Derived Environment Effects in Colloquial Helsinki Finnish

Arto Anttila

1 The problem

Some phonological rules apply only in derived environments, i.e. across a morpheme boundary or if fed by an earlier phonological rule, but are blocked elsewhere.[1] This syndrome, known as Nonderived Environment Blocking (NDEB), is a traditional puzzle in generative phonology. Familiar textbook examples include English Trisyllabic Shortening which applies in the morphologically derived *divĭn+ity* (from *divīne*), but not in the nonderived *nīghtingale*. A much-discussed question concerning NDEB is the following:

(1) What alternations are subject to NDEB?

[1]Earlier versions of this paper were presented at a staff seminar at the Centre for Advanced Studies/Department of English Language and Literature, National University of Singapore (August 1999), a Symposium on Variation Theory and Formal Theory at the 28th Conference on New Ways of Analyzing Variation, University of Toronto (October 1999), MIT Phonology Workshop (March 2001) and New York University Linguistics Colloquium (March 2001). I thank Bao Zhiming, Young-mee Yu Cho, Vivienne Fong, Gregory Garretson, Tarja Heinonen, Sharon Inkelas, Brett Kessler, Anna Łubowicz, K.P. Mohanan, Tara Mohanan, Carol Neidle, Anthi Revithiadou, Cathie Ringen, Caro Struijke, Cheryl Zoll and an anonymous reviewer for comments and/or discussion. I thank Kotimaisten kielten tutkimuskeskus [Research Institute for the Languages of Finland] for the permission to use the electronic version of *Nykysuomen sanakirja* [Dictionary of Modern Finnish] (Sadeniemi 1973) and the Department of General Linguistics, University of Helsinki, for giving me access to Heikki Paunonen's Spoken Helsinki Finnish Corpus. The research for this paper was in part supported by a National University of Singapore Faculty of Arts and Social Sciences Postdoctoral Fellowship. All errors are mine.

The following abbreviations are used in the glosses: COMP = comparative, INE = inessive, PAR = partitive, PL = plural.

The answers to (1) have traditionally been given in terms of rule typologies:

(2) a. NDEB is a property of non-automatic neutralization rules (The Revised Alternation Condition, RAC, Kiparsky 1973)

b. NDEB is a property of cyclic rules (The Strict Cycle Condition, SCC, Mascaró 1976)

c. NDEB is a property of lexical rules (The Elsewhere Condition, Kiparsky 1982)

d. NDEB is a property of structure-building rules operating on underspecified representations (Kiparsky 1993a, for earlier formulations, see e.g. Ringen 1975 and Borowsky 1986)

Kiparsky (1993a) showed that there exist rules that are both cyclic and lexical, but which nevertheless apply in nonderived environments, contradicting (2b) and (2c). The crucial evidence comes from the optional rule of Vowel Coalescence (henceforth VC) in Colloquial Helsinki Finnish. As Kiparsky demonstrated, this rule is both cyclic and lexical, yet it applies in nonderived environments. An example is given in (3):

(3) Vowel Coalescence in Colloquial Helsinki Finnish:

/makea/ 'sweet' → má.ke.a∼má.kee

In this paper, I take a closer look at the Finnish evidence in the light of a corpus of spoken Helsinki Finnish collected by Heikki Paunonen and his associates in the early 1970's and documented in Paunonen 1995. The corpus covers 126 speakers grouped by age, sex, social class, and neighborhood, about 500,000 word forms in all. The raw corpus is available at the University of Helsinki Language Corpus Server at `http://www.ling.helsinki.fi/uhlcs`. For the purposes of the present study, all the environments relevant to Vowel Coalescence were tagged phonologically and morphologically by the present author, approximately 13,000 vowel sequences in all.[2]

Two theoretically important generalizations emerge:

[2] The tagging had to be done manually because of morphological ambiguities which are common in speech due to reduction phenomena. The following decisions are worth mentioning: (i) Everything was tagged, including the interviewer; (ii) Unclear cases, including

(4) a. Nonderived environments. VC is categorically blocked in nonderived environments if the structural change is highly marked; if the structural change is unmarked, VC may apply even in nonderived environments.

b. Derived environments. VC is quantitatively dispreferred in derived environments if the structural change is highly marked; if the structural change is unmarked, VC is quantitatively preferred.

These generalizations do not make immediate sense in rule-based phonology. If NDEB is a property of a class of phonological rules, then one would certainly expect a single rule either to show or not show NDEB. Instead, (4a) states that one and the same rule sometimes does, sometimes doesn't show NDEB, depending on markedness. (4b) is even more puzzling as a rule's application probability is usually not taken to be a matter of grammar at all.

After considering the Finnish evidence in detail, we will come to the conclusion that derived environment behavior cannot be tied to phonological rules of any kind. The reason is that the very same rule may show NDEB in certain contexts, but not in others, depending on markedness. This suggests that reference to global properties of grammar is inevitable, and that rules, i.e. specific phonological processes, cannot serve as the locus of explanation. We will then construct an analysis of the Finnish facts in terms of Optimality Theory (Prince and Smolensky 1993). More specifically, we will propose that NDEB results from root faithfulness (McCarthy and Prince 1995) which is relativized to markedness. A simple partially ordered optimality-theoretic grammar is constructed that predicts both the categorical and quantitative blocking patterns observed in the data. Under this view, NDEB turns out to be a categorical special case of quantitative dispreference.

I am deeply indebted to Paunonen's (1995) valuable earlier study of VC based on a slightly different, but largely coextensive subset of the same corpus. While my interpretation of the facts is quite different from his, all of

---

irresolvable ambiguities, were marked by a special tag and excluded; (iii) Ambiguities that were frequently irresolvable include *oikee*, either from *oikea* 'right' or *oikein* 'really', where only the first is an instance of Vowel Coalescence, and part-of-speech ambiguities like *suomalaisia*, either 'Finn-PL-PAR, n.' or 'Finnish-PL-PAR, a.'. Such cases are often, but not always, disambiguated by the context; (iv) Sequences of two vowels where either vowel bears primary stress were not tagged (e.g. *té.at.te.ri* 'theatre', *ráu.ta.tie=à.se.ma* 'railway station') because they do not meet the structural description of the rule (see below).

Paunonen's factual observations and most of his generalizations still stand under my reanalysis.

2 The categorical aspects of VC

Under the most general formulation, VC applies optionally to any heterosyllabic two-vowel sequence, whether underlying or derived, where both vowels are unstressed and the second vowel is [+low].

(5) $V_1.V_2 \rightarrow V_1$: where $V_2 = [+\text{low}]$

ea → ee	má.ke.a	∼	má.kee	'sweet'
eä → ee	kí.pe.ä	∼	kí.pee	'sick'
oa → oo	ái.no.a	∼	ái.noo	'only'
öä → öö	Ý r.jö.-ä	∼	Ý r.jö-ö	'George-PAR'
ua → uu	ká.tu.-a	∼	ká.tu-u	'street-PAR'
yä → yy	hýö.ty.-ä	∼	hýö.ty-y	'advantage-PAR'
ia → ii	lá.si.-a	∼	lá.si-i	'glass-PAR'
iä → ii	kén.k-i.-ä	∼	kén.ki-i	'shoe-PL-PAR'

VC is genuinely optional in the sense of being variable within an individual. In the following short dialogue `[File: sIIm3a]` we have four instances of coalescence and four instances of non-coalescence. The same speaker sometimes does, sometimes doesn't apply VC, apparently unpredictably.

(6) OH: Millas**ii** ihmis**ii** siel käy jud**oo**massa?
/millas-i-a/, /ihmis-i-ä/, /judoa-ma-ssa/
What sort of people practise judo there?

JS: Siel käy iha, nuor**ia** ja vanhojaki.
/nuor-i-a/
Some are really young, but there are old people too.

OH: Mieh**iä** nais**ia**?
/mieh-i-ä/, /nais-i-a/
Men? Women?

JS: Joo mieh**ii** ja nais**ia**.
/mieh-i-ä/, /nais-i-a/
Yes, men and women.

As the last line shows, both the coalesced and hiatus variants may occur within the same NP; more examples are cited in Paunonen (1995:106-107). Even more strikingly, both variants may occur within the same word. The word *useamia* 'many-COMP-PL-PAR' contains both /ea/ and /ia/. All four logical possibilities are attested:

(7) /usea-mp-i-a/ 'many-COMP-PL-PAR'

a. us**ea**mp**ia** (no VC, no VC)
b. us**ee**mp**ia** (VC, no VC)
c. us**ea**mp**ii** (no VC, VC)
d. us**ee**mp**ii** (VC, VC)

However, the randomness is merely apparent. We now turn to the iron-clad structural regularities, both categorical and quantitative, that govern variation. The categorical regularities are summarized in (8). The table shows that the NDEB-effect emerges clearly in the IA-column, but not so clearly in the EA-column.

(8) The general picture. + = VC may apply, − = VC may not apply. I = /i,u,y/ = high vowel, E = /e,o,ö/ = mid vowel, A = /a,ä/ = low vowel.

		IA	EA
NONDERIVED	NOUN	−	−/+
	ADJECTIVE	−	+
DERIVED	NOUN	+	+
	ADJECTIVE	+	+

(9) The first generalization:

VC is blocked in nonderived environments if the first vowel is [+high] (IA).

