where it is not relevant to the analysis of syllable weight. For instance, dialects with palatalization before front vowels have [myʧy] or [myʧi] instead of [myky].

[4]In phonetic transcriptions of Fenno-Swedish, I adhere to IPA standards except that I mark vowel and consonant length by gemination, so as to conform with the phonological (lexical) representations, and to allow convenient marking of syllable boundaries (by "."). Italics are reserved for citing word in Swedish spelling, which will be done for standard West Swedish and standard Helsinki Swedish only.

[5]The single contrary example is *ga* [ga] 'go' in Vörå (central Ostrobothnia, Harling-Kranck 1998:121), apparently a fast speech variant of that dialect's normal [gaa].

[6]The contrast between /CVC/ and /CVCC/ is clearest before a vowel in close contact, e.g. [hol i mitten] 'hole in the middle', [r̬unn o] 'round too' (H.-K. 22). The /CVC/ words are partly retentions of Proto-Nordic /CVC/, partly analogical reintroductions (Huldén 1957:122), and partly apocopated from CVCV at different periods.

(4) [sov] ‘slept’ (21), [styd] ‘support’ (22), [hol] ‘hole’ (22), [led] ‘opening (in fence)’ (31), [smör] ‘butter’ (55), [lag] ‘to make’ (55), [rog] ‘rye’ (134), [tär] ‘there’ (129), [las] ‘read’ (past) (Huldén 1957:133), [far] ‘rides’ (Huldén 165), [net] ‘net’, [skot] ‘shot’, [gres] ‘grass’ (Selenius 1972:34)

CVC words are excluded, however, in southern Ostrobothnia, on some islands off Turku/Åbo in the Southwest, and, as already mentioned, in the Åland dialects that impose the West Swedish two-mora minimum on stressed syllables.

In the urban Fenno-Swedish of Helsinki and Turku, light stressed syllables have a more restricted distribution. Open syllables in lexical words (such as the nouns, verbs, adjectives, and adverbs in in (2)) are obligatorily lengthened under stress, as in Sweden. Light stressed syllables do occur, but only in certain rather special circumstances: in function words before voiced consonants, in truncated lexical words (such as (5f)), and a few others discussed below. Consequently, Helsinki/Turku Swedish does not have the particular three-way contrasts in (3), though it still has those in (5).[7]

(5) Helsinki/Turku Swedish:

a. *före* [före] ‘before’, *före* [föööre] ‘ski trail conditions’, *förre* [förre] ‘former’

b. *bara* [bara] ‘only’, *bara* [baara] ‘the bare’, *barra* [barra] ‘to shed needles’

c. *hela* [hela] ‘the whole’ (all of), *hela* [heela] ‘the whole’ (undamaged), *hälla* [hella] ‘to pour’

d. *mina* [mina] ‘my’, *mina* [miina] ‘mine’ (explosive device), *minna(s)* [minna(s)] ‘to remember’

e. *så* [so] ‘so’, *så* [soo] ‘to sow’

f. *dia* [dia] ‘slide, transparency’, *dia* [diia] ‘to suckle’

The core constraints. The data so far have a fairly straightforward analysis, except for the mysterious restrictions in Helsinki/Turku, to which I return below after surveying the other parameters of syllable weight. Let us assume the constraints in (6):

(6) a. CONSONANT EXTRAMETRICALITY (abbreviated C-EX): A word-final consonant is weightless (i.e. it is not part of the prosodic word).

b. FOOT-BINARITY: A foot (and hence a word) has at least two moras.

c. STRESS-TO-WEIGHT: A stressed syllable has at least two moras.

d. DEP-Vμ: An output vocalic mora corresponds to an input mora (“don’t lengthen vowels”).

The most widespread type of Fenno-Swedish, where /CVC/ words remain unlengthened, is derived by the following ranking (where commas separate constraints whose mutual ranking is not crucial):

[7]The Helsinki/Turku data, and most of the descriptive generalizations discussed below, are from Reuter 1982 (especially valuable for its phonetic data), Reuter 1986, and Bergroth 1928. This variety of Swedish is essentially identical with the one I learned in Helsinki in the 1940s and early 1950s.

(7) General Fenno-Swedish: FOOT-BINARITY ≫ DEP-Vμ ≫ STRESS-TO-WEIGHT, C-EXTRAMETRICALITY

(8)

General F.-Sw.	FT-BIN	DEP-Vμ	STR/WT	C-EX
Input: /CVCV/				
1a. ☞ CV́.CV			*	
1b. CV́V.CV		*		
Input: /CVC/				
2a. CV́(C)	*		*	
2b. ☞ CV́C				*
2c. CV́V(C)		*		
Input: /CV/				
3a. CV́	*		*	
3b. ☞ CV́V		*		

Its similarity to Proto-Nordic, and its discontinuous distribution within Finland, suggest that this is the most archaic of the Fenno-Swedish quantity systems. Pointing to the same conclusion is the formal relationship between the constraint systems of the dialects. In the Stratal OT framework, (Booij 1996, 1997, Orgun 1996, Kiparsky 2000, 2003, Bermúdez-Otero 1999, 2006a, 2006b, Bermúdez-Otero and Hogg 2003, Rubach 1997, 2000) sound change corresponds the promotion of markedness constraints to undominated status in the postlexical phonology (with the innovative constraint ranking then spreading to the word phonology, or even to the stem phonology). If (7) is taken as the point of origin, each of the attested systems is derivable from another by a single constraint promotion.

Starting from (7), promotion of CONSONANT EXTRAMETRICALITY to undominated status yields the ranking in (9), which characterizes the dialects of South and Central Ostrobothnia and of the Southwestern islands:

(9) South Ostrobothnia: CONSONANT EXTRAMETRICALITY, FOOT-BINARITY ≫ DEP-Vμ ≫ STRESS-TO-WEIGHT

In these dialects, input words of the form /CVCV/, /CVC/, and /CV/ surface respectively as [CV.CV], [CVVC], and [CVV].

(10)

S.Ostrobothnia	C-EX	FT-BIN	DEP-Vμ	STR/WT
Input: /CVCV/				
1a. ☞ CV́.CV				*
1b. CV́V.CV			*	
Input: /CVC/				
2a. CV́(C)		*		*
2b. CV́C	*			
2c. ☞ CV́V(C)			*	
Input: /CV/				
3a. CV́		*		*
3b. ☞ CV́V			*	

As the constraints correctly predict, lengthened monosyllabic bases alternate with short-vowel suffixed forms in South Ostrobothnian:[8]

(11)

[faar]	'rides'	[fara]	'to ride'	(Nagu, 153)
[veed]	'wood'	[vedin]	'the wood'	(Lappfjärd, 99)
[koom]	'came'	[koma]	'to come'	(Petalax, 109; Munsala, Huldén 125)
[taal]	'speech'	[talar]	'speaks'	(Närpes, Riad 1992:181)
[viik]	'week'	[vikun]	'the week'	(Närpes, Riad 1992:181)

If, in addition, STRESS-TO-WEIGHT is promoted, we get the dialects with consistent open syllable lengthening, such as the Swedish of Åland and Sweden:[9]

(12) West Swedish: STRESS-TO-WEIGHT, C-EXTRAMETRICALITY, FOOT-BINARITY ≫ DEP-Vμ

The input words /CVCV/, /CVC/, and /CV/ then surface respectively as [CV.CV], [CVVC], and /CVV/:

(13)

West Swedish	STR/WT	C-EX	FT-BIN	DEP-Vμ
Input: /CVCV/				
1a. CV́.CV	*			
1b. ☞ CV́V.CV				*
Input: /CVC/				
2a. CV́(C)	*		*	
2b. CV́C		*		
2c. ☞ CV́V(C)				*
Input: /CV/				
3a. CV́	*		*	
3b. ☞ CV́V				*

A fourth system emerges if at stage (7) STRESS-TO-WEIGHT (rather than C-EXTRAMETRICALITY) is promoted. This is the standard Danish system, with open syllable lengthening but no monosyllable lengthening:[10]

(14) Danish: STRESS-TO-WEIGHT, FOOT-BINARITY ≫ DEP-Vμ ≫ C-EXTRAMETRICALITY

(15)

[glad]	'happy'	[glaade]	'happy' (pl.)	
[blad]	'leaf'	[blaadet]	'the leaf'	
[gud]	'god'	[guuden]	'the god'	(Riad 1992:330)

[8] Analogous length alternations have developed in the dialect of Älvdalen in Sweden, e.g. *smiið* 'blacksmith', pl. *smiðir*, *daal* 'valley', pl. *dalir* (Riad 1992:306). They are also found (but before final obstruents only) in the German dialects of Northeastern Switzerland, e.g. *šmiid* 'smith', *šmidə* 'to forge', *baad* 'bath', pl. *bedər*, *glaas* 'glass', pl. *glesər* (Toggenburg, Wiget 1916:70, Glarus, Streiff 1915:49, Thurgau, Kraehenmann 2001a, 2001b).

[9] As well as, of course, of Icelandic (Kiparsky 1984).

[10] The same alternation is found in noun inflection in certain north German dialects, e.g. *Glas* 'glass', pl. *Gläser*, *Rad* 'wheel', gen. *Raades* (only before final obstruents), also in Dutch nouns, e.g. *dag*, pl. *daagen* 'day', *glas*, pl. *glaazen* 'glass', *hol*, pl. *hoolen* 'hole' (Dresher 2000:61).

The reader can verify that if some other system than (7) were instead posited as the original one, then (7) and (9) could not be derived from it by constraint promotion without positing unattested intermediate stages.[11] This confirms that the dialect with (7) is the most conservative.

