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Alternatives to paradigm constraints

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1. Overview

(1) Two theoretical options:
- (a) Paradigms are real. The grammar actively strives to eliminate phonological differences within a paradigm (paradigm uniformity) and to maintain phonological differences across paradigms (antihomophony) (e.g. Kenstowicz 1996, 1998, Steriade 2000, McCarthy 2003).
- (b) Paradigms are epiphenomenal. The structure of paradigms follows from the interaction of independent principles.

(2) Example (Laalo 1988): The two most important conditioning factors governing Finnish Assibilation (t → s / _i) are paradigm uniformity and homonymy avoidance. This supports (1a).

(3) This talk: I defend an alternative analysis of Assibilation that covers the data better and does not refer to paradigms. This supports (1b).

2. The basic interactions

(4) The four relevant alternations:

(a) Vowel Deletion	a → ∅ / _i	huuta-i → huuti	'shout-PAST'
(b) Assibilation (optional)	t → s / _i	huut-i~huusi	'shout-PAST'
(c) Consonant Gradation	tt → t _VC.	ott-i-n → otin	'take-PAST'
(d) Apocope (optional)	i → ∅	huus-i~huus	'shout-PAST'

(5) The four processes interact around *ti*-sequences:
- (a) Vowel Deletion creates *ti*-sequences by deleting an intervening vowel.
- (b) Assibilation removes *ti*-sequences by changing *t* to *s*.
- (c) Consonant Gradation creates *ti*-sequences by shortening *tt* to *t*.
- (d) Apocope removes *ti*-sequences by deleting *i*.

(6) Ordering: Vowel Deletion → Assibilation → Consonant Gradation → Apocope

(7) Vowel Deletion feeds Assibilation (✓ = good derivation, × = bad derivation)

	/huuta-i/ 'shout-PAST'			/huuta-i/	
VD	huuti		AS	--	
AS	huuti~huusi		VD	huuti	
	[huuti]~[huusi] ✓	(feeding)		[huuti] ×	(counterfeeding)

(8) Assibilation never applies to geminates (Kirchner 2000), not even if shortened by Consonant Gradation. Thus, Consonant Gradation counterfeeds Assibilation.

	/otta-i-n/ 'take-PAST-1P.SG'			/otta-i-n/	
VD	ottin		VD	ottin	
AS	--		CG	otin	
CG	otin		AS	otin~osin	
	[otin] ✓	(counterfeeding)		[otin]~*[osin] ✗	(feeding)

(9) Apocope counterfeeds Consonant Gradation

	/hakkat-i/ 'beat-PAST'			/hakkat-i/	
VD	--		VD	--	
AS	hakkasi		AS	hakkasi	
CG	--		AP	hakkasi~hakkas	
AP	hakkasi~hakkas		CG	hakkasi~hakas	
	[hakkas] ✓	(counterfeeding)		[hakkasi]~*[hakas] ✗	(feeding)

(10) This establishes the total ordering VD < AS < CG < AP.

(11) Further evidence: Vowel Deletion feeds Consonant Gradation, hence VD < CG.

	/otta-i-n/			/otta-i-n/	
VD	ottin		CG	--	
CG	otin		VD	oltin	
	[otin] ✓	(feeding)		*[ottin] ✗	(counterfeeding)

(12) Further evidence: Apocope counterbleeds Assibilation, hence AS < AP.

	/hakkat-i/			/hakkat-i/	
AS	hakkasi		AP	hakkati~hakkat	
AP	hakkasi~hakkas		AS	hakkasi~hakkat	
	[hakkasi]~[hakkas] ✓	(counterbleeding)		[hakkasi]~*[hakkat] ✗	(bleeding)

(13) Counterbleeding order AS < AP predicts four-way variation (attested)

	/huuta-i/		/huuta-i/		/huuta-i/		/huuta-i/	
VD	huuti		huuti		huuti		huuti	
AS (optional)	--		huusi		--		huusi	
CG	--		--		--		--	
AP (optional)	--		--		huut		huus	
	[huuti]	~	[huusi]	~	[huut]	~	[huus]	✓

(14) <u>lent-i</u> sii-he kuva-m peä-le (Jaakkima, Southeast, *ti*-variant)
fly-PAST it-ILL picture-GEN top-ALL
"flew there, onto the picture"

mulla-t <u>lens-i-it</u> (Hiitola, Southeast, *si*-variant)
soil-PL fly-PAST-3P.PL
"soil flew (was scattered) around"

se <u>lent</u> ko lintu (Hiitola, Southeast, *t'*-variant)
it fly(-PAST) like bird
"it flew like a bird"

se ku <u>lens</u> moa-ha (Kurkijoki, Southeast, *s'*-variant)
it EMPH fly(-PAST) ground-ILL
"it flew to the ground"

(15) Bleeding order AP < AS predicts three-way variation (unattested)

	/huuta-i/		/huuta-i/		/huuta-i/		/huuta-i/	
VD	huuti		huuti		huuti		huuti	
AP (optional)	--		--		huut		huut	
CG	--		--		--		--	
AS (optional)	--		huusi		--		--	
	[huuti]	~	[huusi]	~	[huut]	~	[huut]	✗

(16) Conclusion: Ordering correctly predicts both transparent and opaque interactions.

(17) Three further questions:
(a) What is the phonological motivation behind these processes?
(b) How are these processes related to morphology?
(c) How can we account for quantitative generalizations in variation?

(18) Outline of the talk:
(a) Give an analysis that (i) explains the interaction facts; (ii) provides a phonological motivation for the alternations; (iii) relates them to morphology; (iv) derives the observed variation within/across dialects; (v) derives the observed quantitative tendencies within/across dialects.
(b) Show that a paradigm-based analysis cannot do the same.