(10)	a.	miniä∼*minii	'daughter-in-law'
		mini-ä∼mini-i	'mini-PAR'
	b.	rasia∼*rasii	'box'
		lasi-a∼lasi-i	'glass-PAR'
	c.	saippua∼*saippuu	'soap'
		hattu-a∼hattu-u	'hat-PAR'
	d.	Pöytyä∼*Pöytyy	'place name'
		löyly-ä∼löyly-y	'steam-PAR'

As (10) shows, derived IA-sequences coalesce, nonderived IA-sequences do not. What we see here is classical derived environment behavior. Now, if NDEB is a property of rules and the IA∼II alternation exhibits NDEB, then one would expect the EA∼EE alternation to do the same, for certainly, under any reasonable rule-based analysis, both alternations should be attributed to one and the same phonological rule. But this is not what we find.

(11) The second generalization:

VC applies across the board if the first vowel is [–high] (EA).

(12)	a.	hopea∼hopee	'silver'
		ove-a∼ove-e	'door-PAR'
	b.	ainoa∼ainoo	'only'
		Aino-a∼Aino-o	'female.name-PAR'
	c.	pimeä∼pimee	'dark'
		nime-ä∼nime-e	'name-PAR'

Contrary to all expectations, VC applies to hundreds of nonderived EA-stems, all common native words such as *pimeä* 'dark'. It is exactly this class of words that crucially proves the independence of cyclicity/lexicality and NDEB (Kiparsky 1993a:280-282). The fundamental generalization here is that IA-stems show NDEB, EA-stems do not. In other words, the derived environment effect is split along a phonological dimension.

However, there is a group of EA-stems that do show the expected NDEB-effect: recently borrowed nouns.[3]

(13) An exception to the second generalization:

VC is blocked in nonderived environments if the first vowel is [–high] (EA) and the word is a recently borrowed noun.

[3] Of the following list, only *idea* and *komitea* come from Paunonen's corpus. The rest are based on my own judgments.

(14)	a.	idea∼*idee	‘idea’
		forte-a∼forte-e	‘forte’
	b.	Korea∼*Koree	‘Korea’
		Palme-a∼Palmee	‘Palme-PAR’
	c.	komitea∼*komitee	‘committee’
		cumlaude-a∼cumlaude-e	‘cum laude-PAR’
	d.	teodikea∼*teodikee	‘theodicy’
		ukulele-a∼ukulelee	‘ukulele-PAR’

Let us briefly speculate on what could have motivated such an exceptional pattern. We begin from the following observation: of stems ending in EA or IA, nouns canonically end in IA, adjectives in EA. The following statistics are extracted from the electronic version of *Nykysuomen sanakirja* [Dictionary of Modern Finnish] (Sadeniemi 1973):

(15)		-IA		-EA		
	Nouns:	92.6%	[651]	7.4%	[52]	100%
	Adjectives:	2.2%	[6]	97.8%	[273]	100%

Let us assume that, for purely phonological reasons, IA resists coalescence more than EA. Since the vast majority of noun stems end in IA and the vast majority of adjective stems in EA (for historical reasons that are irrelevant here), we have a plausible basis for analogy: the failure of coalescence in IA sequences has been reanalyzed as failure of coalescence in nouns. Under this scenario, incoming EA-nouns such as *idea* ‘idea, n.’ would simply be imitating the majority of nouns, and those happen to be mostly IA-stems which have independent phonological reasons to resist coalescence. As is typical of analogical change, the regularization does not apply across the board: a small number of native EA-nouns resist the change and only new words succumb to analogy.[4]

A parallel noun/adjective split can be observed in two other rules that affect stem-final low vowels: A-DELETION which deletes stem-final [+low]

[4] The reviewer asks whether EA-coalescence is also disfavored in nouns that contain EA-sequences but end in IA-sequences. There are no such examples in Paunonen’s corpus. *Nykysuomen sanakirja* [Dictionary of Modern Finnish] contains two relevant examples: *genealogia* ‘genealogy’ and *oseanografia* ‘oceanography’. According to my intuitions, coalescence is out of the question in both cases (**geneelogia*, **oseenografia*), confirming the generalization that coalescence is blocked across the board in nonderived recently borrowed nouns.

vowels and A-MUTATION which changes them to rounded mid vowels. Both rules apply before the past tense or plural /-i-/:

(16)	a. *a,ä* → ∅	/muna-i-ssa/	→ mun-i-ssa	'egg-PL-INE'
	b. *a,ä* → *o,ö*	/kana-i-ssa/	→ kano-i-ssa	'hen-PL-INE'

In (16), the choice between the two rules is straightforwardly phonological: deletion occurs after rounded vowels, mutation elsewhere. In trisyllabic stems the phonological condition is lost and morphology takes charge: nouns mutate, adjectives delete.[5]

(17)	/kihara/	'curl, n.'	→	kiharo-i-ssa
	/kihara/	'curly, a.'	→	kihar-i-ssa

Also in this case, the morphological condition appears to be a recent analogical development. To the best of my knowledge, it was first observed by G. Karlsson (1978) although weak quantitative reflexes of it are already visible in *Nykysuomen sanakirja* [Dictionary of Modern Finnish].

A possible alternative explanation begins with the observation that virtually all recent borrowings are nouns. Thus, one might suggest that the exceptional pattern has nothing to do with the noun/adjective distinction, but instead all recently borrowed stems follow the same pattern, i.e. we have a special loanword phonology. The behavior of recently borrowed EA-final adjectives would decide between the two hypotheses, but to the best of my knowledge they do not exist. This story has the unfortunate drawback of not explaining why recent borrowings should exhibit NDEB, rather than not. After all, both models are abundantly available in the language.[6]

In sum, the Colloquial Helsinki Vowel Coalescence rule, which is both cyclic and lexical, turns out to exhibit an unusual split NDEB pattern: in IA-stems, the rule is blocked in nonderived environments; in EA-stems it "overapplies", except in recently borrowed nouns which show NDEB.

Another way to summarize the data pattern in (8) is to state three implications:

[5]For a more detailed account of the phonology/morphology interactions involved, see Anttila 2002.

[6]A parallel case is the Polish rule of First Velar Palatalization (Rubach 1984) which palatalizes velars before front vocoids and is blocked in nonderived environments. An interesting observation, attributed to Christina Bethin by Łubowicz (1998:20), fn. 14, is that all these NDEB cases are borrowings: [ke]*fir* 'kefir', [ke]*lner* 'waiter', [k'i]*siel* 'jelly', [ge]*ncjana* 'gentian', *a*[ge]*nt* 'agent', [g'i]*ps* 'plaster', [x'i]*gienistka* 'hygienist', [x'i]*storia* 'history', [xe]*tera* 'shrew (person)'. In addition, all are nouns.

(18) Summary:

a.	IA ⊃ EA	Coalescence in IA implies coalescence in EA.
b.	ND ⊃ D	Coalescence in nonderived environments implies coalescence in derived environments.
c.	N ⊃ A	Coalescence in nouns implies coalescence in adjectives.

These three implications capture the distribution of pluses and minuses in (8). (18b) states the weak form of NDEB observed in the Finnish data: if coalescence applies in nonderived environments in some phonologically and morphologically defined class of stems, it also applies in derived environments in the same class of stems.

3 The quantitative aspects of VC

The most striking aspect of the Helsinki data is that the categorical blocking pattern turns out to have a quantitative analogue.[7] The generalization (19a) is due to Paunonen (1995:111), the generalizations (19b–c) are mine.

(19)

a.	IA ⊃ EA	Coalescence is at least as common in EA as in IA, other things being equal.
b.	ND ⊃ D	Coalescence is at least as common in derived as in nonderived environments, other things being equal.
c.	N ⊃ A	Coalescence is at least as common in adjectives as in nouns, other things being equal.

First, consider (19a). The words *lasi-a* 'glass-PAR' and *ove-a* 'door-PAR' are both derived nouns. The only difference is phonological: the first word ends in *-ia*, the second in *-ea*. VC applies optionally to both, but is systematically more common in the *ove-a* type. As Paunonen shows, the generalization (19a) is extremely well supported by various types of data. Outside Helsinki, it is reflected in the dialect geography of Finland. In Helsinki, it holds of individual speaker groups, down to the level of idiolects, and also of

[7]At this point, I have quantitative data only on the vowel sequences /ea/ and /ia/, which are the two most common mid-low and high-low combinations.

various morphologically defined word classes, such as partitives and infinitives. In fact, even the behavior of individual words is consistent with the generalization. The word *useampia* 'many-COMP-PL-PAR' behaves as one might expect:

(20) /usea-mp-i-a/ 'many-COMP-PL-PAR'

		Frequency
a. us**ea**mp**ia**	(no VC, no VC)	22
b. us**ee**mp**ia**	(VC, no VC)	5
c. us**ee**mp**ii**	(VC, VC)	3
d. us**ea**mp**ii**	(no VC, VC)	1

The unexpected type is (20d) where IA coalesces, but EA does not. There is exactly one such example in the entire corpus. All other examples (30 out of 31) conform to Paunonen's generalization.[8]

The morphological implications (19b) and (19c) also have quantitative reflexes. (19b) emerges in pairs like *hopea* 'silver' and *ove-a* 'door-PAR'. Both are *-ea*-final nouns. The only difference is morphological: the first word is nonderived, the second derived. VC applies optionally to both, but is systematically more common in the derived *ove-a* type. Finally, (19c) emerges in pairs like *ov-i-a* 'door-PL-PAR, n.' and *uus-i-a* 'new-PL-PAR, a.' Both are *-ia*-final derived words, but the first is a noun, the second adjective. Again, VC applies optionally to both, but is systematically more common in the *uus-i-a* type, that is, in adjectives.