1.2 Distinctive superheavy syllables

The behavior of superheavy syllables is clearcut in the special case when they contain a long vowel followed by a geminate consonant. In West Swedish, these are categorically excluded in stems, and stem-final long vowels are shortened before suffixes beginning with geminates.

(16) *rodde* /ruu-dde/ [rudde] 'rowed' (cf. *ro* /ruu/ [ruu] 'row')

Because final -C is weightless, CVVCC words pattern with medial CVVC syllables:

(17) *rodd* /ruu-dd/ [rudd] 'rowing', *rott* /ruu-tt/ [rutt] 'rowed'

Outside of such gemination cases, stressed -VVC and -VCC syllables do occur in West Swedish, as do monosyllabic words in -VVCC and -VCCC. Contrast (18a) and (18b).

(18) a. *vikta* /viik-t-a/ [viikta] 'folded' (pl.), *vikt* [viikt] (sg.) (from *vika* [viikka] 'to fold')

b. *vikt-a* /vikt-a/ [vikkta] 'to weight' (e.g. in the statistical sense, from *vikt* [vikkt] 'weight')

In fact, all varieties of Swedish seem to have them, albeit with many phonological and morphological restrictions.[12]

The fact that the long vowel + geminate configuration is specially restricted can be explained on the basis of moraic theory as follows (Riad 1992:244). If vowel length and consonant gemination are represented moraically, then a long vowel must correspond to two moras, and the first half of a geminate consonant must correspond to a mora.[13] Therefore a -VVC rhyme whose final -C initiates a geminate must contain *three* moras. Other kinds of -VVC rhymes *can* be trimoraic, but need not be, for rhyme consonants need not be weight-bearing — an analytic option not available when the -C is part of a geminate. Thus the modern Swedish dialects support Riad's 1992:244 argument from earlier stages of Swedish for the intrinsically trimoraic character of the long vowel + geminate configuration (what he calls "true overlength"). In what follows I take this special type of -VVC syllable as a diagnostic of a dialect's superheavy syllables, on the assumption that other kinds of -VVC syllables are not necessarily superheavy (though they may be if the facts so dictate).

With respect to such intrinsic superheavy syllables, Fenno-Swedish dialects are again more permissive than those of Sweden. The dialects of Nyland (Uusimaa) and of Northern and Central Ostrobothnia allow them:

(19) /loo-dde-s/ [looddes] 'pretended' (66), /dreett-en/ [dreetten] 'the shaft' (43)

[11] The West Swedish system (12) could in principle have arisen by the same two sound changes in reverse order. Perhaps this is what in fact happened in the Danish-type dialects of Southern Sweden.

[12] For example, long vowels are generally allowed before obstruent + sonorant clusters, even if they are not possible onsets, e.g. *odla* [uud.la] 'cultivate', *tävla* [teev.la] 'compete'. On the other hand, *[uul.da], *[teel.va] are not possible Swedish words.

[13] On the treatment of initial geminates, as moraic semisyllables, see Kiparsky 2002.

Due to the weightlessness of final -C, these same dialects also have monosyllabic words of the form CVVCC, where CC is a geminate, as in (20) (contrast (17)).

(20) /smoo-tt/ [smoott] ‘little one’ (21) (from [smoo] ‘little’), /haa-dd/ [haadd] ‘had’ (157) (from [haa] ‘have’), /ruu-dd/ [ruudd] ‘rowing’ (from [ruu] ‘row’)

In these dialects, the shortening process seen in (16) and (17) simply does not apply. Superheavy syllables are lexically distinctive and contrast on the surface with the other three syllable types in (3). The same four-way contrast CVC : CVVC : CVCC : CVVCC is also found in monosyllabic words before *-t, -d, -s*:

(21) a. [led] ‘opening (in fence)’ (31), [(far-)leed] ‘(shipping) channel’ (Selenius 210), [redd] ‘afraid’ (34), [beedd] ‘asked’ (pp.) (Huldén 146)

b. [skot] ‘shot’ (Selenius 34), [boot] ‘boat’ (Selenius 210), [pott(-stuul)] ‘potty(-chair)’ (22), [goott] ‘gone’ (39)

In the phonology of these dialects, the faithfulness constraint (22a) MAX-μ outranks and defeats the constraint (22b) *$\mu\mu\mu$, which imposes the two-mora maximum on syllables

(22) a. MAX-μ: : An input mora corresponds to an output mora (“don’t shorten syllables”).

b. *$\mu\mu\mu$: No three-mora syllables (Kager 1999).

Superheavy syllables also respond to final consonant weightlessness, but in a different way than monomoraic syllables do. Suppose that prosodic repair is prevented by high-ranking MAX and DEP constraints. Then, if the constraint requiring final -C to be weightless outranks prosodic minimality conditions (such as the requirement that feet have at least two moras), it prevents words that would otherwise satisfy them from doing so. -C weightlessness also *allows* the satisfaction of prosodic *maximality* conditions (such as the requirement that feet have at most three moras) by words that would otherwise violate them. But this second effect is *not* dependent on the mutual ranking of the constraints in question. Only the *prohibition* of C-Extrametricality could “bleed” a maximality constraint. Suppose there are no constraints that prohibit C-Extrametricality. Then an extra word-final consonant would be allowed on top of the three-mora syllable maximum in *all* dialects, and indeed the same should be true for for all maximality conditions in all languages. It remains to be seen if this simple and strong hypothesis can be maintained.

A further argument for the moraic analysis of geminates comes from the consonant lengthening processes of Fenno-Swedish examined in the next subsection.

1.3 Gemination and redundant superheaviness

Coda Gemination. Most Swedish dialects (possibly all of them) lengthen coda consonants after short stressed vowels. For the reasons stated below, the lengthened consonants will be considered true geminates.

(23) Coda gemination:

a. *vissna* [viss.na] ‘to wilt’, *vända* [venn.da] ‘to turn’, *stövlar* [stövv.lar] ‘boots’, *halva* [hall.va] ‘half’ (def.), *aska* [ass.ka] ‘ash’, *taxa* [takk.sa] ‘rate’

b. *vikt* [vikkt] ‘weight’, *kraft* [krafft] ‘strength’, *visst* [visst] ‘certainly’, *vänd* [vennd] ‘turn!’, *golv* [gollv] ‘floor’, *bild* [billd] ‘picture’, *hund* [hʉnnd] ‘dog’

In one special environment, most Fenno-Swedish dialects lengthen not the postvocalic coda consonant but the consonant after it, namely when the postvocalic coda consonant is voiced and the following consonant is voiceless. In practice, this means that a voiceless obstruent is geminated after a coda sonorant. I will refer to this special type of gemination as *Fortition*.

(24) Fortition:

a. *dansa* [dans.sa] ‘to dance’, *vänta* [vent.ta] ‘to wait’, *hjälpa* [jelp.pa] ‘to help’, *önska* [öns.ska] ‘to wish’, *minsta* [mins.sta] ‘the least’

b. *dans* [danss] ‘dance’, *vänt* [ventt] ‘turned’, *valp* [valpp] ‘puppy’, *stark* [starkk] ‘strong’, *flöjt* [flöjtt] ‘flute’, *paus* [pauss] ‘pause’, *salt* [saltt] ‘salt’, *trumf* [trʉmff] ‘trump’, *skämt* [ʃemtt] ‘joke’, *Ulf* [ʉlff] (name), (W. Nyland) [skarfft] ‘sharply’ (Selenius 1972:90)

The phonological nature of gemination. Gemination applies only in stressed syllables, including those with secondary stress. Particularly interesting in this respect are the dialects of Western Nyland, which have adjacent stressed syllables in a class of native and borrowed words (most with “grave” accent in West Swedish). Each of the stressed syllables undergoes Coda Gemination or Fortition, as the case may be (Selenius 1972:94):

(25) [gamm.lasst] ‘oldest’ (from [ga.mal] ‘old’), [tons.sill] ‘tonsil’, [kont.takkt] ‘contact’, [portt.fölljd] ‘wallet’, [bann.diit] ‘bandit’, [porss.liin] ‘porcelain’

The asymmetry between stressed and unstressed syllables must be due either directly to STRESS-TO-WEIGHT, which requires stressed syllables to be heavy, or indirectly to the inhibitory effect of WEIGHT-TO-STRESS on lengthening of unstressed syllables (for these constraints see Prince & Smolensky 1993, Anttila 1997, Kager 1999). I will pursue the latter approach, and posit general constraints corresponding to Fortition and Coda Gemination, dominated by syllabic well-formedness constraints, and by WEIGHT-TO-STRESS, which requires heavy syllables to be stressed. High-ranking DEP-STRESS prevents satisfaction of WEIGHT-TO-STRESS by stressing, so gemination is blocked instead.[14]

If STRESS-TO-WEIGHT or WEIGHT-TO-STRESS are what restricts Fortition and Coda Gemination to stressed syllables, then these processes must increase syllable weight. Therefore they must add a mora to the syllable, which means that the lengthened consonant has the status of a true geminate. This is the first argument.

A convergent argument is based on the generalization that Coda Gemination does not apply after long vowels:[15]

(26) a. *vikta* /viik-t-a/ [viik.ta] ‘folded’ (pl.), not *[viikk.ta]

[14]That DEP-STRESS is undominated at the word level is independently motivated by the “stress-neutral” character of the word phonology.