3. Process interaction in Stratal Optimality Theory

(19) Stratal Optimality Theory: phonological ordering = morphological ordering

(20) Assumptions (Kiparsky 2003):
(a) LEVELS: Stem level, word level, postlexical level
(b) PARALLELISM: Within a level, constraint interaction is transparent.
(c) SERIALISM: Stem level → word level → postlexical level

(21) Since rule ordering must reduce to level ordering, we have three options:
(a) Vowel Deletion and Assibilation interact at stem level. ✓
(b) Assibilation and Consonant Gradation interact at word level. ✗
(c) Consonant Gradation and Apocope interact at postlexical level. ✗

(22) RULE ORDERING → STRATAL OPTIMALITY THEORY

RULE ORDERING		STRATAL OPTIMALITY THEORY
1. Vowel Deletion (VD)	→	1. Stem Level
2. Assibilation (AS)	→	1. Stem Level
3. Consonant Gradation (CG)	→	2. Word Level
4. Apocope (AP)	→	3. Postlexical Level

(23) Three predictions:
- (a) VD and AS should interact with stem-level morphology.
- (b) CG should interact with word-level morphology.
- (c) AP should have no morphological or lexical conditions.

4. Assibilation

4.1. The length effect

(24) Generalization: If *ti* → *si* applies to a stem, it applies to any longer stem.

(25) Standard Finnish past tense (Anttila 2003): *ti* → *si* is
- (a) blocked after a monomoraic first syllable (μ.*ti*)
- (b) variable and/or lexically conditioned after a bimoraic first syllable (μμ.*ti*)
- (c) obligatory after a trimoraic first syllable (μμμ.*ti*)
- (d) obligatory after two or more syllables (σ.σ.*ti*)

(26)

(a)	/vetä-i/	ve.ti	*ve.si	'pull- PAST'
(b)	/hoita-i/	hoi.ti	*hoi.si	'take.care- PAST'
	/souta-i/	sou.ti ~	sou.si	'row- PAST'
	/pyytä-i/	*pyy.ti	pyy.si	'ask-PAST'
(c)	/kaarta-i/	*kaar.ti	kaar.si	'veer- PAST'
(d)	/tilat-i/	*ti.la.ti	ti.la.si	'order-PAST'

(27) The length effect emerges in 24/25 dialects (3rd person /A/-final verbs)

	μ	μμ	μμμ, σσ	ATTESTED	SAMPLE DIALECT
(a)	*ti* --	*ti~si*	*ti~si*	18 dialects	Southeast
	ti --	*ti~si*	-- *si*	3 dialects	Vermlanti
	ti --	*ti* --	*ti~si*	1 dialect	Northern Ostrobothnia
	ti --	*ti* --	*ti* --	1 dialect	Western Savo
	ti --	-- *si*	-- *si*	1 dialect	Ingria
(b)	*ti* --	*ti~si*	*ti* --	1 dialect	Southern Ostrobothnia [*si*, N=1]

(28) A metrical analysis:
- (a) Finnish feet: Left-aligned, left-headed, main stress left, no degenerate feet.
- (b) Proposal: Assibilation is blocked within the head foot.

(29) Assibilation in verbs

(a)	(*vé.ti*)	syllabic trochee
(b)	(*húu*)*si*~(*húu.ti*)	moraic trochee~syllabic trochee
(c)	(*pá.ran*)*si*~(*pá.ran.ti*)	syllabic trochee~dactyl

(30) The grammar of Assibilation

(a)	IDENT$_{\varphi}$	Do not alter the features of a segment within the head foot.
	IDENT	Do not alter the features of a segment.
	PARSE-σ	Syllables belong to feet.
	*TERNARY	Prosodic constituents are at most binary.
	*TI	No *ti*-sequences. (Kim 2001)
(b) Ranking:		IDENT$_{\varphi}$ >> {*TI, PARSE-σ, *TERNARY} >> IDENT

(31) Monomoraic stems: No Assibilation (*ti*)

/vetä-i/ 'pull-PAST'	IDENT$_{\varphi}$	*TI	PARSE-σ	*TERNARY	IDENT
a. → (vé.ti)		*			
b. (vé.si)	*!				*

(32) Bimoraic stems: Variation (*ti*~*si*)

/huuta-i/ 'break-PAST'	IDENT$_{\varphi}$	*TI	PARSE-σ	*TERNARY	IDENT
a. → (húu)si			*		*
b. (húu)ti		*	*!		
c. (húu.si)	*!				*
d. → (húu.ti)		*			

(33) Disyllabic stems: Variation (*ti*~*si*)

/paranta-i/ 'improve-PAST'	IDENT$_{\varphi}$	*TI	PARSE-σ	*TERNARY	IDENT
a. → (pá.ran)si			*		*
b. (pá.ran)ti		*!	*		
c. (pá.ran.si)	*!			*	*
d. → (pá.ran.ti)		*		*	

(34) Trimoraic stems: Variation (*ti*~*si*)

/kaarta-i/ 'veer-PAST'	IDENT$_{\varphi}$	*TI	PARSE-σ	*TERNARY	IDENT
a. → (káa)r.si			*		*
b. (káar)ti		*	*!	*	
c. (káar.si)	*!			*	*
d. (káar)si			*	*!	*
e. → (káar.ti)		*		*	