All these quantitative generalizations are robust. They hold in different age groups (old, middle-aged, young), social classes (I, II, III), neighborhoods (Töölö, Sörnäinen) and sexes. In other words, no matter how we pick a group of people, the same structural hierarchies emerge. For example, consider the distribution of coalescence by age. The absence of derived *-ea*-final adjectives can be considered an accidental lexical gap.[9]

[8]One may wonder how (20d) is possible at all. The explanation hinges on secondary stress. Recall that coalescence requires both vowels to be unstressed. In this case, *ú.se.àm.pii* is a possible stress pattern and coalescence is blocked because of secondary stress on the third syllable. The role of secondary stress in Vowel Coalescence has not escaped the attention of Finnish historical phonologists, see e.g. Rapola 1966:419. Unfortunately, at this point I do not yet have serious quantitative data on the secondary stress factor. I hope to return to this topic on another occasion.

[9]An example of an /e/-final adjective is /toope/ 'stupid', in the partitive singular /toope-a/. While Paunonen's corpus contains no examples of this word, according to my

(21) The phonological effect

			Old		Middle-aged		Young	
N	ND	EA	3.3%	(1/30)	18.2%	(4/22)	50%	(4/8)
		IA	0%	(0/337)	0%	(0/263)	0%	(0/247)
N	D	EA	24.3%	(65/267)	30.5%	(60/197)	67.2%	(168/250)
		IA	7.8%	(147/1,886)	11.4%	(182/1,597)	43.5%	(685/1,576)
A	ND	EA	49.3%	(242/491)	64.9%	(334/515)	93.0%	(687/739)
		IA	0%	(0/80)	0%	(0/100)	0%	(0/81)
A	D	EA	–	–	–	–	–	–
		IA	9.6%	(146/1,519)	16.8%	(220/1,308)	64.2%	(923/1,437)

(22) The derived environment effect

			Old		Middle-aged		Young	
N	EA	D	24.3%	(65/267)	30.5%	(60/197)	67.2%	(168/250)
		ND	3.3%	(1/30)	18.2%	(4/22)	50%	(4/8)
N	IA	D	7.8%	(147/1,886)	11.4%	(182/1,597)	43.5%	(685/1,576)
		ND	0%	(0/337)	0%	(0/263)	0%	(0/247)
A	EA	D	–	–	–	–	–	–
		ND	49.3%	(242/491)	64.9%	(334/515)	93.0%	(687/739)
A	IA	D	9.6%	(146/1,519)	16.8%	(220/1,308)	64.2%	(923/1,437)
		ND	0%	(0/80)	0%	(0/100)	0%	(0/81)

(23) The part-of-speech effect

			Old		Middle-aged		Young	
ND	EA	A	49.3%	(242/491)	64.9%	(334/515)	93.0%	(687/739)
		N	3.3%	(1/30)	18.2%	(4/22)	50%	(4/8)
ND	IA	A	0%	(0/80)	0%	(0/100)	0%	(0/81)
		N	0%	(0/337)	0%	(0/263)	0%	(0/247)
D	EA	A	–	–	–	–	–	–
		N	24.3%	(65/267)	30.5%	(60/197)	67.2%	(168/250)
D	IA	A	9.6%	(146/1,519)	16.8%	(220/1,308)	64.2%	(923/1,437)
		N	7.8%	(147/1,886)	11.4%	(182/1,597)	43.5%	(685/1,576)

The same phonological and morphological regularities emerge in each age group. Table (21) shows that *-ea* coalesces more than *-ia*, derivedness and

intuitions this word clearly coalesces: *toope-e* ‘stupid-PAR’.

part of speech being equal. Table (22) shows that derived words coalesce more than nonderived words, phonology and part of speech being equal. Finally, table (23) shows that adjectives coalesce more than nouns, derivedness and phonology being equal, except among nonderived *ia*-stems where coalescence is blocked across the board. In other words, the structural hierarchies hold perfectly. Crucially, their surface reflexes are sometimes categorical, sometimes quantitative.

How did this pattern arise? Another look at the figures shows that age has a systematic effect on coalescence frequencies: young speakers apply coalescence more than middle-aged apeakers, who in turn apply coalescence more than old speakers. Whether this reflects change in progress or age-grading is not obvious. In his discussion of the possible historical scenarios, Paunonen (1995:122-32) first considers the possibility that Vowel Coalescence reflects a historical change that started from EA-words, this being phonetically the most natural environment for coalescence, and moved on to IA-words along various morphological dimensions, which would explain the IA $\supset$ EA asymmetry. However, he hastens to point out that regular development is inconsistent with the demographic and dialectological facts. Spoken Helsinki Finnish emerged from a recent confluence of dialects that occurred over a very short period of time. Thus, it is all the more striking that the end result should be structurally so systematic, down to subtle quantitative tendencies. Paunonen (1995:132) concludes that this can only be attributed to the influence of 'language-internal causal connections' (*sisäinen vaikutusyhteys*), or put slightly differently, (universal) grammar.

To sum up, we have discovered three structural hierarchies that emerge consistently from the data. Their combined surface effect is sometimes a categorical rule, sometimes a quantitative tendency.

(24) a. Coalescence is more likely in EA than in IA. The result may be categorical blocking: *hopea*∼*hopee* 'silver, n.' vs. *rasia*∼**rasii* 'box, n.'

b. Coalescence is more likely in derived forms than in nonderived forms. The result may be categorical blocking: *mini-ä*∼*mini-i* 'mini-PAR, n.' vs. *miniä*∼**minii* 'daughter-in-law, n.'

c. Coalescence is more likely in adjectives than in nouns. The result may be categorical blocking: *korea*∼*koree* 'beautiful, a.' vs. *Korea*∼**Koree* 'Korea, n.'

Table (25) shows the eight possible factor combinations and the observed numbers in the entire corpus. The factors favoring coalescence are underlined (EA, D, A). The coalescence rates are given in two ways: as ranges covering the three age groups and as the average coalescence rate in the entire corpus.

(25) Obs$_1$% = the average coalescence rate in the total corpus
Obs$_2$% = the observed range of variation

			VC	Obs$_1$%	Obs$_2$%	Total N
N	EA	D	applies	41.0%	24.3–67.2%	714
N	EA	ND	applies	18.8%	3.4–66.7%	48 (native)
			NDEB	0%	0%	12 (borrowing)
N	IA	D	applies	20.0%	7.8–43.5%	5,059
N	IA	ND	NDEB	0%	0%	847
A	EA	D	applies	–	–	0
A	EA	ND	applies	72.4%	49.5–93.0%	1,745
A	IA	D	applies	30.2%	9.6–64.2%	4,264
A	IA	ND	NDEB	0%	0%	261

Categorical blocking emerges if coalescence is disfavored by at least two factors. In order to get blocking in EA-stems, we need both morphological criteria to weigh against coalescence and even then the pattern remains lexically restricted. In IA-stems blocking is more widespread; here nonderivedness is by itself sufficient. In general, nonderivedness is not a sufficient condition for blocking, but it is a necessary one, whereas being a noun is neither. In this sense, nonderivedness is the stronger one of the two morphological conditions in disfavoring the rule's application.

We conclude that the total blocking of an alternation is the categorical limiting case of quantitative dispreference that occurs in phonologically and/or morphologically marked environments.

4 An optimality-theoretic analysis

We will now proceed to give an optimality-theoretic analysis of the unusual NDEB pattern in Colloquial Helsinki Finnish. This will entail taking a stand on two important questions:

(26) a. What is the nature of NDEB?
b. What is the grammatical status of quantitative regularities?

First, we introduce the general approach by accounting for the purely phonological vowel height effect (EA vs. IA) in terms of Optimality Theory (OT) (Prince and Smolensky 1993). The core of OT consists of two proposals: (i) grammars consist of potentially conflicting constraints; (ii) conflicts are resolved by ranking the constraints in terms of their relative strength. It is commonly assumed that the ranking relation is a TOTAL ORDER, i.e. every constraint is ranked with respect to every other constraint. In this paper, we will relax this requirement by allowing rankings that are genuine PARTIAL ORDERS. The idea that grammatical constraints may remain mutually unranked goes back to Prince and Smolensky (1993:51) who mention "crucial nonranking" as a formal possibility provided by the theory for which no evidence existed at the time. Its empirical relevance was pointed out in Kiparsky's (1993b) unpublished work on variation in English *t,d*-deletion and the idea has since been applied to several cases of variation outside English, e.g. Nagy and Reynolds 1997, Anttila 1997, Anttila and Cho 1998 and Ringen and Heinämäki 1999, among others.

Second, we turn to the morphological side of the problem. We consider four possible ways of integrating the derived environment effect into the phonological analysis: (i) local conjunction of markedness and faithfulness (Łubowicz 1998); (ii) cophonologies, i.e. derived and nonderived lexical items participate in different rankings; (iii) root faithfulness, i.e. roots are more resilient under markedness pressure than affixes (McCarthy and Prince 1995); (iv) prespecification, i.e. alternating vowels are underspecified, nonalternating vowels (NDEB) are prespecified (Kiparsky 1993a, Inkelas 2000). We will choose root faithfulness as the most satisfactory one of the four options. We then turn to the apparently very similar noun/adjective effect. While the empirical evidence is less than fully conclusive in this case, we will suggest that general considerations favor a cophonology analysis.