[15]Cases like (Helsinki Swedish) *vakna* [va:k:na] ‘to wake up’ are not exceptions to this generalization. They arise not by Coda Gemination but by postvocalic Fortition (see below), based on the syllabification [vaak.kna], which the sonority profile allows.

b. *bord* [buur(d)] ‘table’, not *[buurr(d)], *vald* [vaal(d)] ‘elected’ not *[vaall(d)] (parentheses indicate the weightlessness of final -C)

For, if Coda Gemination adds a mora, we can understand why it doesn’t apply in (26), where the output of lengthening would be a four-mora syllable (taking final weightlessness into account in (26b)), a highly marked type. If, on the other hand, we were to suppose that Coda Gemination does not add a mora (but merely a nonmoraic rhyme slot), we could not explain its failure to apply in (26), for syllables with four rhyme slots are quite common in Swedish, e.g. /viik-t-s/ [viikts] ‘folded’ (supine).

The force of the argument is somewhat weakened by the fact that Fortition does apply even in medial CVVC and final CVVCC syllables:[16]

(27) a. *karta* [kaart.ta] ‘map’

b. *fart* [faart(t)] ‘speed’ *valt* [vaalt(t)] ‘elected’ (neuter)

However, the generalization about Coda Gemination remains striking. I tentatively conclude that Fortition and Coda Gemination are driven by distinct constraints, ranked in that order, with an intervening prosodic constraint which bars VVCC rhymes.

Both gemination processes are normally confined to the word domain.[17] This indicates (on our theoretical assumptions) that they are word-level processes, therefore phonological rather than phonetic. On the assumption that the phonological representation of quantity is moraic, this constitutes another argument for the proposed interpretation.

The upshot is that lengthening in Fenno-Swedish is genuine gemination, which adds a mora to a stressed syllable at the word level. Thus, in the lexical phonology, (23) and (24) are syllabified as, e.g., /viss.na/, /vikk(t)/, /dans.sa/, /dans(s)/, all with superheavy stressed syllables (parentheses mark weightless final consonants).

The scope of Fortition. The Fenno-Swedish dialect of Borgå (Porvoo) does not have Fortition at all. Instead, it just lengthens the postvocalic coda consonant, even in words like (28) (contrast (24)).[18]

(28) [skvall.pas] ‘to be splashed’, [ʧörr.kan] ‘the church’, [grɯnnt] ‘shallow’ (Borgå, H-K 1998:26-28)

[16]In Swedish, vowels are obligatorily lengthened before /rn/ and /rd/, as in *varna* [va:ɳa], *mord* [muuɖ] ‘murder’, and long vowels also occur in some words before /rt/, as in (27); this lengthening takes effect even in Fenno-Swedish dialects, where these clusters do not fuse into a single retroflex consonant. Retroflex consonants, although phonetically single consonants, count as two consonants for purposes of syllable weight (as well as for other phonological constraints), in accord with their underlying status as clusters, e.g. *konsert* [konsæ:r] or [konsæʈ] (respectively with /-r/ and /-rt/); [*konsæ:ʈ] or [*konsær] are impossible. Dialectally, the lengthening applies before some other combinations of a sonorant plus a voiced consonant, e.g. Eastern Nyland *saand* ‘sand’, *haald* ‘hold’.

[17]However, Fortition occasionally occurs across compound boundaries and even across external word boundaries, e.g. *den konsekvensen* [dèŋǩ.kon.se.kvéns.sen] ‘that consequence’ (Itkonen 1965), though this is rather exceptional (Reuter 1982:101).

[18]The articulation of voiceless stops is noticeably lenis in these dialects, but no more so than in some others which do show the more common lengthening pattern of (23) and (24).

A number of dialects have Fortition not only postconsonantally but also after vowels.[19] The Swedish of Helsinki and Turku, the dialects of Åland, and the island of Nagu in the Southwest, are of this type. The following examples are from Föglö (Åland, H.-K. 84-86):[20]

(29) Postvocalic Fortition:

a. /eeta/ [eet.ta] ‘eat’, /smaaka/ [smaak.ka] ‘taste’, /baaka/ [baak.ka] ‘bake’, /flaata/ [flaat.ta] ‘flat surface’

b. [maatt][21] ‘food’, [gröött] ‘porridge’

In these dialects, the medial consonants of words like *mata* [maat.ta] ‘to feed’, *kåkar* [kook.kar] ‘hovels’ — phonemically singletons — are phonetically about a long as the underlying geminates of words like *matta* [mat.ta] ‘carpet’, *kockar* [kok.kar] ‘cooks’.[22]

Most Fenno-Swedish dialects don’t have postvocalic Fortition. In them, a word like *rita* ‘to draw’, phonemically /riita/, is pronounced [riita], nearly like Finnish *riita*. The short medial consonant in such words is a salient shibboleth of rural Fenno-Swedish.

The strict parallelism of final and non-final syllables with respect to Fortition across dialects constitutes more evidence for -C weightlessness. The following implications hold:

(30) a. Postconsonantal Fortition: [skvalp.pas] ⇔ [valpp], [skvall.pas] ⇔ [vallp]

b. Postvocalic Fortition: [maat.ta] ⇔ [maatt], [maa.ta] ⇔ [maat]

If -C is weightless, the processes can be unified. In our analysis, /skval.pas/ → /skvalp.pas/ is parallel to /val(p)/ → /valp(p)/, and /maa.ta/ → /maat.ta/ is parallel to /maa(t)/ → /maat(t)/.

1.4 The syllabic typology of Fenno-Swedish dialects

Six weight systems. The syllable weight properties just reviewed — light stressed syllables, distinctive superheavy syllables, and redundant superheaviness due to Coda Gemination and Fortition in its two varieties — do not combine freely. In fact, just six basic quantitative systems are attested in Fenno-Swedish. These are tabulated in (31).[23]

(31) Fenno-Swedish syllable types:

[19] Diphthongs seem to pattern with long vowels, e.g. Snappertuna (Western Nyland) [poi.ki] ‘boy’. In dialects with post-long vowel gemination, the voiceless stop would of course be geminated, e.g. Helsinki/Turku *pojke* [poik.ke].

[20] In the text from the island of Kökar in Eastern Åland (H.-K. 78-81), postvocalic Fortition is variable.

[21] The gemination of word-final consonants is heard clearly when a vowel follows in close contact in the next word. Examples from the dialect recordings are [maatt ifroon] ‘food from’, [gröött o…] ‘porridge and…’, [mjölkk o smör] ‘milk and butter’ (H.-K. 85). Contrast [tibaak o] ‘back too’ (109), [maat o kaffe] ‘food and coffee’ (110), from a dialect without postvocalic Fortition (South Ostrobothnia).

[22] Intervocalic lengthening also occurs in Sweden (Elert 1965:145,186). There it is not quite as marked as in Helsinki, and I do not take a position on whether it should be analyzed as gemination, as in Fenno-Swedish. However, the lengthening is quite marked, and more than outweighs the lengthening of the vowel before voiced consonants: e.g. the overall duration of *rita* /riita/ ‘to draw’ is longer than the overall duration of *rida* /riida/ ‘to ride’ (Elert 1965:162).

[23] The words in the table are meant to to represent only quantitative *types*. Their actual vowel and consonant qualities may differ from dialect to dialect in ways that are irrelevant to the present discussion.

		General	S.Ostrob.	Borgå	S.W.	Helsinki	Brändö	
1.	*baka*	[baka]	[baka]	[baka]	[baka]	[baakka]	[baakka]	‘to bake’
2.	*mina*	[mina]	[mina]	[mina]	[mina]	[mina]	[minna]	‘my’ (pl.)
3.	*gått*	[goott]	[goott]	[goott]	[gott]	[gott]	[gott]	‘gone’
4.	*vända*	[vennda]	[vennda]	[vennda]	[vennda]	[vennda]	[vɛnnda]	‘to turn’
5.	*vänta*	[ventta]	[ventta]	[vennta]	[ventta]	[ventta]	[vɛntta]	‘to wait’
6.	*ropa*	[ruupa]	[ruupa]	[ruupa]	[ruuppa]	[ruuppa]	[ruuppa]	‘to call’
7.	*råg*	[rog]	[roog]	[rog]	[roog]	[roog]	[roog]	‘rye’

Row 1 shows whether light stressed syllables occur in lexical words, and row 2 shows whether they occur in function words. The next four rows show, respectively, the distribution of lexically distinctive superheavy syllables (long vowel plus geminate consonant), regular Coda Gemination (common to all dialects), postconsonantal Fortition, postvocalic Fortition, and lexical CVC words (recall that lexical CV words are excluded everywhere).

The first column, labeled “General”, represents the most common pattern, scattered throughout the Fenno-Swedish area from Nyland (Uusimaa) in the South, through part of the Southwest, and into central and northern Ostrobothnia in the North. The other dialects are confined to particular localities. South Ostrobothnia (column 2) and Borgå in Nyland (column 3) share the full contrast between light, heavy, and superheavy syllables. The remaining dialects lack contrastive superheavy syllables (columns 4–6). In addition, Helsinki/Turku (column 5) has light stressed syllables and CVC words only under limited conditions (as discussed below), and Brändö (on Åland) lacks them completely. Abstracting away from particulars, then, the typology can be schematized as follows:

(32)

		General	S.Ob.	Borgå	S.W.	Helsinki	Brändö
1.	light stressed syllables	yes	yes	yes	yes	(yes)	no
2.	lexical superheaviness	yes	yes	yes	no	no	no
3.	postvocalic Fortition	no	no	no	no	yes	yes
4.	postconsonantal Fortition	yes	no	no	yes	yes	yes
5.	CVC words	yes	no	yes	no	(yes)	no

Three generalizations emerge from (31) and (32).