(35) A typology of Assibilation

	μt-i	μμt-i	μμμt-i/σσt-i
1. PARSE-σ >> *TI >> *TERNARY	(*vé.ti*)	(*húu.ti*)	(*káar.ti*)/(*pá.ran.ti*)
2. PARSE-σ >> *TERNARY >> *TI	(*vé.ti*)	(*húu.ti*)	(*káar.ti*)/(*pá.ran.ti*)
3. *TERNARY >> PARSE-σ >> *TI	(*vé.ti*)	(*húu.ti*)	**(*káa*)*r.si*/(*pá.ran*)*si***
4. *TERNARY >> *TI >> PARSE-σ	(*vé.ti*)	**(*húu*)*si***	**(*káa*)*r.si*/(*pá.ran*)*si***
5. *TI >> *TERNARY >> PARSE-σ	(*vé.ti*)	**(*húu*)*si***	**(*káa*)*r.si*/(*pá.ran*)*si***
6. *TI >> PARSE-σ >> *TERNARY	(*vé.ti*)	**(*húu*)*si***	**(*káa*)*r.si*/(*pá.ran*)*si***

(36) The length effect derived:
- (a) No Assibilation (grammars 1-2)
- (b) Assibilation in trimoraic and disyllabic stems (grammar 3)
- (c) Assibilation in all but monomoraic stems (grammars 4-6)

(37) A note on Vowel Deletion: *AI 'No unstressed *ai* diphthongs' (undominated). The ranking *AI >> *TI guarantees that Vowel Deletion feeds Assibilation.

4.2. Morphological effects

(38) Observation 1: Verbs and nouns behave differently.
- (a) In verbs, Assibilation depends on stem length.
- (b) In regular nouns, Assibilation is blocked irrespective of stem length.

(39) Standard Finnish:

(a)	/vetä-i/	ve.ti		*ve.si	'pull- PAST'
	/vuota-i/	vuo.ti	~	vuo.si	'seep- PAST'
	/kaarta-i/	*kaar.ti		kaar.si	'veer- PAST'
(b)	/sota-i-na/	sotina		*sosina	'war-PL-ESS'
	/vuota-i-na/	vuotina		*vuosina	'skin-PL-ESS'
	/suunta-i-na/	suuntina		*suunsina	'direction-PL-ESS'

(40) Observation 2: Different nouns behave differently.
- (a) In regular nouns, Assibilation is blocked.
- (b) In /e/-final nouns, Assibilation is obligatory.

(41)

(a)	/sota-i-na/	sotina / *sosina	'war-PL-ESS'
	/vuota-i-na/	vuotina / *vuosina	'skin-PL-ESS'
(b)	/vete-i-nä/	*vetinä/vesinä	'water-PL-ESS'
	/vuote-i-na/	*vuotina / vuosina	'year-PL-ESS'

(42) Analysis: Different stems have different foot structures.
- (a) Verbs have variable feet (moraic trochee, syllabic trochee, dactyl).
- (b) /e/-nouns have short feet, hence Assibilation always applies.
- (c) Regular nouns have long feet, hence Assibilation is always blocked.

(43) /e/-final nominals: *TI >> IDENT$_{\varphi}$

/vete-i/ ‘water-PL’	*TI	IDENT$_{\varphi}$	PARSE-σ	*TERNARY	IDENT
a. →(vé.si)		*			*
b. (vé.ti)	*!				

/vuote-i/ ‘year-PL’	*TI	IDENT$_{\varphi}$	PARSE-σ	*TERNARY	IDENT
a. →(vúo)si			*		*
b. (vúo.si)		*!			*
c. (vúo)ti	*!		*		
d. (vúo.ti)	*!				

/kuukaute-i/ ‘month-PL’	*TI	IDENT$_{\varphi}$	PARSE-σ	*TERNARY	IDENT
a. → (kuu.kau)si			*		*
b. (kuu)kau.si			**!		*
c. (kuu.kau.si)		*!		*	*
d. (kuu.kau.ti)	*!			*	
e. (kuu.kau)ti	*!		*		

(44) Consequences:
  (a) Assibilation across the board.
  (b) The stem-final syllable is extrametrical, if possible.

(45) Regular nominals: PARSE-σ >> {*TI, *TERNARY }

/sota-i/ ‘war-PL’	IDENT$_{\varphi}$	PARSE-σ	*TI	*TERNARY	IDENT
a. → (só.ti)			*		
b. (só.si)	*!				*

/vuota-i/ ‘skin-PL’	IDENT$_{\varphi}$	PARSE-σ	*TI	*TERNARY	IDENT
a. → (vúo.ti)			*		
b. (vúo)ti		*!	*		
c. (vúo.si)	*!				*
d. (vúo)si		*!			*

/egypti/ 'Egypt'	IDENT$_{\varphi}$	PARSE-σ	*TI	*TERNARY	IDENT
a. → (e.gyp.ti)			*	*	
b. (e.gyp)ti		*!	*		
c. (e.gyp.si)	*!			*	*
d. (e.gyp)si		*!			*