4.1 The phonological effect

We first derive the vowel height asymmetry, both in its categorical and quantitative manifestations. Dialects of the categorical type include Literary Finnish where neither EA nor IA coalesce, and the system of old female upper middle class Töölö residents who allow coalescence optionally in EA, but never in IA (Paunonen 1995:112). We start by assuming the following phonological constraints:

(27) Constraints:

*EA	Avoid /ea, oa, öä/ hiatus.	(markedness)
*IA	Avoid /ia, ua, yä/ hiatus.	(markedness)
FAITH	No coalescence.	(faithfulness)

I follow Paunonen in assuming that *ea* $\rightarrow$ *ee* is a phonologically more natural process than *ia* $\rightarrow$ *ii* which can be expressed as the ranking *EA $\gg$ *IA.[10] This yields a typology of three totally ranked grammars. Two of the corresponding dialects are found in Paunonen 1995:109. While Paunonen's descriptions of regional dialects are obviously simplifications, they will serve for illustrative purposes here.

(28) No coalescence (conservative dialect, Literary Finnish):

/-ea/	FAITH	*EA	*IA
1a. ⇒ /-ea/		*	
1b. /-ee/	*!		
2a. ⇒ /-ia/			*
2b. /-ii/	*!		

(29) Coalescence only in mid vowels (General Häme):

/-ea/	*EA	FAITH	*IA
1a. /-ea/	*!		
1b. ⇒ /-ee/		*	
2a. ⇒ /-ia/			*
2b. /-ii/		*!	

[10] The constraints *EA and *IA are deliberately noncommittal as to the exact nature of this asymmetry which is found in other languages as well, see e.g. Haas 1988. Casali (1996:48-50) suggests that vowel sequences where the two vowels are not sufficiently distinct from each other are disfavored.

(30) Only coalescence (advanced dialect, not yet found)

	/-ea/	*EA	*IA	FAITH
1a.	/-ea/	*!		
1b. ⇒	/-ee/			*
2a.	/-ia/		*!	
2b. ⇒	/-ii/			*

This simple three-constraint system generalizes straightforwardly to quantitative regularities if we assume that any partial ordering of constraints is a possible grammar. Let C be the set of constraints and R a binary ranking relation with the following properties:

(31)
a. IRREFLEXIVITY. R is irreflexive if and only if for every x in C, R contains no ordered pair $\langle x, x\rangle$ with identical first and second members. (No constraint can be ranked above or below itself.)

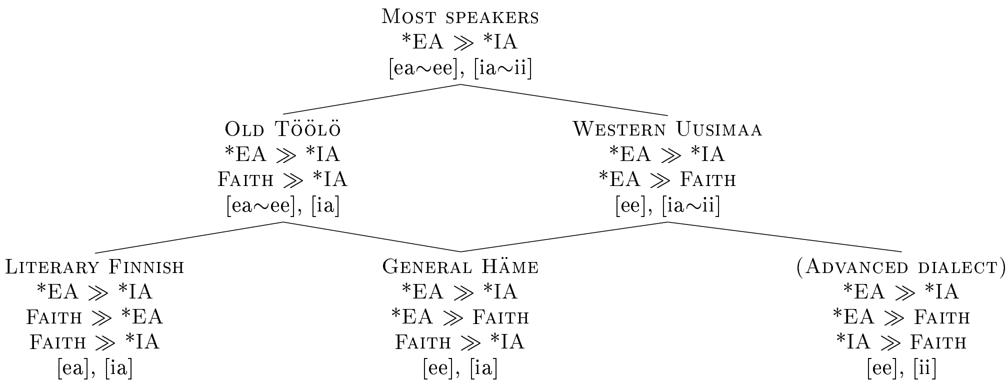
b. ASYMMETRY. R is asymmetric if and only if for any ordered pair $\langle x, y\rangle$ in R the pair $\langle y, x\rangle$ is not in R. (If x is ranked above y, it cannot be ranked below y.)

c. TRANSITIVITY. R is transitive if and only if for all ordered pairs $\langle x, y\rangle$ and $\langle y, z\rangle$ in R, the pair $\langle x, z\rangle$ is also in R. (If x is ranked above y and y is ranked above z, then x is ranked above z.)

The properties (31a–c) define a partial order. In Optimality Theory, grammars are usually assumed to have the additional property of CONNECTEDNESS which requires that, for every two distinct constraints x and y in C, $\langle x, y\rangle \in R$ or $\langle y, x\rangle \in R$, i.e. every constraint is ranked with respect to every other constraint. This defines a total ordering, or a tableau.

If we assume that any partial ordering is a possible grammar, we get three more grammars. The resulting typology of six grammars is displayed in diagram (32). The grammars are described as sets of ordered constraint pairs and grouped into natural classes by shared rankings.

(32)



An important consequence of adopting partially ordered grammars is that it becomes possible for grammars to include other grammars. This is visually represented in diagram (32) in terms of immediate dominance. Consider the grammars labeled Most speakers and Old Töölö. The labels are mnemonic: we will soon see that the first grammar is a rough approximation of the grammar of most speaker groups, whereas the second is the grammar of old female upper middle class Töölö residents. (33) and (34) display these two grammars in two equivalent ways: as ordered pairs of constraints and as totally ordered tableaux.

(33) Most speakers:

Ordered pairs: {*EA ≫ *IA}

Tableaux:

*EA	*IA	Faith	→ [ee], [ii]
*EA	Faith	*IA	→ [ee], [ia]
Faith	*EA	*IA	→ [ea], [ia]

(34) Old Töölö:

Ordered pairs: {*EA ≫ *IA, Faith ≫ *IA}

Tableaux:

*EA	Faith	*IA	→ [ee], [ia]
Faith	*EA	*IA	→ [ea], [ia]

In terms of totally ordered tableaux, Most speakers properly includes Old Töölö. In terms of ordered pairs of constraints, Old Töölö properly includes Most speakers. Speaking in the tableau idiom, we will say that the grammar OLD TÖÖLÖ is a SUBGRAMMAR of the grammar MOST SPEAKERS. The fact that grammars may literally include other grammars will be exploited in this paper in various ways.

Now, consider the outputs of these two grammars. OLD TÖÖLÖ consists of two tableaux: the first predicts coalescence in EA-stems, the second predicts no coalescence. We interpret this empirically as follows: OLD TÖÖLÖ allows coalescence optionally in EA-stems, but prohibits it in IA-stems. Next, consider MOST SPEAKERS. This time, we have three tableaux: one predicts coalescence in IA-stems, two predict coalescence in EA-stems. The empirical intepretation we will adopt is straightforward: both vowel sequences may coalesce, but EA-stems coalesce more than IA-stems. More specifically, we will assume the following quantitative interpretation of partial ordering (Anttila 1997):

(35) QUANTITATIVE INTERPRETATION. (i) A candidate is predicted by the grammar iff it wins in some tableau; (ii) If a candidate wins in n tableaux and t is the total number of tableaux, then the candidate's probability of occurrence is n/t.

Given this interpretation, the grammar MOST SPEAKERS thus predicts a pattern where EA coalesces in 2/3 and IA in 1/3 of the cases. This is roughly the quantitative profile of Paunonen's total corpus (Paunonen 1995:110): EA $\rightarrow$ EE 63.1%; IA $\rightarrow$ II 29.8%.

4.2 The NDEB effect

We have now introduced the general assumptions of our analysis and generated a simple phonological typology of six dialects, but have not yet addressed the morphological facts, the most important of which is the NDEB effect. At present, the constraints apply indiscriminately to both derived and nonderived forms, predicting many incorrect outputs, e.g. optional coalescence in the nonderived *rasia*~**rasii* 'box' by MOST SPEAKERS, something never found in any dialect.

A novel optimality-theoretic solution to the derived environment problem has been proposed by Łubowicz (1998) who suggests that NDEB-effects can be derived from the LOCAL CONJUNCTION of markedness and faithfulness constraints (Smolensky 1995). The intuitive content of the morphological part of Łubowicz's proposal can be informally summarized as follows: if a stem-final consonant gets grouped into the same syllable with a suffix-initial vowel (.C-V.), this results in a stem/syllable misalignment which triggers the alternation; within roots no stem/syllable misalignment occurs, hence the alternation is blocked. Thus, according to Łubowicz, the common denominator of morphological derived environment effects is stem/syllable misalignment. However, this does not hold true of Finnish Vowel Coalescence. In cases like *o.ve.-a* 'door-PAR' the stem and syllable edges are perfectly aligned. We would thus expect coalescence not to take place, but it does.[11]

Another possibility is to suggest that, just as different dialects are obviously affiliated with different grammars, in the same way different morphological categories may subscribe to different COPHONOLOGIES within an individual's system.[12] For various uses of cophonologies, see e.g. McCarthy and Prince 1993, Itô and Mester 1995a, 1995b, 1998, Orgun 1996, Inkelas et al. 1997, Inkelas 1998 and Anttila 2002. Thus, for example, we could say that most speakers use the grammar $\{$*EA $\gg$ *IA$\}$ for general purposes, but its subgrammar $\{$*EA $\gg$ *IA, FAITH $\gg$ *IA$\}$ for nonderived roots, with the notable exception of old female upper middle class Töölö residents who have generalized this subgrammar to all stems, derived and nonderived.