- Postvocalic Fortition implies postconsonantal Fortition.
- Postvocalic Fortition is incompatible with contrastive superheaviness.[24]
- Postvocalic Fortition is incompatible with lexical light stressed syllables.

An attempt to explain the distribution of syllable types and the above implicational generalizations follows. It is based on a synchronic phonological analysis in terms of the Stratal OT model. By way of preface, a few remarks on the origin of Fenno-Swedish gemination are in order.

[24]Harling-Kranck 1998:155 cites the form *sjöött* from Finström in Åland, a dialect with post-long vowel gemination, which would be the sole exception to this generalization in the entire collection of dialect material. However, this citation seems to be an error. In the actual text, transcribed in two versions, as well as the accompanying recording, this word clearly has a short vowel.

1.5 The origins of Fenno-Swedish syllable structure

Itkonen (1965) and Reuter (1982) theorize that the characteristic quantitative properties of Fenno-Swedish are the result of accommodation to one of the two quantitative models available in Finnish words. Consider a word like *rita* 'to draw', phonologically /riita/, in Sweden pronounced [riit:a], with a lengthened stop. In the Fenno-Swedish dialects without intervocalic gemination, it is pronounced like Finnish *riita* 'discord' (CVVCV). In the educated urban Swedish of Helsinki and Turku, it is pronounced just about like Finnish *Riitta* (CVVCCV). According to Itkonen and Reuter, this dialect split within Fenno-Swedish arose because native speakers of Finnish acquiring Swedish could identify the phonemically short, but phonetically lengthened intervocalic voiceless obstruents of Swedish either with the short consonants of Finnish (giving rise to the majority of dialects) or with the long consonants of Finnish (Helsinki, Turku, SW islands).[25]

Still, we have to ask *why* the dialects have split this way. Why did they not all choose gemination, which better approximates the West Swedish pronunciation? The reason why most dialects did not adopt postvocalic Fortition — in terms of the substratum theory, why their speakers interpreted the Swedish lengthened postvocalic voiceless obstruents as singletons — may be that (except for South Ostrobothnia) these dialects have lexically distinctive superheavy syllables. The generalization is that Fortition was avoided wherever it would have merged a contrast between heavy and superheavy syllables. This would reflect a functional principle of *contrast preservation* (Flemming 1995, 2001). If we suppose that South Ostrobothnia shortened its superheavy syllables after the gemination system was established, we would even have the stronger generalization that Fortition was introduced wherever possible to enhance heavy syllables provided the distinction between heavy and superheavy syllables was not suppressed.

Two further facts lend support to this scenario. It explains an otherwise puzzling asymmetry between the two Fortition environments. Few dialects have postvocalic fortition, whereas all dialects except for Borgå have consonantal Fortition. From the contrast preservation perspective the explanation is obvious. Postconsonantal geminates are never contrastive in Swedish, so contrast preservation is irrelevant to them, and speakers were free to choose the phonetically closest rendition as geminates.

Perhaps the most striking evidence comes from monosyllabic words. In the dialects that maintain the distinction between CVC and CVCC words, both Coda Gemination and Fortition are obviously inapplicable to monosyllabic words — otherwise they would surface as CVCC. Restricting Gemination and Fortition to polysyllabic words would however be unnatural and stipulative. In any case, the reason the CVC : CVCC contrast is retained is because CVC words escape vowel lengthening due to the low ranking of C-EXTRAMETRICALITY, as shown in (7). The generalization that Gemination and Fortition do not neutralize any contrasts extends to these cases as well, however.

[25]The borrowing of Swedish words into Finnish usually reflects both intervocalic gemination and cluster gemination. For example, the Swedish name *Brita* is rendered as *Riitta* in Finnish, as would be expected if it were taken from a dialect with post-long vowel gemination. The Swedish word *simpel* is rendered as *simppeli* in Finnish, as would be expected if it were taken from a dialect with cluster gemination. (For some reason, gemination of fricatives in borrowings is not so regular; Reuter 1982:154 ff.) The pattern was presumably established on the basis of the Fenno-Swedish prestige dialect, which has both these gemination processes. Since then, gemination has simply become a conventional way of rendering foreign voiceless stops in Finnish, even when they are not actually geminated in the source language. For example, in *pankkiiri* 'banker', Finnish has a geminate even though the Swedish source word *bankir* [baŋkíir] has a singleton (because the preceding vowel is unstressed), and the Finnish spoken-language rendition of 'Clinton', *Klinttoni*, has a geminate even though the English source has a singleton.

The non-neutralizing property of the gemination processes is also relevant to the synchronic analysis, to which I now turn. I will argue that it should be factored out into a general anti-neutralization constraint.

1.6 The gemination system

The constraints. Let us suppose that gemination is effected by two constraints.

(33) a. FORTITION: A voiceless consonant is geminated.

b. CODAGEMINATION: A postvocalic coda consonant is geminated.

FORTITION and CODAGEMINATION are probably to be decomposed into more elementary constraints, but I will not pursue this refinement further here. The contextual restrictions on them emerge from higher-ranked constraints. For example, syllable structure constraints prohibit Fortition in onsets. The mutual ranking of FORTITION and CODAGEMINATION and their ranking with respect to other constraints determine the dialectal variation with respect to gemination. These include the prosodic maximality constraint *$\mu\mu\mu$ (see (22b)), and, more interestingly, a synchronic NONEUTRALIZATION constraint, the counterpart to the diachronic explanation for the dialectal distribution and contextual restrictions on gemination explored in the preceding section.

In standard OT phonology the expectation is that the system of lexical contrasts should emerge from the constraint system. A constraint which prohibits neutralization turns this backwards. The argument for such a constraint is that it allows several generalizations to be captured which are otherwise lost. First, it explains why postvocalic Fortition does not apply in any dialect where /CVVC/ (and /CVVC(C)/ in monosyllables) is distinctive: for in just those dialects it would wipe out a lexical contrast. Notice that in this case the direction of explanation cannot be reversed. That is, we cannot attribute the absence of distinctive /CVVC/ in West Swedish and Helsinki to postvocalic Fortition, for several reasons. First, the neutralization applies equally before *voiced* consonants, where Fortition is inapplicable. Secondly, the neutralization is in fact not effected by Fortition, but by shortening of /CVVC/ to /CVC/, e.g. [ruudde] $>$ [rudde] 'rowed' (past), [ruutt] $>$ [rutt] (pp.). Therefore it is the existence of distinctive /CVVC/ (due to the stem-level ranking MAX$\mu \gg$ *$\mu\mu\mu$) that constrains Fortition, not the other way round.

A similar argument is based on dialects that distinguish /CVC/ words from /CVCC/ words. The explanation cannot involve merely restricting Coda Gemination and Fortition to polysyllables, for, as shown in (7), the primary cause of the retention of the CVC : CVCC contrast is the low ranking of C-EXTRAMETRICALITY, which allows CVC words to escape vowel lengthening. Conversely, the generalization that Gemination and Fortition do not neutralize any contrasts extends to these cases as well.

This justifies a constraint which prevents gemination from erasing weight contrasts. The most general formulation would be NONEUTRALIZATION:

(34) NONEUTRALIZATION: An output must not have a more faithful input correspondent.

An output $\mathcal{A}$ corresponding to input A violates NONEUTRALIZATION if there is an input B such that B $\Leftrightarrow \mathcal{A}$ incurs fewer faithfulness violations than A $\Leftrightarrow \mathcal{A}$. The effect of NONEUTRALIZATION in General Fenno-Swedish (type (8)) is summarized in (35).

(35) a. /riita/ $\not\rightarrow$ *[riitta] (Fortition is blocked because [riitta] has the more faithful input correspondent /riitta/)

b. /led/ $\not\rightarrow$ *[ledd] (Coda Gemination is blocked because [ledd] has the more faithful input correspondent /ledd/)

c. /las/ $\not\rightarrow$ *[lass] (Coda Gemination and Fortition are blocked because [lass] has the more faithful input correspondent /lass/)

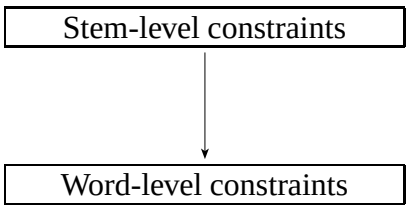
In each case, the output candidates incur a violation of NONEUTRALIZATION at the word level because they have input correspondents which have fewer faithfulness violations. This will be true for all dialects which admit distinctive superheavy syllables. Similarly, in the dialects with a /CVC/ : /CVCC/ opposition , Coda Gemination and Fortition of /CVC/ to [CVCC] incur a violation of NONEUTRALIZATION, because the output [CVCC] has a more faithful input correspondent /CVCC/.

Let us suppose that (34) is formally like any other constraint in that it can be ranked with respect to the other constraints. This means that at any given level the markedness constraints will divide into those that can effect neutralization and those that cannot, with the two sets separated by (34).

Stratal OT. The alternative inputs to which NONEUTRALIZATION refers do not have to be actual lexical items, just *possible* inputs. This presupposes some way of characterizing possible inputs independently of the constraints that map inputs to outputs. In fully parallel OT, such a characterization is not available because, under the Richness of the Base assumption, *any* input form is admissible. The form if underlying representations emerges from the constraint system itself via Lexicon Optimization. Thus, constraints such as NONEUTRALIZATION, which refer to possible inputs, are not available in parallel OT.