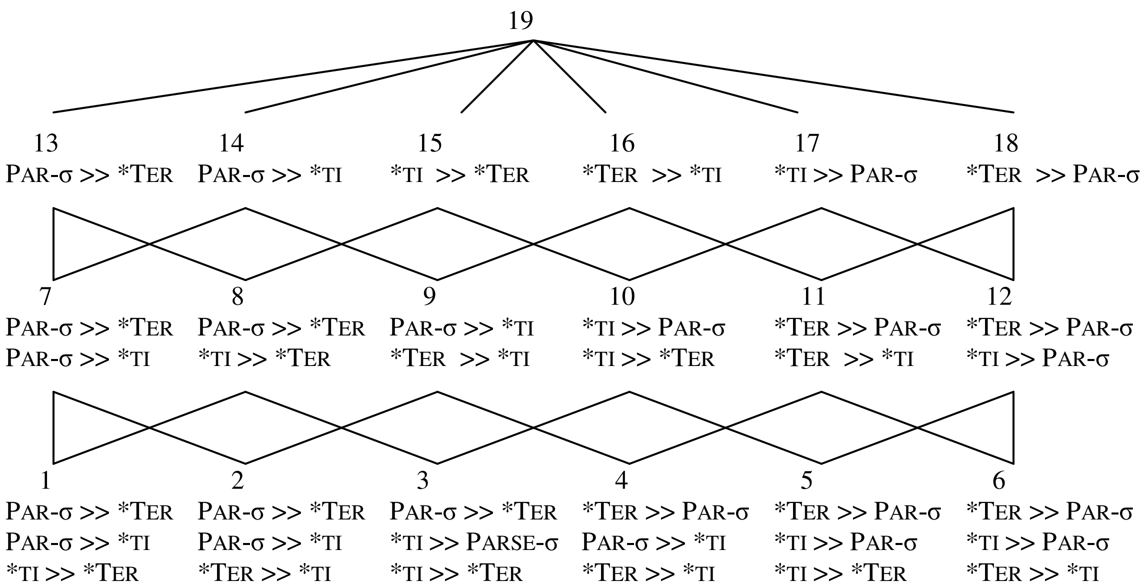
(46) Consequences:
  (a) Assibilation is blocked everywhere.
  (b) The stem is exhaustively footed.

(47) Morphological prediction confirmed:
- (a) Vowel Deletion and Assibilation apply to combinations of bound stem and suffix, e.g. /huuta-i/ → *huusi* 'shout-PAST', where **huuta* is not a possible word.
- (b) Assibilation refers to stem classes (/e/-noun vs. regular noun) and lexical categories (verb vs. noun).

4.3. Variation and quantitative predictions

(48) Assumption: A grammar can be partially ordered. The number of total rankings within the grammar that generate a particular output is proportional to this output's probability of occurrence.

(49) A complete typology of Assibilation



1	2	3	4	5	6
(*vé.ti*)	(*vé.ti*)	(*vé.ti*)	(*vé.ti*)	(*vé.ti*)	(*vé.ti*)
(*húu.ti*)	(*húu.ti*)	**(*húu*)*si***	(*húu.ti*)	**(*húu*)*si***	**(*húu*)*si***
(*pá.ran.ti*)	(*pá.ran.ti*)	**(*pá.ran*)*si***	**(*pá.ran*)*si***	**(*pá.ran*)*si***	**(*pá.ran*)*si***

(50) Predicted and attested dialects (3rd person /A/-final verbs). N = attested dialects.

	μ	μμ	μμμ/σσ	NODES	N	EXAMPLE
A	*ti* --	*ti* --	*ti* --	1, 2, 7	1	Western Savo
B	*ti* --	*ti* --	-- ***si***	4	--	--
C	*ti* --	-- ***si***	-- ***si***	3, 5, 6, 10, 12, 17	1	Ingria
D	*ti* --	*ti* --	*ti*~***si***	9, 14	1	N. Ostrobothnia
E	*ti* --	*ti*~***si***	-- ***si***	11, 18	3	Vermlanti
F	*ti* --	*ti*~***si***	*ti*~***si***	8, 13, 15, 16, 19	18	Southeast
	ti --	*ti*~***si***	*ti* --	--	1	S. Ostrobothnia

(51) The predicted typology (A, B, C, D, E, F) covers 24 out of the 25 dialects. One dialect is predicted, but not attested; one dialect is attested, but not predicted.

(52) The predicted variable dialects (D, E, F) are all quantitatively distinct:

	PARTIAL ORDER	PREDICTED ASSIBILATION %		
		μ	μμ	μμμ/σσ
8	{PARSE -σ >> *TER, *TI >> *TER}	0	50	50
9	{PARSE -σ >> *TI, *TER >> *TI}	0	0	50
11	{*TER >> PARSE -σ, *TER >> *TI}	0	50	100
13	{PARSE-σ >> *TER}	0	33	33
14	{PARSE -σ >> *TI}	0	0	33
15	{*TI >> *TER}	0	67	67
16	{*TER >> *TI}	0	33	67
18	{*TER >> PARSE –σ}	0	67	100
19	{}	0	50	67

(53) A quantitative prediction (quantitative length effect): If stem length increases, the rate of *ti* → *si* cannot decrease.

(54) Testing for the quantitative length effect in the corpus (/A/-final 3rd person verbs)

	μμ	μμμ/σσ	Total
ti	302 (53.0%)	613 (47.5%)	915
si	268 (47.0%)	678 (52.5%)	946
Total	570 (100%)	1,291 (100%)	1,861

$df = 1$, $X^2 = 4.78566591582295$, $p \leq 0.05$

(55) The asymmetry emerges in 20/25 dialects. The 5 discrepancies are not significant.