The question now arises: why would nonderived roots be affiliated with a particular ranking instead of some other ranking? For example, why would nonderived roots not choose the grammar labelled ADVANCED DIALECT which predicts coalescence everywhere? Indeed, why do we not have *derived* environment blocking? No principled answer is forthcoming. As an explanation of NDEB, cophonologies seem descriptive and arbitrary.[13]

A third alternative is to assume that NDEB arises from a specialized faith-

[11]An analogous example is Basque final vowel raising (Hualde 1989), discussed by Łubowicz 1998 and Inkelas 2000.

[12]I use the term "cophonology" to refer to any subgrammar of a given language. Of two cophonologies, one may or may not be a subgrammar of the other. There are obvious similarities between cophonologies, the LEVELS of Lexical Morphology and Phonology (Kiparsky 1982, Mohanan 1986, Kiparsky to appear) and lexical STRATA in languages like Japanese, as analyzed in Itô and Mester 1995a, 1995b, 1998.

[13]As the reviewer points out, no advocate of cophonologies has ever used them to explain nonderived environment blocking; however, see the recent work by Yu (2000). The reviewer also asks what it would look like if a rule or constraint applied only in nonderived environments, and suggests it would look like a morpheme structure condition, and those abound. However, it is easy to imagine a dialect of Finnish where coalescence would apply optionally in roots (*rasia*∼*rasii* 'box'), but not in derived forms (*lasi-a*/**lasii* 'glass-PAR'). No such dialects exist and we must explain why.

fulness constraint FAITH$_{root}$ that requires faithfulness to roots. For various uses of this constraint, see e.g. McCarthy and Prince 1995, Beckman 1998 and Alderete 1999. Under this scenario, coalescence in nonderived forms would result in a violation of FAITH$_{root}$ (*rasia*/**rasii* 'box'), whereas coalescence in morphologically derived forms would not violate FAITH$_{root}$ (*lasi-a*∼*lasii* 'glass-PAR'). For a different faithfulness-driven approach to NDEB, see Burzio 2000.

While perhaps not the general solution, FAITH$_{root}$ fares better than its competitors in explaining the Finnish blocking facts. In particular, FAITH$_{root}$ yields the observed asymmetry between derived and nonderived forms, both in its categorical and quantitative manifestations. To derive the categorical NDEB-effect in IA-stems, it suffices to rank FAITH$_{root}$ above the markedness constraint *IA. This yields the subtler dialect typology in (36). Coalesced forms appear in boldface.

(36) Rankings: *EA ≫ *IA, FAITH$_{root}$ ≫ *IA

	/ove-a/	/hopea/	/lasi-a/	/rasia/
1. FAITH ≫ *EA ≫ FAITH$_{root}$ ≫ *IA	ove-a	hopea	lasi-a	rasia
2. FAITH ≫ FAITH$_{root}$ ≫ *EA ≫ *IA	ove-a	hopea	lasi-a	rasia
3. FAITH$_{root}$ ≫ FAITH ≫ *EA ≫ *IA	ove-a	hopea	lasi-a	rasia
4. FAITH$_{root}$ ≫ *EA ≫ FAITH ≫ *IA	**ove-e**	hopea	lasi-a	rasia
5. FAITH$_{root}$ ≫ *EA ≫ *IA ≫ FAITH	**ove-e**	hopea	**lasi-i**	rasia
6. *EA ≫ FAITH ≫ FAITH$_{root}$ ≫ *IA	**ove-e**	**hopee**	lasi-a	rasia
7. *EA ≫ FAITH$_{root}$ ≫ FAITH ≫ *IA	**ove-e**	**hopee**	lasi-a	rasia
8. *EA ≫ FAITH$_{root}$ ≫ *IA ≫ FAITH	**ove-e**	**hopee**	**lasi-i**	rasia

Instead of three, we now predict five distinct invariant systems. The variable systems will be discussed shortly.

(37) a. No coalescence (1-3).
b. Coalescence in derived EA-environments (4).
c. Coalescence in all derived environments (5).
d. Coalescence in all EA-environments (6-7).
e. Coalescence everywhere but nonderived IA-environments (8).

Yet another possibility is to derive NDEB from representational assumptions, in particular PRESPECIFICATION. We will put this alternative on hold and take it up after we have discussed the part-of-speech effect. At this point, we will tentatively accept the root faithfulness hypothesis as the basis for NDEB.

4.3 The part-of-speech effect

We now turn to the part-of-speech effect. The basic observation is that nouns coalesce less than adjectives, just as nonderived forms coalesce less than derived forms. This seems to suggest that the two should receive parallel synchronic analyses. The obvious solution is to introduce another specialized faithfulness constraint Faith_{noun}, parallel to Faith_{root}, following Smith (1997).

The analysis is straightforward. We first add the constraint Faith_{noun} into the existing partial ordering. This results in a system with five constraints (*EA, *IA, Faith_{root}, Faith_{noun}, Faith) and two binary rankings (*EA $\gg$ *IA, $\text{Faith}_{root} \gg$ *IA). Within this space, we must now locate the grammar that best matches the Finnish data. Here we will try to model the average frequencies in the entire corpus; modelling the distinct dialects within the corpus is a challenge that will be left for future work. The best match is achieved by the grammar in (38) using mean absolute deviation as a measure of fit.[14] The percentages are very good in categories with a large number of tokens, but worse in categories with fewer tokens.

(38) The noun faithfulness analysis

Constraints: *EA, *IA, Faith_{root}, Faith_{noun}, Faith
Rankings: *EA $\gg$ *IA, $\text{Faith}_{root} \gg$ *IA, *EA $\gg \text{Faith}_{root}$,
*EA $\gg \text{Faith}_{noun}$, $\text{Faith}_{root} \gg \text{Faith}_{noun}$

(39) Predictions and observations

	Pred N	Obs N	Pred%	Obs_1%	Obs_2%	Total N
ove-a_{noun}	571	293	80	41.0	24.3–67.2%	714
hopea_{noun}	38	9	80	18.8	3.4–66.7%	48 (native)
idea_{noun}	10	0	80	0	0	12 (borrowing)
lasi-a_{noun}	1,012	1,014	20	20.0	7.8–43.5%	5,059
rasia_{noun}	0	0	0	0	0%	847
toope-a_{adj}	–	–	80	–	–	0
makea_{adj}	1,396	1,263	80	72.4	49.5–93.0%	1,745
uusi-a_{adj}	1,279	1,289	30	30.2	9.6–64.2%	4,264
kauhia_{adj}	0	0	0	0	0%	261

[14] This grammar was found by exhaustive search using a simple recursive algorithm. Within the space defined by the five constraints and the two binary rankings, the algorithm found 579 nonidentical partial orderings of which 40 were total orderings.

However, this is just the first step; the interaction of phonology and morphology gets subtler. Recall that not all nouns are alike: native nouns like *hopea* 'silver' coalesce variably (*hopea*∼*hopee*), whereas otherwise identical recent borrowings like *idea* 'idea' never coalesce (*idea*/**idee*). Since the grammar in (38) does not distinguish between the two noun classes, it predicts the same coalescence rate (80%) in both. Because /ea/-final nouns are not very common, this oversight is negligible from the quantitative point of view, but numbers aside, it is obvious that a generalization is being missed. The question is how to capture increasingly smaller subregularities and ultimately lexical idiosyncrasies in this framework.

The most straightforward move would be to introduce a high-ranking constraint $\text{F}\textsc{aith}_{recentlyborrowednoun}$ which would block coalescence in *idea* 'idea', but not in *hopea* 'silver'. Two problems arise. First, if one wants to maintain the hypothesis that constraints are universal, this one will probably not qualify. Second, as discussed in section 2, the blocking of coalescence in *idea* and other recently borrowed nouns can be plausibly attributed to analogy with the statistical majority of nouns which typically end in /ia/. But if this is so, then the explanation has nothing to do with universal constraints, but rather the brute fact that Finnish happens to have many more nouns ending in /ia/ than in /ea/ plus the independent principle "Imitate the majority".

An alternative is to postulate cophonologies. Under this approach, different lexical items, or groups of lexical items, subscribe to different rankings, hence their phonological differences. Note that this is not equivalent to choosing a ranking randomly if we make the reasonable assumption that lexeme-specific phonologies are subgrammars of the general phonology of the language. Under this scenario, the lexical items *idea* 'idea' and *hopea* 'silver' are similar in that both share the general rankings of Finnish; they are different in that *idea* 'idea' imposes further rankings that categorically block coalescence.

However, if we posit distinct cophonologies for native and recently borrowed nouns, the obvious question is why not do the same for nouns and adjectives. What makes a cophonology analysis particularly attractive is that it allows us to dispense with the constraint $\text{F}\textsc{aith}_{noun}$. This simplifies our constraint inventory, which in turn reduces the number of possible grammars. The question is whether the simpler four-constraint system is still empirically sufficient, that is, whether we are still able to find a grammar that satisfactorily matches the Finnish data. The grammar shown in (40) seems a reasonably good fit.