However, I have argued on independent grounds that parallel OT should be rejected (Kiparsky 2000, 2002, to appear). Instead, I propose to adopt Lexical Phonology's distinction between lexical and postlexical phonology, where the lexical phonology itself comprises a stem phonology ("level 1") and a word phonology ("level 2"). (It goes without saying that this organization is not specific to Swedish but common to all languages.) Contrary to traditional Lexical Phonology, however, I view each of these phonological subsystems as a parallel OT constraint system. These constraint systems may differ in ranking. All seriality lies in the interface between the levels. Within the lexical phonology, the output of the stem level is the input to the word level:

(36)



The output of the word level is in turn the input to the postlexical constraint system.

I'll call this marriage of OT and Lexical Phonology STRATAL OT (a term suggested by John McCarthy). Tha major arguments for Stratal OT, that it provides a unified, restrictive, and simple treatment of phonological opacity and cyclicity, have been presented elsewhere. Its significance for the present study of Swedish word phonology is that it allows us to distinguish between the quantitative restrictions on stems and those on words. Because the levels interface serially, words derived from stems inherit the latter's quantitative properties in so far as the word phonology

permits. The two specific corollaries that we will be exploiting are the possibility of characterizing the class of possible inputs to the word phonology, and distinguishing in a principled way between lexical words and function words.

To summarize: from the OT perspective, a contrast is absent when the faithfulness constraints that would maintain it are dominated by the markedness constraints that suppress it. Under parallelism, contrast is definable only on output representations. In Stratal OT, contrast is definable on the output of each phonological level. A contrast which exists at one level might be neutralized by a markedness constraint at another. At the stem level, Richness of the Base and Lexicon Optimization figure exactly as in parallel OT (in this respect no different from the traditional approach of Lexical Phonology). The inputs to the word level are just the outputs of the stem level, with word-level morphology applied. Constraints such as NoNeutralization, which make reference to what is a possible input, are therefore definable. For example, /CVC/ is a possible input to the word phonology in a given dialect of Swedish just in case it is a possible output of the stem phonology in that dialect. This provides a straightforward way to define neutralization and contrast preservation.

The general Fenno-Swedish pattern of gemination is obtained by the word-level ranking shown in (37):

(37) NoNeutralization $\gg$ Fortition $\gg$ CodaGem $\gg$ *$\mu\mu\mu$

As can be seen in (64), the ranking Fortition $\gg$ CodaGemination is crucial in cases like *vänta* ‘wait’, which is pronounced [vent.ta], not *[venn.ta]. Fortition and CodaGemination converge in words like *räkna* ‘to count’, *atlas* ‘atlas’, pronounced [rekk.na], [att.las]. When both consonants of the cluster are voiced, as in *vända* ‘turn’, *semla* ‘bun’, *Selma* (proper name), Fortition is not at stake, so (33b) CodaGemination requires lengthening the postvocalic consonant (rather than the onset): [venn.da], [semm.la], [sell.ma], not [*ven.dda], *[seml.la], *[selm.ma]). When all consonants of a cluster are voiceless, then syllable structure allows only one of them to be geminated; by CodaGemination this is the postvocalic one, so *hetsar* ‘incites’, *hästar* ‘horses’, are pronounced [hett.sar], [hess.tar] (not *[hets.sar], *[hest.tar]). In viewing the tableau, keep in mind that this being the word phonology, the inputs are the stem-level outputs. Observe the role of NoNeutralization in items 6, 7, and 8.

(38)

General F.-Sw. (W.L.)	NoNeutr	Fortition	CodaGem	*μμμ
Input: /rista/ ‘to carve’				
1a. rís.ta		**	*	
1b. ☞ ríss.ta		*		*
1c. ríst.ta		*	*	*
Input: /velja/ ‘to choose’				
2a. vél.ja			*	
2b. ☞ véll.ja				*
2c. vélj.ja			*	*
Input: /ven.da/ ‘to turn’				
3a. vén.da			*	
3b. ☞ vénn.da				*
3c. vénd.da			*	*
Input: /venta/ ‘to wait’				
4a. vén.ta		*	*	
4b. vénn.ta		*		*
4c. ☞ vént.ta			*	*
Input: /riida/ ‘to ride’				
5a. ☞ ríi.da				
5b. ríii.da				*
5c. ríid.da	*			*
Input: /riita/ ‘to draw’				
6a. ☞ ríi.ta		*		
6b. ríii.ta		*		*
6c. ríit.ta	*			*
Input: /stöött/ ‘hit’ (pp.)				
7a. ☞ stöött				*
7b. stött	*			
7c. stööt	*	*	*	
Input: /las/ ‘read’				
8a. ☞ las		*	*	
8b. las(s)	*			

The Borgå ranking differs only in that CodaGemination is undominated (its ranking with respect to NoNeutralization is immaterial), so that it swamps out any visible effect of Fortition:

(39) NoNeutralization, CodaGem ≫ Fortition ≫ Max-μ ≫ *$\mu\mu\mu$

(40)

Borgå (W.L.)	NoNeutr	CodaGem	Fortition	*μμμ
Input: /rista/ ‘to carve’				
1a. rís.ta		*	**	
1b. ☞ ríss.ta			*	*
1c. ríst.ta		*	*	*
Input: /velja/ ‘to choose’				
2a. vél.ja		*		
2b. ☞ véll.ja				*
2c. vélj.ja		*		*
Input: /ven.da/ ‘to turn’				
3a. vén.da		*		
3b. ☞ vénn.da				*
3c. vénd.da		*		*
Input: /venta/ ‘to wait’				
4a. vén.ta		*	*	
4b. ☞ vénn.ta				*
4c. vént.ta		*		*
Input: /riida/ ‘to ride’				
5a. ☞ ríi.da				
5b. ríii.da				*
5c. ríid.da	*			*
Input: /riita/ ‘to draw’				
6a. ☞ ríi.ta			*	
6b. ríii.ta			*	*
6c. ríit.ta	*			*
Input: /stöött/ ‘hit’ (pp.)				
7a. ☞ stöött				*
7b. stött	*			
7c. stööt	*	*	*	
Input: /las/ ‘read’				
8a. ☞ las		*	*	
8b. las(s)	*			

So far our analysis does not incorporate the grammatical constraints on the distribution of light stressed syllables that we noted for Helsinki, specifically the fact that they occur just in function words and in a few other small classes of lexical items. The following section supplies the missing pieces necessary for understanding this grammatical conditioning. It amounts to an independent argument for Stratal OT.

2 Stems and words

2.1 Light stressed syllables in Helsinki

Helsinki (and Turku) Swedish has light stressed syllables in the following classes of words:

(41) a. in function words before voiced consonants,

b. in words where the open syllable results from epenthesis,

c. in a class of suppletive verb allomorphs,

d. in truncated words.

Otherwise they occur only in a small number of polysyllabic words (mostly Finnish loans). The environments in (41) seem like a motley assortment, but we shall see that they have something interesting in common that explains why they go together.[26]

In what follows, words cited in italics represent standard Helsinki Swedish in regular Swedish spelling, which marks distinctive consonant length by gemination. I add colons to mark vowel length, and (where necessary) primary and secondary accents and periods to mark syllable boundaries. The reader can easily recover the actual Swedish orthography by just erasing these marks. The actual pronunciation can be recovered as far as syllable weight is concerned by applying Fortition and Coda Gemination under the conditions stated above, and for the vowels, by the correspondences *å* = [o], *o* = [u], *u* = [ʉ], *ä* = [e].

A list of function words with short stressed syllables in Helsinki Swedish is given in (42). Observe that consonant immediately following the short CV́ syllable is always voiced.

(42) a. *Pronouns, determiners: ja* 'I', *du* 'you', *vi* 'we', *ni* 'you', *honom* 'him', *de* 'it', *va* 'what', *mina* 'mine (pl.)', *dina* 'your (sg.)', *våra* 'our', *era* 'your (pl.), *deras* 'their', (but *henne* 'her' (acc.)), *någo* 'something', *hudan, väför en* 'what kind of', *sådan*, pl. *såna* 'such', *sånahä́na* 'this kind of', *sånadä́na* 'that kind of', *hela (da:gen)* 'all (day)'

b. *Auxiliaries: ha* 'have', *hade* ∼ *hadde* 'had', *ä* 'is', *va* 'was', *ska* 'shall', *vara* 'be', *vari(t)* 'been', *blivi(t)* 'become', *sku* 'should', *sku boda* 'should have', *sku vila* 'would like to', (but *må:* 'may')

c. *Prepositions, particles, verb prefixes: före* 'before', *genom* 'through', *över*, *inom* 'within' (vs. *mellan* 'between', *u:tan* 'without')

d. *Conjunctions: å* 'and', *både* 'both [. . . and]' (but *bå:da* 'both', determiner), *medan* 'while', *bara* 'if only' (vs. *innan* 'before')

e. *Small adverbs:*[27] *så* 'so', *då* 'then', *nu* (1) 'now', (2) affirmative (= West Sw. *no:g*), and their derivatives: *númè:ra, núförtì:den* 'nowadays', *dåförtì:den* 'in those days', *me* 'too', *ändå* 'still' (can be end-stressed), *bara* 'only', *redan, ren* 'already', *igenom* 'through', *óvan* 'above, over'

f. *Complementizer: å* 'to' (infinitive purpose clauses)

g. *Interjections: jahá* 'I see', *ahá* 'aha', *nå* 'nu', *tja* 'well'.