	REGIONAL DIALECT	OBSERVED ASSIBILATION %			PROBLEM	N
		μ	μμ	μμμ/σσ		
4	Southeast	0	64.0	62.6	64.0 > 62.6	273
5-B	Central Savo	0	39.1	31.3	39.1 > 31.3	230
7	Central Ostrobothnia	0	48.3	40.8	48.3 > 40.8	161
3-B	Central Häme	0	42.4	73.3	✓	134
3-D	South-Eastern Häme	0	58.0	86.8	✓	126
5-C	Central Finland	0	26.3	47.0	✓	85
5-A	Northern Carelia	0	9.1	10.9	✓	77
5-F	Kainuu	0	5.8	14.8	✓	76
3-A	Upper Satakunta	0	43.5	59.2	✓	72
6	Southern Ostrobothnia	0	4.0	0.0	4.0 > 0	70
1-A	Southwest, Northern	0	76.7	97.7	✓	69
9	Northern Finland	0	28.6	72.9	✓	62
2-A	Western Uusimaa	0	72.0	75.9	✓	54
8	Northern Ostrobothnia	0	0.0	5.0	✓	52
2-E	Pori region	0	85.7	66.7	85.7 > 66.7	37
5-E	Western Savo	0	0.0	0.0	✓	36
2-D	Lower Satakunta	0	30.0	48.0	✓	35

11	Vermlanti	0	89.5	100.0	✓	33
2-C	Turun ylämaa	0	44.4	69.6	✓	32
10	Northwest	0	36.4	72.2	✓	29
5-D	Päijät-Häme	0	50.0	96.0	✓	29
1-B	Southwest, Southern	0	88.9	100.0	✓	25
12	Ingria	0	100.0	100.0	✓	24
3-C	Southern Häme	0	60.0	77.8	✓	23
2-B	Somero and Somerniemi	0	60.0	100.0	✓	12

5. More evidence for metrical structure

5.1. A metrical analysis of Apocope

(56) Proposal: Apocope targets extrametrical vowels.

(57) First prediction: Apocope should be favored if Assibilation has applied.

(a)	/huuta-i/	→ (*húu*)*si*	→ (*húu*)*s*	expected
(b)	/huuta-i/	→ (*húu.ti*)	→ (*húut*)	unexpected

(58) Observation: There are no dialects with *t'*, but no *s'*.

	PATTERN	DESCRIPTION	N	SAMPLE DIALECT
(a)	*ti si* -- --	No Apocope	11	Somero and Somerniemi
	ti -- -- --	No Apocope	1	Western Savo
(b)	*ti si t' s'*	Apocope across the board	6	Southwest, Northern
	-- *si t' s'*	Apocope across the board	2	Vermlanti
(c)	*ti si* -- *s'*	Apocope only in *si*	4	Western Uusimaa
	-- *si* -- *s'*	Apocope only in *si*	1	Ingria

(59) Second prediction: Apocope should apply differently in the two noun classes.

(a)	/e/-final nouns:	(*kak*)*si* → (*kak*)*s*	expected
(b)	regular nouns	(*sek.si*) → (*seks*)	unexpected

(60) Confirmation: Colloquial Helsinki Finnish (Paunonen 1995):

(a)	kaksi~kaks	'two'
	uusi~uus	'new'
	vuosi~vuos	'year'
(b)	seksi/*seks	'sex'
	aasi/*aas	'donkey'
	kymnaasi/*kymnaas	'junior high'

(61) The grammar of Apocope:

(a)	MAX(meter)	Do not delete metrical structure.
	MAX_{φ}	Do not delete footed segments.
	MAX	Do not delete segments.
	*I	No short *i*.
(b)	MAX(meter) >> {MAX_{φ}, MAX, *I}	

(62) Monomoraic stems:

(vé.ti)	MAX(meter)	MAX$_\varphi$	MAX	*I
a. →(vé.ti)				*
b. →(vét)		*	*	

(63) Bimoraic stems:

(húu.ti)	MAX(meter)	MAX$_\varphi$	MAX	*I
a. →(húu.ti)				*
b. →(húut)		*	*	
(húu)si	MAX(meter)	MAX$_\varphi$	MAX	*I
c. →(húu)si				*
d. →(húu)s			*	

(64) Disyllabic stems:

(pá.ran.ti)	MAX(meter)	MAX$_\varphi$	MAX	*I
a. →(pá.ran.ti)				*
b. →(pá.rant)		*	*	
(pá.ran)si	MAX(meter)	MAX$_\varphi$	MAX	*I
c. →(pá.ran)si				*
d. →(pá.ran)s			*	

(65) A typology of Apocope: Invariant dialects

	μ	μμ		μμμ/σσ	
1. MAX >> MAX$_\varphi$ >> *I	(*vé.ti*)	(*húu.ti*)	(*húu*)*si*	(*pá.ran.ti*)	(*pá.ran*)*si*
2. MAX >> *I >> MAX$_\varphi$	(*vé.ti*)	(*húu.ti*)	(*húu*)*si*	(*pá.ran.ti*)	(*pá.ran*)*si*
3. MAX$_\varphi$ >> MAX >> *I	(*vé.ti*)	(*húu.ti*)	(*húu*)*si*	(*pá.ran.ti*)	(*pá.ran*)*si*
4. MAX$_\varphi$ >> *I >> MAX	(*vé.ti*)	(*húu.ti*)	**(*húu*)*s***	(*pá.ran.ti*)	**(*pá.ran*)*s***
5. *I >> MAX$_\varphi$ >> MAX	**(*vét*)**	**(*húut*)**	**(*húu*)*s***	**(*pá.rant*)**	**(*pá.ran*)*s***
6. *I >> MAX >> MAX$_\varphi$	**(*vét*)**	**(*húut*)**	**(*húu*)*s***	**(*pá.rant*)**	**(*pá.ran*)*s***

(66) Three invariant dialect types
- (a) No Apocope (grammars 1-3)
- (b) Apocope in extrametrical syllables (grammars 4)
- (c) Apocope across the board (grammars 5-6)