(40) The cophonology analysis:

Constraints:	*EA, *IA, FAITH$_{root}$, FAITH
General rankings:	*EA ≫ *IA, FAITH$_{root}$ ≫ *IA
Noun rankings:	General rankings ∪ FAITH$_{root}$ ≫ *EA
Adjective rankings:	General rankings ∪ *EA ≫ FAITH$_{root}$

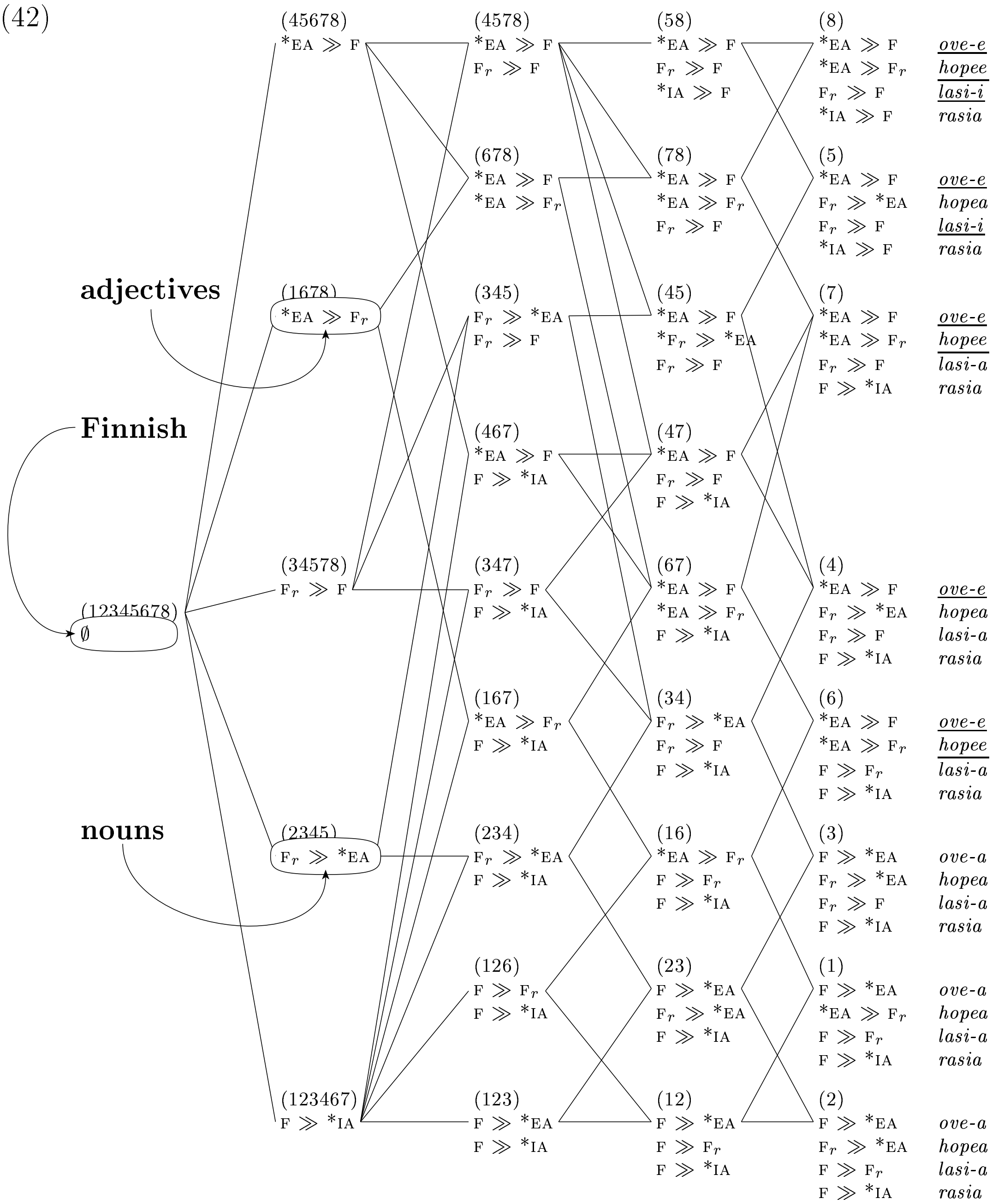
Minor regularity: Four native /ea/-final nouns (*hopea* 'silver', *häpeä* 'shame', *lipeä* 'lye', *aukea* 'clearing') do not subscribe to the noun rankings, but only to the general rankings of Finnish.

(41) Predictions and observations

	PRED N	OBS N	PRED%	OBS$_1$%	OBS$_2$%	TOTAL N
ove-a$_{noun}$	357	293	50.0	41.0	24.3–67.2%	714
hopea$_{noun}$	18	9	37.5	18.8	3.4–66.7%	48 (native)
idea$_{noun}$	0	0	0.0	0.0	0%	12 (borrowing)
lasi-a$_{noun}$	1,265	1,014	25.0	20.0	7.8–43.5%	5,059
rasia$_{noun}$	0	0	0.0	0.0	0%	847
toope-a$_{adj}$	–	–	75.0	–	–	0
makea$_{adj}$	1,309	1,263	75.0	72.4	49.5–93.0%	1,745
uusi-a$_{adj}$	1,066	1,289	25.0	30.2	9.6–64.2%	4,264
kauhia$_{adj}$	0	0	0.0	0.0	0%	261

In this analysis, the noun and adjective cophonologies are literally embedded within the general phonology of Finnish. This point is made more visually by diagram (42) which displays all the subregularities (partial orderings) hidden within the general Finnish rankings. The eight tableaux are located on the right, numbered from 1 to 8 and annotated with the relevant outputs. All in all, we find 32 distinct subregularities of which 12 are invariant, 20 variable.

(42)



The noun grammar correctly blocks coalescence in recently borrowed nouns like *idea* ‘idea’ (*idea/*idee*). The marginal variability in native nouns like *hopea* 'silver' (*hopea*∼*hopee*) follows if we place them directly under the general phonology of Finnish. The pattern is typical of analogical change: a handful of native roots have not yet caught up with the recent analogical trend, and perhaps never will, whereas incoming roots unhesitatingly subscribe to the noun grammar. Note that the exceptional variability is predicted to be phonologically possible only in EA-roots. In IA-roots, the general phonology of Finnish dictates blocking across the board. In general, cophonologies seem the right way of handling the synchronic complications due to lexical diffusion (Wang 1969, Wang 1977, Labov 1994, Kiparsky 1989, Kiparsky 1995), a species of analogical change that proceeds lexical item by lexical item, yet crucially in a phonologically constrained manner.

In his otherwise insightful discussion, Paunonen did not notice the crucial role that the noun/adjective distinction plays in Vowel Coalescence. This led him to the puzzling observation that coalescence is systematically *more* common in nonderived EA-nominals, e.g. *makea* 'sweet', than in derived EA-nominals (partitives), e.g. *ove-a* 'door-PAR'. In order to make sense of this observation, he proposed the following explanation:

(43) The alternation *korkea*∼*korkee* 'high', *ainoa*∼*ainoo* 'only' [nonderived words, A.A.] thus only concerns the shape of a single lexeme, whereas in partitives [derived words, A.A.] the alternation between coalesced and hiatus forms would entail increasing complexity in the morphological rule system. From this point of view, the sound development *ea, eä* > *ee* and *oa* > *oo* is freer to proceed in *ea, oa* nominals than in partitives. For this reason, one would expect that in *ea, eä* nominals the coalescence forms would be more common than in *ea, eä*-final partitives. Indeed, this is the case. (Paunonen 1995:141) [Translation mine, A.A.]

In other words, Paunonen is forced to conclude that sound change somehow avoids creating complexity in morphological rule systems. However, there is an alternative explanation available. While perfectly accurate, Paunonen's word counts do not distinguish between nouns and adjectives. Recall that virtually all EA-final nonderived forms, e.g. *makea* 'sweet', are adjectives, and virtually all EA-final derived forms, e.g. *ove-a* 'door-PAR', are nouns. Thus, the tendency of *makea* 'sweet' to coalesce more than *ove-a* 'door' is not because the first is nonderived and the second derived; it is because the first is an adjective and the second a noun. This strong part-of-speech effect is hidden in Paunonen's word counts, and once teased apart, the puzzle disappears. Indeed, nonderived words are *less* likely to coalesce than derived words, not the other way round.

The general predictions of our analysis are summarized in (44). The following two generalizations hold of all the 32 subregularities:

(44) All else being equal, Vowel Coalescence is

a. at least as likely in EA as in IA sequences
b. at least as likely in derived as in nonderived environments

In other words, the grammar correctly ties the likelihood of coalescence to segmental phonology and derivedness. In contrast, no general predictions are made concerning the relative coalescence rates of nouns and adjectives. This is because the noun/adjective distinction is not hard-wired in the constraints, but follows from the language-specific assignment of lexical items to cophonologies: the fact that nouns coalesce less than adjectives is contingent upon the particular assignment we have chosen. It would thus not be surprising to find a language where the behavior of nouns and adjectives were the reverse of Finnish, i.e. where adjectives are more faithful to their inputs than nouns. It is here that the noun faithfulness analysis (Smith 1997) and the cophonology analysis make crucially different predictions.