[26]Even more limited CV́ appears in some of the dialects of Åland. For example, *bara* 'only', *seta* 'to put', *rikit* 'really', *såna* 'such' in Kökar (Harling-Kranck 1998:78 ff.), and *kuna* 'to be able', *bara* 'only', *någe* 'some' in Saltvik (*ibid.* 88 ff.). Except for *seta*, and perhaps *kuna*, these words have (or can have) short vowels in Helsinki/Turku also. However, most words which have light stressed syllables in the latter dialects seem to have geminate consonants in Åland, e.g. *minna* 'my' (pl., Helsinki *mina*, West Sw. *mi:na*), *meddan* 'while' (Helsinki *medan*, West Sw. *me:dan*). Occasionally even Sweden goes with Åland in having geminates in place of the Fenno-Swedish light stressed syllables: Helsinki *honom*, West Sw. *honnom* 'him'; Helsinki *i moron*, West Sw. *i morron* 'tomorrow'; Helsinki *hade* ∼ *hadde* 'had', West Sw. *hadde* 'had'.

[27]This class was identified for Finnish in Hanson 1992 and Hanson & Kiparsky 1996:320 as adverbs which "constitute entire phrases and so permit no modification or complementation". A general theory of such "non-projecting categories" is presented in Toivonen 2001.

The systematic character of the restriction to function words is underscored by the fact that, when function words are promoted to lexical words, any stressed light syllables in them are automatically lengthened, in conformity with the regular quantitative constraints on stems.

(43) a. *nu* 'now' vs. *nu:-et* 'the present time'

b. *mina* 'my (pl.)' vs. *de mi:na* 'my relatives, my loved ones'

c. *hela (da:gen)* 'all (day)' vs. adj. *(en) he:l (da:g)* '(a) whole (day)', and *he:l, he:l-a* 'entire, undamaged'

d. *ja* 'I' vs. *ja:g-et* 'the ego'

e. *ha* 'have' (auxiliary) vs. *att ha:* 'to have'

2.2 Explaining the distribution

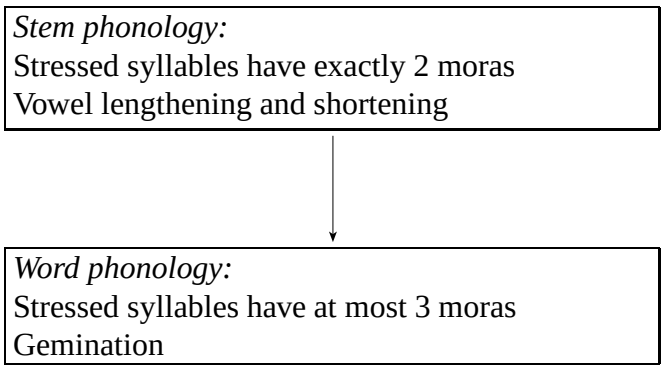
What is the basis for the phonological distinction between lexical words and function words? Stratal OT interprets Lexical Phonology's "level 1" and "level 2" as stems and words, and takes their respective phonologies to be governed by distinct constraint systems. Because the levels interface serially — that is, the output of the stem phonology is the input to the word phonology — words derived from stems inherit the latter's properties in so far as the word phonology permits.

Lexical words (nouns, verbs, adjectives, adverbs of the projecting type) enter the derivation as stems, while function words do not. Therefore, stems must conform to an additional set of phonological constraints, namely those which constitute the stem phonology. But both lexical words and function words are subject to the word phonology, and both participate in the postlexical phonological derivation.[28] Moreover, the templatic truncation morphology is also demonstrably a word-level process.

In Helsinki Swedish, stressed syllables are strictly bimoraic in the stem phonology. In the word phonology, one-mora syllables arise through function words, truncation, and epenthesis, and three-mora syllables arise through gemination.

[28] In Kiparsky (forthcoming) I provide independent evidence for this claim from a number of languages. For example, function words in English are not subject to lexical stress, to Vowel Shift, or to Philadelphia æ-"tensing". Cross-linguistically, it is well known that roots and function words are not necessarily subject to the same prosodic minimality constraints as words are.

(44)



Formally, in the stem phonology the prosodic constraints (6c) STRESS-TO-WEIGHT which requires stressed syllables to have at least two moras, and (22b) *$\mu\mu\mu$, which prohibits syllables of more than two moras, both outrank the faithfulness constraints that prevent vowel lengthening and shortening (MAX-V, DEP-V). In the word phonology, however, the prosodic constraints are outranked by FORTITION and CODAGEMINATION, as well as by faithfulness constraints. Thus, superheavy and light stressed syllables are prohibited in stems, but not in words.

Function words. According to our proposed analysis, surface CV́ syllables occur just in words which for some reason escape lengthening at the stem level. These turn out to be just the four types of words with light stressed syllables in (41). The simplest case is that of function words. By hypothesis, function words are not stems, therefore not subject to stem phonology. Of course, they are words, and as such subject to word phonology. But lengthening is enforced only in the stem phonology, not at the word level. Therefore, function words retain underlying short syllables even under stress.

Once again, CVC monosyllables pattern like CV́ in polysyllabic words: they occur only in function words, and only where -C is voiced. The contrast between final single and geminate stops tends to be neutralized in citation forms, but it is audible within a phonological phrase, particularly when a vowel follows:

(45) a. /ann/, /hann/: *om Ann inte hann ä:ta* [om ann int hann eetta] 'if Ann didn't have time to eat'

b. /han/, /kan/: *om han inte kan ä:ta* [om han int kan eetta] 'if he can't eat'

These data suggest that Coda Gemination in these dialects applies only in the postlexical phonology.

Epenthesis. Case (41b) comprises words which are underlying monosyllables of the form /CVCL/, pronounced as monosyllabic before vocalic endings and as disyllabic elsewhere in virtue of epenthesis of *-e-* to break up the final cluster. These words retain underlying light syllables before voiced consonants, resulting in the three-way surface contrast between /CV́-/, /CV́C-/ and /CV́V-/ seen in (46). Before voiceless consonants, we just get the usual two-way distinction between /CV́C-/ and /CV́V-/.

(46) a. *hy.vel* 'plane' (tool), (pl. *hyv:.lar*, *hyv:.la* 'to plane'),[29] *stö.vel* 'boot' (pl. *stöv:.lar*), *ö.verst* 'uppermost' (*öv:.re* 'upper'), *ö.ver.ste* 'colonel'

[29] A reminder: cited words in italics are in Swedish spelling, with periods added to mark syllable boundaries, and macrons to mark vowel length and tautosyllabic consonant length. The spelling of these words is *hyvlar, hyvla*.

b. *kä:.gel* ‘bowling pin’ (pl. *kä:.glar*), *få:.gel* ‘bird’, (pl. *få:.glar*), *i:.gel* ‘leech’ (pl. *i:.glar*), *sni:.gel* ‘snail’ (pl. *sni:.glar*), *na:.vel* ‘navel’ (pl. *na:v.lar*), *spektá:kel* [spek.tá:k.kel] ‘spectacle’ (pl. *spek.tá:k.kler*)

c. *dub.bel* ‘double’ (pl. *dub.bla*), *nyckel* [nyk.kel] ‘key’ (pl. *nycklar*) [nyk.klar], *cykel* [syk.kel] ‘bicycle’ (pl. *cyklar* [syk.klar]), *smug.gel(go:ds)* ‘smuggling, contraband’ (*smug.gla*), *spug.gel* ‘barf’ (*spug.gla*)

In a stem such as /hyvl/, the conditions for lengthening are not met, and the vowel stays short (as in other words ending in -CC, e.g. *kalv* ‘calf’). Epenthesis takes place just at the word level. The evidence is that it is bled by vowel-initial suffixes (e.g. inflection), as the examples in (46) show. But lengthening does not apply to words. Therefore, an underlying short vowel is retained even when it comes to stand in a final open syllable by epenthesis.

Root inflections. Case (41c) is represented by a small class of lexical words with light stressed syllables which are inflected from bound roots. The periphrastic perfect is based on the so-called supine form, which is normally built on the verb stem, in which case it conforms to the lexical length constraints, e.g. (inf. *veta* [ve:t.ta] ‘know’, supine *vetat* [ve:t.tat]). Some verbs, however, can form their supines from a bound root form. For example, the verb ‘to strike’ has a supine from a bound root form *slaj-*, which is not used in any other form of the verb. Just the root-based inflections stay short; contrast the other forms in (47), which lengthen regularly:

(47) *dragit* [dra.ji] ‘pulled’ (pres. *dra:*, past *dro:g*), *slagit* [sla.ji] ‘hit’ (*slå:, slo:g), tagit* [ta.ji] ‘taken’ (*ta:, to:g*), *givit* [ji.vi] ‘given’ (*ge:, ga:v*), *blivit* [bli.vi] ‘become’ (*bli:, ble:v*)

The supines of the first three verbs can also be formed from regular verb stems, in which case they have the expected long vowel, e.g. *dra:gi(t), sla:gi(t)* (stem *dra:g, sla:g*). Elsewhere, lengthening applies regularly to these verbs. For example, ‘to strike’ has the stems *slå:* (*slå:.en.de* ‘striking’, *sla:g* ‘a strike’, *slo:g* ‘struck’).