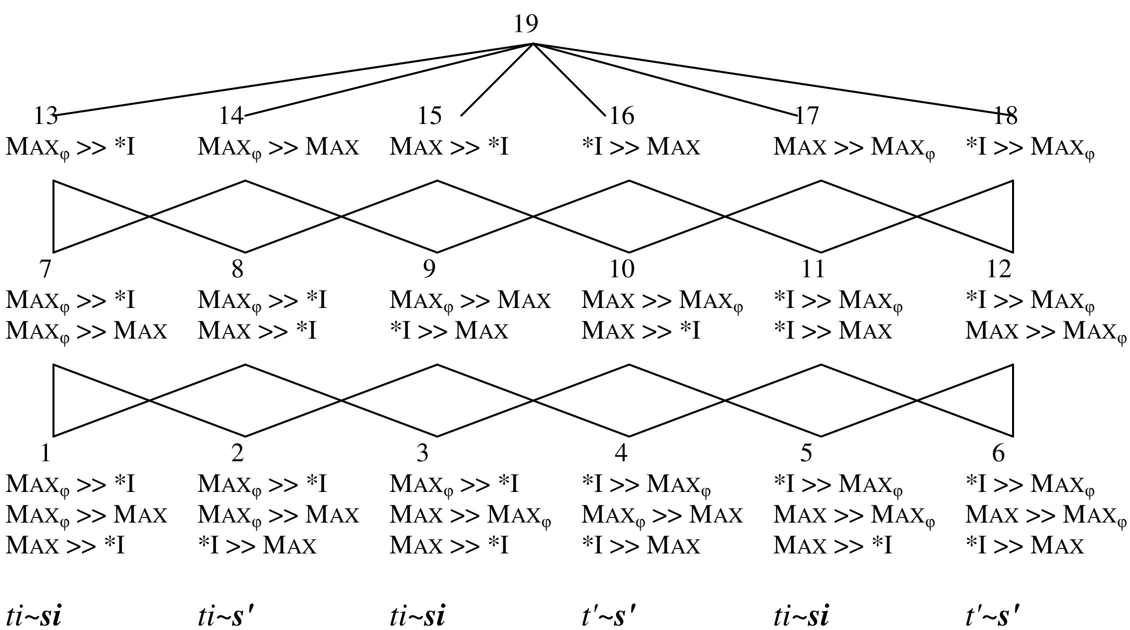
(67) Lexical and postlexical phonologies combined (invariant dialects)

		POSTLEXICAL		
		No Apocope	Apocope in extrametrical syllables	Apocope everywhere
LEXICAL	No Assibilation	*ti ti ti*	*ti ti ti*	*t′ t′ t′*
	Assibilation in μμμ/σσ	*ti ti* ***si***	*ti ti* ***s′***	*t′ t′* ***s′***
	Assibilation in μμ, μμμ/σσ	*ti* ***si si***	*ti* ***s′ s′***	*t′* ***s′ s′***

(68) The typological asymmetry derived: If *ti* → *t′*, then also *si* → *s′*.

5.2. Variation and quantitative predictions

(69) Generalizing the typology to variable dialects. A complete typology of Apocope.



(70) Predicted and attested dialects (/A/-final 3rd person verbs). N = attested dialects.

			PARTIAL ORDERS	N	EXAMPLE
1	*ti*	***si***	1, 3, 5, 8, 10, 15	12	Somero and Somerniemi
2	*ti*	***s′***	2	--	--
3	*t′*	***s′***	4, 6, 11	--	--
4	*ti*	***si~s′***	7, 13	4	Western Uusimaa
5	*ti~t′*	***s′***	9, 16	--	--
6	*ti~t′*	***si~s′***	12, 14, 17, 18, 19	9	Northern Southwest

(71) Quantitative profiles of predicted variable Apocope dialects

	PARTIAL ORDER	PREDICTED APOCOPE %	
		ti	***si***
7	{MAX$_{\varphi}$ >> *I, MAX$_{\varphi}$ >> MAX}	0	50
9	{MAX$_{\varphi}$ >> MAX, *I >> MAX}	50	100
12	{*I >> MAX$_{\varphi}$, MAX >> MAX$_{\varphi}$}	50	50
13	{MAX$_{\varphi}$ >> *I}	0	33
14	{MAX$_{\varphi}$ >> MAX}	33	67
16	{*I >> MAX}	67	100
17	{MAX >> MAX$_{\varphi}$}	33	33
18	{*I >> MAX$_{\varphi}$}	67	67
19	{}	33	50

(72) Third prediction: *si* → *s′* is at least as frequent as *ti* → *t′*.

(73) The quantitative *t′/s′* asymmetry in the entire corpus (/A/-final 3rd person verbs)

	No Assibilation			Assibilation			TOTAL
No Apocope	*ti*	91.9%	[841]	*si*	53.0%	[499]	[1,340]
Apocope	*t′*	8.1%	[74]	*s′*	47.0%	[443]	[517]
TOTAL		100.0%	[915]		100.0%	[942]	[1,857]

$df = 1$, $X^2 = 350.335564063651$, $p \leq 0.001$

(74) The quantitative *t′/s′* asymmetry in individual dialects

	REGIONAL DIALECT	PATTERN	*t′/ti+t′*	*s′/si+s′*	N
4	Southeast	*ti si t′ s′*	0.32	0.74	273
5-B	Central Savo	*ti si t′ s′*	0.09	0.81	230
7	Central Ostrobothnia	*ti si* -- --	--	--	161
3-B	Central Häme	*ti si* -- --	--	--	134
3-D	South-Eastern Häme	*ti si t′ s′*	0.58	0.89	126
5-C	Central Finland	*ti si* -- *s′*	--	0.89	85
5-A	Northern Carelia	*ti si t′ s′*	0.06	0.25	77
5-F	Kainuu	*ti si* -- --	--	--	76
3-A	Upper Satakunta	*ti si* -- --	--	--	72
6	Southern Ostrobothnia	*ti si* -- --	--	--	70
1-A	Southwest, Northern	*ti si t′ s′*	0.25	0.75	69
9	Northern Finland	*ti si* -- *s′*	--	0.03	62
2-A	Western Uusimaa	*ti si* -- *s′*	--	0.05	54
8	Northern Ostrobothnia	*ti si* -- --	--	--	52
2-E	Pori region	*ti si* -- *s′*	--	0.04	37
5-E	Western Savo	*ti* -- -- --	--	--	36
2-D	Lower Satakunta	*ti si* -- --	--	--	35
11	Vermlanti	-- *si t′ s′*	1.00 [N = 2]	0.97	33
2-C	Turun ylämaa	*ti si* -- --	--	--	32
10	Northwest	*ti si* -- --	--	--	29
5-D	Päijät-Häme	*ti si t′ s′*	0.33	0.96	29
1-B	Southwest, Southern	-- *si t′ s′*	1.00 [N = 1]	0.54	25