Let us now summarize the main results. We have found that the blocking of Vowel Coalescence can be traced back to three independent factors: vowel height, (non)derivedness and part of speech. These effects add up and in the extreme case result in categorical blocking. We have proposed that the derived environment effect and the part-of-speech effect are fundamentally different: the derived environment effect follows from the (presumably universal) phonological constraint $\text{F}{\scriptsize\text{AITH}}_{root}$, whereas the part-of-speech effect is language-specific and synchronically implemented by means of the very different device of cophonologies.

5 A note on prespecification

We are now ready to consider yet another approach to blocking effects: prespecification. Various versions of this approach have been proposed by e.g. Ringen (1975), Borowsky (1986), Kiparsky (1993a), Inkelas and Cho (1993) and Inkelas (2000). Kiparsky's formulation is stated in (45):

(45) NDEB is a property of structure-building rules operating on underspecified representations (Kiparsky 1993a)

The intuition is simple: if the target of a structure-building rule is underspecified, the rule can apply and the result is alternation. If the target of a structure-building rule is prespecified, the rule cannot apply because it is defeated by the pre-existing representation and the result is blocking. In the Finnish case, we could prespecify the nonalternating vowels as [+low] and leave the alternating vowels underspecified for height as shown in (46):

(46) A prespecification analysis:

a.	/hopeA/	hopea∼hopee	/A/ underspecified for height
b.	/idea/	idea/*idee	/a/ prespecified [+low]

As Sharon Inkelas (p.c.) has pointed out to me, this approach is perfectly compatible with Optimality Theory. For a demonstration that the approach extends to blocking effects of various kinds, see Inkelas 2000. Following Inkelas, we could assume that the grammar permits underspecification only if an alternation has been observed and that the speaker assumes that an observed sequence is nonalternating until proven otherwise. It would be straightforward to reformulate the present analysis along these lines. All we need to do is change our assumptions about underlying forms on a lexeme-by-lexeme basis and substitute NoLongVowel (Rosenthall 1994) for Faith; both constraints essentially say "don't coalesce". However, a prespecification analysis does not seem warranted for reasons to which we will now turn.

First, prespecification does not extend to quantitative regularities in any obvious way. This means that partial ordering would remain a necessary part of the analysis. Since partial ordering by itself captures the relevant differences, e.g. the difference between *hopea∼hopee* 'silver' (variable coalescence) and *idea/*idee* 'idea' (blocking), it is not clear what prespecification would add to the analysis.

Second, as pointed out by Inkelas, prespecification provides a uniform approach to all blocking effects. However, as we have seen, not all blocking effects are alike. Blocking of the "nonderived environment type" is a well-known cross-linguistic fact; to capture it we posited the (potentially universal) constraint FAITH_{root}. Blocking of the "noun type" is arguably a Finnish-specific fact that results from the analogical influence of the majority of nouns. Blocking of the "vowel height type" may well have a phonetic explanation. All three blocking phenomena can undoubtedly be *described* as prespecification, but in reality they have quite different sources. It seems that by adopting prespecification we would simply end up stipulating that most roots, nouns and *ia*-sequences tend to have a prespecified /a/, whereas most suffixes, adjectives and *ea*-sequences tend to have an underspecified /A/. This would describe the facts, but we could just as well have stipulated the opposite. The point is that different types of blocking originate in quite different ways and at least some types of blocking can be derived from general principles, grammatical or otherwise.

Third, following Inkelas, we might propose that underspecification is possible only if an alternation has been observed, else full specification is assumed. However, as we have been observing throughout this paper, the fact that an alternation is observed in context A, but not in context B, is not an historical accident, but something that follows from the grammar itself, at least in part. Again, while underspecification can describe the facts, it adds little to our understanding of why alternations should occur in certain environments, but be blocked in others.

In sum, while prespecification is compatible with Optimality Theory, Vowel Coalescence does not provide evidence for a prespecification analysis of blocking.

6 On the limitations of this study

Finally, a comment on the limitations of the present study is due. Our quantitative results are preliminary in two respects. First, only *-ea* and *-ia* stems have been considered. The reason for choosing these two was that they are the most frequent of the vowel sequences subject to coalescence. However, Paunonen's study suggests that including *-oa, -öä, -ua* and *-yä* will not drastically change the general picture.

Second, each category contains words of varying lengths. For example, among IA-final derived adjectives we find both *suur-i-a* 'big-PL-PAR' (three syllables) and *semmos-i-a* 'such-PL-PAR' (four syllables). The difference is potentially relevant because word length affects secondary stress placement which in turn affects coalescence. The prediction is that coalescence should be blocked if secondary stress falls on either vowel. In *súu.r-i.-a* there is no secondary stress; in *sém.mo.s-ì-a* secondary stress falls on the third syllable, although perhaps only at the word level or postlexically (Kiparsky 2001), and the matter is further complicated by the fact that secondary stress is itself optional in certain circumstances (Keyser and Kiparsky 1984). It will be interesting to see whether including the secondary stress factor in the analysis results in more accurate quantitative predictions.

7 Conclusion

In this paper, we have examined a peculiar case of nonderived environment blocking: optional Vowel Coalescence (VC) in Colloquial Helsinki Finnish. Its theoretical significance lies in the fact that it runs counter to all the best-known explanations of derived environment behavior. As Kiparsky (1993a) already showed, VC is incompatible with the Strict Cycle Condition (Mascaró 1976) and the Elsewhere Condition (Kiparsky 1982) because it is both cyclic and lexical, yet applies in nonderived environments. We may now further add that VC is also incompatible with the Revised Alternation Condition (Kiparsky 1973): VC is a nonautomatic optional neutralization rule which is blocked in nonderived environments in certain phonological contexts, but not in others. Finally, it would be possible to tie derived environment behavior to structure-building rules by using stipulative prespecification to block VC in the desired environments, but this would miss the fundamental phonological and morphological generalizations, in particular the quantitative ones.

What the evidence ultimately shows is that derived environment behavior cannot be tied to phonological rules of any kind. The reason is that the very same rule may show NDEB in certain environments, but not in others, depending on global grammatical considerations. The old explanations were clearly in the right direction, but time and again it turned out that NDEB was tied to a particular rule type only approximately, if at all. It now seems that the failure to unify NDEB effects was mainly due to the decision to take rules, i.e. specific phonological processes, as the locus of explanation. In this case at least, Optimality Theory leads one to look for explanations in the right direction: since Optimality Theory does not even recognize rules as theoretical entities, it suggests that the explanation for NDEB must be found from global interactions of markedness and faithfulness.

We have argued that the blocking of Vowel Coalescence in Colloquial

Helsinki Finnish is a fairly heterogeneous phenomenon that can be traced back to at least three distinct sources ($\mathcal{M}$ = some markedness constraint, $\mathcal{F}$ = some faithfulness constraint):

(47) a. Markedness differences: *EA $\gg$ $\mathcal{F}$ $\gg$ *IA
(Blocking in IA-sequences, alternation elsewhere)
b. Special vs. general faithfulness: FAITH_{root} $\gg$ $\mathcal{M}$ $\gg$ FAITH
(Blocking in roots, alternation elsewhere)
c. Cophonologies: FAITH_{root} $\gg$ *EA vs. *EA $\gg$ FAITH_{root}
(Blocking in nouns, alternation in adjectives)

We have also shown that all three types of blocking may surface both categorically and quantitatively. Both types of effects follow from an optimality-theoretic analysis that assumes quantitatively interpreted partially ordered grammars.

Index

Alderete, John, 20
analogy, 7, 8, 22, 25, 28
Anttila, Arto, 8, 14, 18, 19

Basque, 19
Beckman, Jill, 20
Bethin, Christina, 8
Borowsky, Toni, 2, 27
Burzio, Luigi, 20

Casali, Roderic, 15
Cho, Young-mee Yu, 14, 27
cophonology, 14, 19, 22, 23, 25, 26, 30

Elsewhere Condition, 2, 29
English, 1, 14

faithfulness
- noun, 21, 22
- root, 3, 14, 20, 26, 28, 30

Haas, Wim de, 15
Heinämäki, Orvokki, 14
Hualde, José, 19

Inkelas, Sharon, 19, 27, 28
Itô, Junko, 19

Japanese, 19

Karlsson, Göran, 8
Keyser, Jay, 29
Kiparsky, Paul, 2, 6, 14, 25, 27, 29

Labov, William, 25
lexical diffusion, 25
Lexical Morphology and Phonology, 19
local conjunction, 14, 18
Lubowicz, Anna, 8, 14, 18, 19

Mascaró, Joan, 2, 29
McCarthy, John, 3, 14, 19, 20
Mester, Armin, 19
Mohanan, K.P., 19

Nagy, Naomi, 14

ordering
- partial, 14, 16–18, 21, 27, 30
- total, 14–17, 21

Orgun, Orhan, 19

Paunonen, Heikki, 2–7, 9, 10, 12, 15, 18, 25, 26, 28
Polish, 8
prespecification, 14, 20, 26–29
Prince, Alan, 3, 14, 19, 20

Rapola, Martti, 10
Revised Alternation Condition, 2, 29
Reynolds, William, 14
Ringen, Catherine, 2, 14, 27
Rosenthall, Samuel, 27
Rubach, Jerzy, 8

Sadeniemi, Matti, 7
Smith, Jennifer, 21, 26
Smolensky, Paul, 3, 14, 18
Strict Cycle Condition, 2, 29

underspecification, 2, 14, 27, 28

variation, 5, 13, 14, 25

Wang, William, 25

Yu, Alan, 19

Zoll, Cheryl, 19

Bibliography

Alderete, J. 1999. *Morphologically Governed Accent in Optimality Theory.* PhD thesis, University of Massachussetts, Amherst. `http://roa.rutgers.edu/, ROA-309-0399`.