Treating these suppletive forms as inflected roots immediately accounts for their short vowel. In particular, a root such as *draj-* is not subject to lengthening. the output of adding the supine suffix *-it* at the word level undergoes *word-level* phonology, where lengthening is not operative. It is a long-standing assumption of Lexical Phonology that bound roots are not “cyclic domains”, i.e. that they are phonologically inert in themselves, and undergo phonology only in combination with affixes.[30]

Truncated words. To appreciate the last class of cases, an additional generalization must be understood: that the two-mora minimum on stressed syllables is enforced only in *non-final feet*. In fact, a general process of pre-stress shortening and destressing (which also applies to some extent in West Swedish dialects) leads to alternations such as the following:

(48) a. *systé:m* ‘system’
systemá:tisk ‘systematic’ [sys.te.máat.tisk]
systematí:k ‘systematism’
systematisé:ra ‘systematize’

[30]The reason is assumed to be that bound roots are not prosodified (and in fact do not need to meet prosodic minimality constraints), see in general Inkelas 1989.

b. *tjä:nare* ‘servant’, *tjänarínna* ‘female servant’
gu:d ‘god’, *gudínna* ‘goddess’
gre:ve ‘count’, *grevínna* ‘countess’

In Fenno-Swedish the process is considerably more general:

(49) a. *tjùgusjú:* ‘twenty-seven’ (*tju:gu* ‘twenty’)

b. *várifrå:n* ‘from where’, *dărifrå:n* ‘from there’, (*va:r* ‘where’, *dä:r* ‘there’)

In long (mostly foreign) words, only a final (binary or unary) foot regularly requires its stressed syllable to be heavy. Syllables in non-final feet, whether bearing primary or secondary stress, remain short, regardless of the voicing of the following consonant.

(50) a. *kválitatì:v* ‘qualitative’, *pósitì:v* ‘positive’, *hýperkorrèkt* ‘hypercorrect’, *póliklì:nik* ‘clinic’, *sémikò:lon* ‘semicolon’, *nóminatì:v* ‘nominative’, *génetì:v* ‘genitive’, *élatì:v* ‘elative’, *íteratì:v* ‘iterative’, *féminì:n* ‘feminine’, *décilì:ter* ‘deciliter’, *géneratì:v* ‘generative’, *mínikjò:l* ‘miniskirt’, *sémikò:lon* ‘semicolon’, *Főlisǒ:n* (place name). Many of these can also have stress on the final foot, e.g. [pà.pe.gój:.ja], including most words in *-iv*, e.g. *prìmitív* ‘primitive’, *rèlatív* ‘relative’, etc.

b. *krèatú:r* ‘creature’, *tèologí:* ‘theology’, *tèoló:g* ‘theologian’, (*filoló:g, pèdagó:g* etc.), *pàradí:s* ‘paradise’, *pàragrá:f* ‘paragraph’, *tèlegrá:f* ‘telegraph’, *èpidemí:* ‘epidemic’, *àkademí:* ‘academy’, *sỳnagó:ga* ‘synagogue’

c. *kámera* ‘camera’, *dómino* ‘domino’, *dómina* ‘domina’, *númerus cláusus* ‘quota’, *mínimum* ‘minimum’, *dýnamo* ‘dynamo’, *ánanas* ‘pineapple’, *sýfilis* ‘syphilis’, *plátina* ‘platinum’, *stímulus* ‘stimulus’, *faksímile* ‘facsimile’, *Távaststjèrna, Ágaton, Kásimir, Sálomon, Júpiter* (personal names), *Ládoga, Ararat, Távastlànd* (place names)

In the last set of cases the CV́CV foot is non-final in virtue of being followed by another syllable. Thus, non-final feet do not become superheavy.

Under secondary stress, closed syllables are also lengthened by gemination of voiceless consonants, as in (51a,b,c); contrast (51d,e):

(51) a. *elak* [ée.làkk] ‘evil, nasty’, *elaka* [ée.làk.ka] (pl., def.)

b. *palsternacka* [páls.ter.nàk.ka] ‘parsnip’

c. *enstaka* [éen.stàak.ka] ‘sporadic’

d. *nutida* [núu.tìi.da] ‘contemporary’

e. *idog* [íi.dùug] ‘diligent’, *idoga* [íi.dùu.ga] (pl., def.)

We are now ready for case (41c). When long words of the type just examined get truncated, their initial foot becomes word-final, *but the truncated form still retains its CV́ syllable*, this time irrespective of the voicing of the following consonant.

(52) *foto* ‘photograph’ (from *fòtografí:*), *Tele(-verket)* ‘the phone company’ (from *tèlefó:n)*, *kilo* ‘kilo(gram)’ (from *kìlográm*), *Hypo(banken)* ‘Mortgage Bank’ (from *hỳpoté:k*), *día(bild)* ‘slide, transparency’ (from *díapòsitì:v*), *Bío-Bìo* (a movie theater), (from *bìográ:f* ‘movie theater’) (but *bi:o* ‘movie theater’), *Póli* (from *(Pòly)tékniska Högskolan* ‘Polytechnical University’), *Majo* ‘the Majority’ (from *Màjorité:ten* ‘the Majority’, a grass-roots citizen’s organization, Reuter 1986)

In the stem-level representation, the base begins with a light syllable. Truncation is a word-level process, as shown by the fact that it applies to words with the postposed definite article to make an inherently definite truncatum, as in *Tele, Hypo, Poli, Majo* (see (52)). Lengthening is not applicable at the word level, therefore in particular not to truncated words. It follows that an underlying short vowel is retained even when truncation puts it into the word-final foot.

Exceptions and residual cases. Akin to truncations are lexicalized fast speech forms reduced to CVCV form by simplification of medial clusters. They too retain the short vowel of the original (regardless of voicing).

(53) *rikit* ‘really’ (from *rikti(g)t*), *vika, viken* ‘which’ (from *vilka, vilka*), *moron* ‘morning’ (from *morgon)*

They are no longer outputs of a productive reduction process, but are simply lexicalized with an underlying short vowel.

There remains a small set of words with unexplained CV́.[31]

(54) *göra* [jö.ra] ‘do’, *käring* ‘old woman’, *senap* ‘mustard’, *tobak* ‘tobacco’, *bravo* ‘bravo’

In a few cases they are morphologically related to regular words:

(55) *karar* ‘men’ (from *ka:r(l)* ‘man’), *skiti(g)* ‘dirty’ (from *ski:t* ‘shit’)

Finnish loanwords and place names are normally pronounced with the CV́ syllables of the original:

(56) *poro* ‘coffe grounds’, *sisu* ‘endurance’, *kiva* ‘fun, nice’ (pl. *kivoga*, as if from a nonexistent **kivog*, after Finnish partitive pl. *kivoja*)

This is not surprising, for practially all speakers of the Helsinki/Turku dialect speak Finnish too.

Other alternations which should be mentioned here for the sake of completeness are the following:

(57) a. /me/, /me:/, /meC/ *me Kickan* ‘with Kickan’, *ta: de mé:* ‘take it along’, *mém mej* ‘wíth me’, *me méj* ‘with mé’, *med dej* ‘with you’ etc. Similarly /påC/, /på/ *på Fő̀lisö̀:n* ‘on Fölisö’, *sti:g på:* (**på*) ‘come in’, *pǻm mej* ‘on me’, *på méj* ‘on mé’.

b. /i/, /i:/: *i* ‘in’, under the same conditions as (a) above.

c. But /ti/, /till/ *ti Fő̀lisö̀:n* ‘to Fölisö’, *hjälpa till (*ti, *ti:*) ‘help’, *tíll mej* ‘tó me’, *ti méj* ‘to mé’.

This exhausts the cases where Helsinki Swedish has a three-way quantity contrast in stressed syllables. Elsewhere, it has the same two-way contrast as West Swedish.

[31]There are also some interjections, but these of course are known to have special properties, and in fact can have stressed short vowels even in Sweden: *jahá* ‘I see’, *ahá* ‘aha’, *nå* ‘nu’, *tja* ‘well’, and *sí du* ‘you see’.

Summary. The grammatical restrictions on stressed light syllables become understandable in Stratal OT if we distinguish properly between the phonological constraints on stems and the phonological constraints on words. Stressed light syllables surface in those types of words that escape the stem-level constraint that prohibit them. (58) is a synopsis of the analysis:

(58)

	(41a)	(41b)	(41c)	(41d)
Underlying	/medan/	/hyvl/	/draj-/	/fotografi:/
Stems	—	[hývl]	—	fòtografí:
Words	[médan]	[hývel]	[dráji]	[fóto]

To recapitulate the main points of our Stratal OT analysis of Helsinki/Turku Swedish:

- Function words have stressed light syllables because they are not subject to the stem-level constraints.
- /CVCC/ words which become disyllabic CVCVC words though word level epenthesis retain short vowels (case (41b)). At the stem level, they do not violate the prohibition on light stressed syllables. At the word level, the constraint is rendered inactive by dominant faithfulness constraints.
- The irregularly inflected verb forms (case (41c)) are formed by adding the regular inflected endings exceptionally to bound roots. Bound roots are not stems, and therefore do not undergo stem-level phonology. The outputs of the affixation process are words, and undergo only the word phonology. Accordingly an underlying short vowel can surface in them.
- Finally, the truncation process responsible for case (41d) is applicable at the word level; this explains phonological properties of the truncatum, including its quantity.

Let us now integrate this analysis into the formal constraint system that we began to develop in earlier sections.

2.3 The constraints

The stem level. We are now ready to incorporate the grammatical aspects of Helsinki Swedish quantity into our Stratal OT constraint system. In the *stem-level* phonology of Helsinki/Turku Swedish, stressed syllables must be bimoraic. That stressed syllables have exactly two moras (at this level) results from the two constraints in (59):

(59) a. *$\mu\mu\mu$: No three-mora syllables.

b. STRESS-TO-WEIGHT (see (6c)).