12	Ingria	-- *si* -- *s'*	--	0.71	24
3-C	Southern Häme	*ti* *si* -- --	--	--	23
2-B	Somero and Somerniemi	*ti* *si* -- --	--	--	12

(75) Summary of Apocope asymmetries:
(a) The typological asymmetry: If *ti* → *t'*, then also *si* → *s'*.
(b) The quantitative asymmetry: *si* → *s'* is more frequent than *ti* → *t'*.

(76) The same regularity emerges both categorically and quantitatively. See e.g. Pierrehumbert 1994, Anttila 2002b (phonology), Anttila and Fong 2000, in press, Boersma and Hayes 2001, Bresnan, Dingare, and Manning 2001, Bresnan and Nikitina 2003 (syntax, semantics). The difference between categorical and quantitative regularities seems fairly superficial (cf. Newmeyer 2002).

(77) Morphological prediction confirmed: We know of no morphological or lexical conditions on Apocope (see also Rapola 1965:328-30, 1966:493). Examples:
(a) maka-si ~ makas 'lie-PAST'
(b) ol-ta-isi ~ oltais 'be-PASS-COND'
(c) talo-si ~ talos 'house-2P.POSS'
(d) puhtaa-ksi ~ puhtaaks 'clean-TRA'
(e) lapsi ~ laps 'child'

5.3. Alternative hypotheses rejected [optional, omit if no time]

(78) Alternative hypothesis 1: Apocope is driven by postlexical resyllabification and thus preferred prevocalically, e.g. *huus että* (no hiatus), dispreferred preconsonantally, e.g. *huusi vaa* (no coda). No such effect is found.

BETTER SYLLABIFICATION		WORSE SYLLABIFICATION		
huus että	(no hiatus)	*huusi että*	(hiatus)	'shouted that'
huusi vaa	(no coda)	*huus vaa*	(coda)	'just shouted'

/A/-final 3rd person verbs

	_#V	_#C
i	98 (68.1%)	624 (67.1%)
i → Ø	46 (31.9%)	306 (32.9%)

$df = 1$, $X^2 = 0.052024633228$, $p \leq 1$ (not significant)

(79) Alternative hypothesis 2: Apocope is inhibited by consonant cluster avoidance and thus preferred after open syllables, e.g. *huusi* → *huus*, dispreferred after closed syllables, e.g. *mursi* → *murs*. No such effect is found.

(a) *huusi* → *huus* CVVC Prediction: Apocope preferred
(b) *mursi* → *murs* CVCC Prediction: Apocope dispreferred

$\mu\mu$	final cluster results	no final cluster results
i	62 (73.8%)	343 (70.6%)
i → Ø	22 (26.2%)	143 (29.4%)

$df = 1$, $X^2 = 0.364056001916085$, $p \leq 1$ (not significant)

(80) Alternative hypothesis 3: Apocope is lexically marked for a handful of stems (Harms 1968, see Zonneveld 1978:158-9). Problems: (i) Misses the phonological generalization (extrametricality) (ii) Misses the morphological generalization (verbs vs. nouns); (iii) Could not be right anyway since Apocope is postlexical.

6. Summary

7. Evaluating paradigm constraints

7.1. Paradigm uniformity

(81) Laalo (1988: 10-11, 198): The present and past tenses should share enough stem material, measured in segments, to be recognizable as forms of the same lexeme.

	PRESENT	PAST	EXPLANATION
(a)	itää	iti / *isi	2 shared segment is better than 1.
(b)	vuotaa	vuoti~vuosi	Both 3 and 4 shared segments are enough.

(82) (a) Prediction 1: Onsets should count for length.
(b) Prediction 2: Assibilation should become increasingly common with each additional segment while metrical length remains constant.

(83) Test 1: Segmental length predicts similarity, metrical length predicts a difference.

			SEGMENTAL LENGTH	METRICAL LENGTH
(a)	vetä-	CV, μ	2 segments	1 mora
	yltä-	VC, μμ	2 segments	2 moras
(b)	souta-	CVV, μμ	3 segments	2 moras
	ääntä-	VVC, μμμ	3 segments	3 moras

(84) Evidence from Google (December 13, 2003, 3rd person plural forms) supports the metrical hypothesis:

SEGMENTS	MORAS	*ti*	*si*	PATTERN
CV = 2	μ = 1	vetivät 100% [5,770]	vesivät 0% [0]	only *ti*
VC = 2	μμ = 2	yltivät 11.7% [352]	ylsivät 88.3% [2,650]	variation

SEGMENTS	MORAS	*ti*	*si*	PATTERN
CVV = 3	μμ = 2	soutivat 92.3% [349]	sousivat 7.7% [29]	variation
VVC = 3	μμμ = 3	ääntivät 0% [0]	äänsivät 100% [24]	only *si*

(85) Test 2: Segmental length predicts a difference, metrical length predicts similarity

			Segmental length	Metrical length
(a)	itä-	V, μ	1 segment	1 mora
	vetä-	CV, μ	2 segments	1 mora
(b)	yltä-	VC, μμ	2 segments	2 moras
	souta-	CVV, μμ	3 segments	2 moras

(86) Evidence from Google (December 13, 2003, 3rd person plural forms) supports the metrical hypothesis.