Anttila, A. 1997. Deriving variation from grammar. In F. Hinskens, R. van Hout, and L. Wetzels (Eds.), *Variation, Change and Phonological Theory*, 35–68. Amsterdam/Philadelphia: John Benjamins Publishing Company. Also: `http://roa.rutgers.edu/, ROA-63`.

Anttila, A. 2002. Morphologically conditioned phonological alternations. *Natural Language and Linguistic Theory* 20(1):1–42. Also `http://roa.rutgers.edu/, ROA-425-10100`.

Anttila, A., and Y. Cho. 1998. Variation and change in Optimality Theory. *Lingua* 104:31–56. Special issue on Optimality Theory.

Beckman, J. N. 1998. *Positional Faithfulness.* PhD thesis, University of Massachusetts, Amherst. `http://roa.rutgers.edu/, ROA-234-1297`.

Borowsky, T. J. 1986. *Topics in the Lexical Phonology of English.* PhD thesis, University of Massachusetts at Amherst.

Burzio, L. 2000. Cycles, Non-Derived Environment Blocking, and Correspondence. In J. Dekkers, F. van der Leeuw, and J. van de Weijer (Eds.), *Optimality Theory: Phonology, Syntax and Acquisition*, 47–87. Oxford: Oxford University Press.

Casali, R. F. 1996. *Resolving hiatus.* PhD thesis, University of California, Los Angeles. `http://roa.rutgers.edu/, ROA-215-0997`.

Haas, W. d. 1988. *A Formal Theory of Vowel Coalescence.* Dordrecht - Holland/Providence RI - USA: Foris publications.

Hualde, J. 1989. The strict cycle condition and noncyclic rules. *Linguistic Inquiry* 20:675–680.

Inkelas, S. 1998. The theoretical status of morphologically conditioned phonology: A case study of dominance effects. In G. Booij and J. van Marle (Eds.), *Yearbook of Morphology 1997*, 121–155. Dordrecht: Kluwer Academic Publishers.

Inkelas, S. 2000. Phonotactic blocking through structural immunity. In B. Stiebels and D. Wunderlich (Eds.), *Lexicon in Focus.* Berlin: Akademie Verlag. Studia Grammatica 45. Also: ROA-366.

Inkelas, S., and Y. Cho. 1993. Inalterability as prespecification. *Language* 69:529–74.

Inkelas, S., O. Orgun, and C. Zoll. 1997. The implications of lexical exceptions for the nature of grammar. In I. Roca (Ed.), *Derivations and Constraints in Phonology*, 393–418. Oxford University Press.

Itô, J., and A. Mester. 1995a. The core-periphery structure in the lexicon and constraints on re-ranking. In J. N. Beckman, L. W. Dickey, and S. Urbanczyk (Eds.), *Papers in Optimality Theory*, 181–210. University of Massachusetts, Amherst: GLSA.

Itô, J., and A. Mester. 1995b. Japanese phonology. In J. A. Goldsmith (Ed.), *The Handbook of Phonological Theory*, 817–38. Oxford: Blackwell.

Itô, J., and A. Mester. 1998. The Structure of the Phonological Lexicon. In N. Tsujimura (Ed.), *A Handbook of Japanese Linguistics*, 62–100. Malden, MA, and Oxford, U.K.: Blackwell.

Karlsson, G. 1978. Kolmi- ja useampitavuisten nominivartaloiden loppu-A:n edustuminen monikon *i*:n edellä [The realization of the final A of trisyllabic and longer nominal stems before the plural *i*]. In *Rakenteita. Juhlakirja Osmo Ikolan 60-vuotispäiväksi, 6.2.1978.*, 86–99. Turun Yliopiston suomalaisen ja yleisen kielitieteen laitos.

Keyser, S. J., and P. Kiparsky. 1984. Syllable structure in Finnish phonology. In M. Aronoff and R. T. Oehrle (Eds.), *Language Sound Structure. Studies in Phonology Presented to Morris Halle by His Teacher and Students*, 7–31. Cambridge, Mass.: MIT Press.

Kiparsky, P. 1973. Phonological representations. In O. Fujimura (Ed.), *Three Dimensions of Linguistic Theory.* Tokyo: TEC.

Kiparsky, P. 1982. Lexical morphology and phonology. In I.-S. Yang (Ed.), *Linguistics in the Morning Calm, Vol. 2*, 3–91. Seoul: Hanshin.

Kiparsky, P. 1989. Phonological change. In F. Newmeyer (Ed.), *Linguistics: The Cambridge Survey*, 363–415. Cambridge: Cambridge University Press.

Kiparsky, P. 1993a. Blocking in nonderived environments. In S. Hargus and E. Kaisse (Eds.), *Phonetics and Phonology, Volume 4: Studies in Lexical Phonology*, 277–313. San Diego, California: Academic Press.

Kiparsky, P. 1993b. Variable rules. Handout distributed at the Rutgers Optimality Workshop (ROW1).

Kiparsky, P. 1995. The phonological basis of sound change. In J. A. Goldsmith (Ed.), *The Handbook of Phonological Theory*, 640–70. Oxford: Blackwell.

Kiparsky, P. 2001. Finnish Noun Inflection. Manuscript, Stanford University.

Kiparsky, P. to appear. *Paradigms and Opacity.* Stanford, California: CSLI Publications.

Labov, W. 1994. *Principles of Linguistic Change: Internal Factors.* Oxford, UK, and Cambridge, USA: Blackwell.

Łubowicz, A. 1998. Derived environment effects in OT. Ms., University of Massachusetts, Amherst. Published version in Shahin, Kimary N. and Susan Blake and Eun-Sook Kim, eds., *WCCFL 17: Proceedings of the Seventheenth West Coast Conference on Formal Linguistics*, Stanford, California: CSLI Publications. Also: `http://roa.rutgers.edu/, ROA-239-0198`.

Mascaró, J. 1976. *Catalan Phonology and the Phonological Cycle.* PhD thesis, Massachusetts Institute of Technology.

McCarthy, J., and A. Prince. 1993. Prosodic Morphology I: Constraint Interaction and Satisfaction. University of Massachusetts, Amherst, and Rutgers University.

McCarthy, J., and A. Prince. 1995. Faithfulness and reduplicative identity. In J. N. Beckman, L. W. Dickey, and S. Urbanczyk (Eds.), *Papers in Optimality Theory*, 249–384. UMass, Amherst: GLSA.

Mohanan, K. 1986. *The Theory of Lexical Phonology.* Dordrecht: Reidel.

Nagy, N., and W. Reynolds. 1997. Optimality theory and variable word-final deletion in Faetar. *Language Variation and Change* 9(1):37–55.

Orgun, C. O. 1996. *Sign-Based Morphology and Phonology with special attention to Optimality Theory.* PhD thesis, Department of Linguistics, University of California, Berkeley. `http://roa.rutgers.edu/, ROA-171`.

Paunonen, H. 1995. *Suomen kieli Helsingissä. Huomioita Helsingin puhekielen historiallisesta taustasta ja nykyvariaatiosta [The Finnish language in Helsinki. Observations on the historical background of and current variation in spoken Helsinki Finnish].* Helsinki: Helsingin yliopiston suomen kielen laitos.

Prince, A., and P. Smolensky. 1993. Optimality Theory: Constraint Interaction in Generative Grammar. Rutgers University, New Brunswick, and University of Colorado, Boulder.

Rapola, M. 1966. *Suomen kielen äännehistorian luennot [Lectures on the Historical Phonology of Finnish].* Helsinki: Suomalaisen Kirjallisuuden Seura.

Ringen, C. 1975. *Vowel Harmony: Theoretical Implications.* PhD thesis, Indiana University. Published in 1988 in the Outstanding Dissertations Series by Garland, New York.

Ringen, C. O., and O. Heinämäki. 1999. Variation in Finnish vowel harmony. *Natural Language and Linguistic Theory* 17:303–337.

Rosenthall, S. 1994. *Vowel/Glide Alternations in a Theory of Constraint Interaction.* PhD thesis, University of Massachussetts, Amherst. ROA-126.

Rubach, J. 1984. *Cyclic and Lexical Phonology: The Structure of Polish.* Dordrecht: Foris.

Sadeniemi, M. (Ed.). 1973. *Nykysuomen sanakirja [Dictionary of Modern Finnish].* Porvoo, Finland: Werner Söderström Osakeyhtiö.

Smith, J. L. 1997. Noun faithfulness: On the privileged status of nouns in phonology. `http://roa.rutgers.edu/, ROA-242-0198`.

Smolensky, P. 1995. On the internal structure of the constraint component *Con* of UG. Handout of a talk given at UCLA, April 7, 1995; Department of Cognitive Science, Johns Hopkins University.

Wang, W. S.-Y. 1969. Competing changes as a cause of residue. *Language* 45:9–25.

Wang, W. S.-Y. (Ed.). 1977. *The Lexicon in Phonological Change.* The Hague: Mouton.

Yu, A. C. L. 2000. Stress assignment in Tohono O'odham. *Phonology* 17:117–135.