Just as in West Swedish, light syllables are repaired by vowel lengthening, rather than by consonant gemination, and superheavy syllables are repaired by vowel shortening, rather than by degemination. Therefore, at the stem-level, the faithfulness constraints MAX-Cμ and DEP-Cμ must the corresponding constraints for vocalic moras.

(60) a. MAX-Cμ: A consonantal mora in the input must correspond to a mora in the output.

b. DEP-Cμ: A consonantal mora in the output must correspond to a mora in the input.

The stem-level constraint system of the Helsinki dialect is:

(61) *$\mu\mu\mu$, STR/W ((6c)) $\gg$ MAX-Cμ, DEP-Cμ

Tableau (62) shows for simple cases how the stem level phonology makes all stressed syllables exactly two moras in length.

(62)

Stem Level		*$\mu\mu\mu$	STR/W	MAX-Cμ	DEP-Cμ
Input: /mata/					
1a.	má.ta		*		
1b. ☞	máa.ta				
1c.	mát.ta				*
1d.	máat.ta	*			*
Input: /matta/					
2a.	má.ta		*	*	
2b.	máa.ta			*	
2c. ☞	mát.ta				
2d.	máat.ta	*			
Input: /ku/					
3a.	ku		*		
3b. ☞	kuu				

Underlying /maata/ will give the same output as /mata/. Similarly, underlying /maatta/ merges with /matta/. Thus, there are no stressed one-mora syllables or three-mora syllables at this level.

This illustrates Lexical Phonology's solution to the "duplication problem", which is also adopted in Stratal OT: the form of underlying representations is characterized by the same constraint system that governs *stem-level* alternations.

At the word level, *$\mu\mu\mu$ is dominated by FORTITION and by CODAGEMINATION. Because Helsinki's stricter stem-level phonology eliminates /CVVC/ syllables and /CV/ syllables (including /CVC words/), Fortition and Coda Gemination in this dialect will not produce violations of NONEUTRALIZATION in the cases considered so far. However the ranking of NONEUTRALIZATION in this dialect can be determined by other considerations. Recall that vowel length is distinctive only syllable-finally and before voiced consonants. In order to derive the length neutralization before voiceless consonants from Fortition, this constraint must outrank NONEUTRALIZATION. As the tableau makes clear, the distinction between the hypothetical inputs to the word level /medan/ and /meddan/ survives, whereas the inputs /deta/ and /detta/ merge into a single output as before. But the distinction can only be manifested in function words, where the CV inputs are available. In lexical words, they are eliminated at the stem level. In this way, the constraint system correctly reconstructs the fact that function words have an extra syllable type, but just before voiced consonants.

(63) Helsinki word-level ranking:

FORTITION $\gg$ CODAGEMINATION $\gg$ *$\mu\mu\mu$, NONEUTRALIZATION

(64)

Helsinki (W.L.)	FORTITION	CODAGEM	*$\mu\mu\mu$	NONEUTR
Input: /rista/ ‘to carve’				
1a. rís.ta	**	*		
1b. ☞ ríss.ta	*		*	
1c. ríst.ta	*	*	*	
Input: /velja/ ‘to choose’				
2a. vél.ja		*		
2b. ☞ véll.ja			*	
2c. vélj.ja		*	*	
Input: /ven.da/ ‘to turn’				
3a. vén.da		*		
3b. ☞ vénn.da			*	
3c. vénd.da		*	*	
Input: /venta/ ‘to wait’				
4a. vén.ta	*	*		
4b. vénn.ta	*		*	
4c. ☞ vént.ta		*	*	
Input: /riida/ ‘to ride’				
5a. ☞ ríi.da				
5b. ríii.da			*	
5c. ríid.da			*	
Input: /riita/ ‘to draw’				
6a. ríi.ta	*			
6b. ríii.ta	*		*	
6c. ☞ ríit.ta			*	
Input: /medan/ ‘while’				
7a. ☞ mé.dan				
7b. mée.dan				*
7c. méd.dan				*
7d. méed.dan			*	
7e. médd.dan			*	
Input: /deta/				
8a. dé.ta	*			
8b. dée.ta	*			*
8c. ☞ dét.ta				*
8d. déet.ta			*	
8e. détt.ta			*	
Input: /nu/				
9a. ☞ nu				
9b. nuu				*

In sum: voiced consonants have two special properties: they don’t undergo Fortition, and they can be preceded by light open syllables. The constraint system (63) explains this intriguing correlation. It derives the basic Helsinki pattern where syllable weight is neutralized before voiceless

consonants (merger of /-V́CV-/ and /-V́CCV-/ into [-V́CCV-]) precisely through Fortition. This implies the ranking FORTITION ≫ NONEUTRALIZATION.

2.4 Opacity

The paradoxical anti-structure-preservation property of Fortition is related to another problem which the Stratal OT model also resolves. The process, which creates superheavy syllables consisting of a long vowel plus a geminate in the output, occurs only in those dialects which *prohibit* such superheavy syllables in *underlying* representations, and which shorten long vowels before geminates in derived words, as seen in (16b) and (18). The puzzle is that, in the output, the lexical restriction on superheavy syllables remains in force only for *voiced* geminates (*[ʃe:l.la], *[ro:d.de], see (1)). Before *voiceless* consonants, Fortition reintroduces the kinds of superheavy syllables that vowel shortening eliminates. This is a typical case of opaque constraint interaction, which Stratal OT claims is due to the serial relation between phonological levels.

As a simple illustration of how the opaque interaction between shortening and lengthening is explained by Stratal OT, consider *heta* [heet.ta] 'to be called' and *hette* [het.te] 'was called' in Helsinki Swedish. The stem is underlying /heet/ and the suffixes are /-a/ and /dde/. The derivations are as follows.

(65) a. /heet-a/ → [hee.ta] → [heet.ta] (word level Fortition).

b. /heet-dde/ → [het.te] (*$\mu\mu\mu$ forces stem level shortening) → [het.te]

In /heet-a/ → [heet.ta], word-level FORTITION reintroduces the superheavy syllable structure at the word level that *$\mu\mu\mu$ eliminates in /heet-dde/ → [het.te] at the stem level. The paradox for parallelism is this. If CVVCCV is admissible, what forces vowel shortening [het.te]? Why do we not get just /heet-dde/ → [heet.te]? On the other hand, if CVVCCV is excluded, why /heet-a/ → [heet.ta]? Stratal OT's answer is that CVVCCV (and superheavy syllables in general) are admissible in words but excluded in stems. This instantiates Stratal OT's general solution to the problem of phonological opacity.

Parallel OT has two devices at its disposal for dealing with opacity: *Base/Output (Output/-Output) constraints* (Benua 1997), and *Sympathy* (with or without Cumulativity, McCarthy 1999a, 1999b). Can either of these deal with these Swedish facts, in particular, with the shortening of the underlying vowel in /heet-te/ in the face of the admissible output [heet.ta]?

It appears that the answer is no. An Output/Output constraint would "borrow" the short vowel from somewhere else in the paradigm. But there is no such form, for the short vowel occurs *only* in the very cases that have to be explained, such as [het.te]. A Sympathy (or Cumulativity) constraint would "borrow" the short vowel from a failed candidate selected by some FAITHFULNESS constraint. But there is no such candidate, simply because there is no more propitious shortening environment than the geminate that is seen in actual output itself. Simple though this case is, parallel OT seems to break down. The Swedish data clearly favor Stratal OT.

2.5 Lexical diffusion

I conclude with a brief historical remark. As noted in Reuter 1986, modern Helsinki Swedish is practically unchanged as far as quantity is concerned since Bergroth 1922 and 1917/1928 (and, apparently, since in Pipping 1892-97, which however I have not seen). The stability is remarkable, considering that short light syllables have been stigmatized in schools at least since the publication of Bergroth's orthoepic handbook in 1917, and very likely even earlier. The main changes are that

a number of lexical items whose short stressed vowels are unpredictable on the present account have been regularized.

(66) a. Bergroth 1922: *juni* 'June', *juli* 'July', *huvu* 'head', *ströming* 'herring', *fräken* 'freckle', *stuli* 'stolen', *svuri* 'sworn', *skuri* 'cut'

b. Reuter 1986: *ju:ni, ju:li, huvvu* (but *Hufvudstadsbladet* [hú̵vu̵stasblàade(t)] 'The Capital Paper', a newspaper), *strömming, stu:li, svu:ri, sku:ri, frä:ken*

The short-vowel forms in (66a) are outright exceptions on the present account, analogous to those in (54)-(56). The regularized forms were normal by ca. 1950. In general, the 1986 situation reported by Reuter is identical to the one I recall from that time; the only recent change I find there is that a few forms, such as *sku vila* 'would like to' and *sku boda* 'should', which I think earlier were fairly standard, are now said to be used only by lower-class speakers.

In diachronic perspective, the development of Helsinki Swedish light stressed syllables constitutes a typical case of lexical diffusion. The theory of lexical diffusion proposed in Kiparsky 1995 (adapted to stratal OT in the obvious way) explains the site and direction of the change as the elimination of arbitrary complexity from the lexicon, with resulting reversion to the unmarked state. The historical record shows that precisely those words which the present analysis characterizes as exceptions that require marking in the lexicon are being slowly eroded on an item-by-item basis, and that precisely in those word classes where vowel shortness is regular according to the present theory, it has managed to resist the uplifted fingers of pedagogues for the better part of a century.

3 Conclusion

The distribution of syllable weight in Fenno-Swedish dialects is governed by an anti-neutralization constraint and by the interaction of distinct constraints on stems and words. Both were shown to support a stratal version of OT phonology against parallel OT.

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