Segments	Moras	*ti*	*si*	Pattern
V = 1	μ = 1	itivät 100% [89]	isivät 0% [0]	only *ti*
CV = 2	μ = 1	vetivät 100% [5,770]	vesivät 0% [0]	only *ti*

Segments	Moras	*ti*	*si*	Pattern
VC = 2,	μμ = 2	yltivät 11.7% [352]	ylsivät 88.3% [2,650]	variation
CVV = 3	μμ = 2	soutivat 92.3% [349]	sousivat 7.7% [29]	variation

(87) Conclusion: Onsets don't count for length, contrary to what the paradigm uniformity hypothesis predicts.

(88) Prediction 2: Assibilation should become increasingly common with each additional segment.

(89) Examples of trimoraic and longer stems with varying numbers of segments:
3 segments: *uurtaa* 'make a groove', *ääntää* 'utter'
4 segments: *kiertää* 'turn', *työntää* 'push', *piirtää* 'draw', *alentaa* 'lower'
5 segments: *rakentaa* 'build', *parantaa* 'improve', *ymmärtää* 'understand'
6 segments: *paimentaa* 'shepherd', *suurentaa* 'enlarge', *korventaa* 'scorch'
7 segments: *viännältää* 'twist onseself'

(90) Testing for a phonemic length effect in stems longer than two moras in Laalo's dialect corpus (/A/-final 3rd person verbs only)

Number of segments	3	4	5	6	7	Total
ti	5	359	181	67	1	613
si	5	372	214	87	0	678
Assibilation %	50.0	50.9	54.2	56.5	0	1,291

df = 4, X^2 = 3.32131738521089, p ≤ 1

(91) Conclusion: All stems longer than two moras behave alike, contrary to what the paradigm uniformity hypothesis predicts.

7.2 Antihomophony

(92) Antihomophony (Laalo 1988:12-14, see also Campbell 1975)

	ACTUAL FORM		BLOCKER	
(a)	/kute-i/ → kuti	'spawn-PAST'	/kuse-i/ → kusi	'piss-PAST'
	/nouta-i/ → nouti	'fetch-PAST'	/nouse-i/ → nousi	'rise-PAST'
	/kyntä-i/ → kynti	'plough-PAST'	/kynsi-i/ → kynsi	'claw-PAST'
	/suota-i/ → suoti	'be filtered-PAST'	/suosi-i/ → suosi	'favor-PAST'
	/sorta-i/ → sorti	'oppress-PAST'	/sorsi-i/ → sorsi	'discriminate-PAST'
(b)	/vetä-i/ → veti	'pull-PAST'	/vete/ → vesi	'water'
	/jouta-i/ → jouti	'have time-PAST'	/jouse/ → jousi	'bow'
	/liitä-i/ → liiti	'glide-PAST'	/liisi/ → liisi	'Lisa'
	/vuota-i/ → vuoti	'seep-PAST'	/vuote-i/ → vuosi	'year'
	/tunte-i/ → tunsi	'feel-PAST'	/tunti/ → tunti	'hour'
	/jäätä-i/ → jääti	'freeze-PAST'	/jää-si/ → jääsi	'ice-2P.PX'
	/häätä-i/ → hääti	'evict-PAST'	/hää-t-si/ → hääsi	'wedding-PL-2P.PX'

(93) Antihomophony effects explained (some already noted in Laalo 1988):
- (a) Monomoraic stems (*kuti*, *veti*) do not assibilate for metrical reasons: (*kú.ti*), (*vé.ti*).
- (b) Bimoraic stems exhibit lexical frequency effects (Laalo 1988): high-frequency stems typically assibilate, low-frequency stems typically do not.

(94) Frequencies from three newspaper corpora (25 verbs): AL = *Aamulehti 1999* (16,608,843 word forms); TS = *Turun Sanomat 1999* (11,821,904 word forms), KA = *Kaleva 1998-1999* (9,758,628 word forms) courtesy of the Finnish IT Center for Science, http://www.csc.fi.

AL = token frequency in the *Aamulehti 1999* corpus
AL% = the percentage of *si*-forms in the *Aamulehti 1999* corpus
P-index = the relative goodness of *si* (experimentally derived, Paunonen 1974)
Av. freq. = average token frequency across the three corpora

		AL	TS	KA	AL%	TS%	KA%	P-index	Av. freq.
si	tietää 'know'	637	414	298	100	100	100	+1.83	450
	löytää 'find'	772	590	362	100	100	100	+1.44	575
	huutaa 'shout'	124	82	47	100	100	100	+1.41	84
	pyytää 'ask'	546	384	402	100	100	100	+1.17	444
	lentää 'fly'	323	230	149	100	100	100	+1.14	234
	murtaa 'break'	85	50	30	100	100	100	+0.94	55
	taitaa 'can, may'	307	205	102	100	100	100	--	205
ti~si	soutaa 'row'	11	11	10	18.2	9.1	10.0	–0.28	11
	kiitää 'speed'	--	33	13	--	36.4	76.9	–0.37	15
	häätää 'evict'	8	5	5	0	20.0	0	–0.80	6
	yltää 'reach'	362	293	177	88.4	84.3	85.3	–0.95	277
	liitää 'glide'	8	3	--	12.5	0	--	–0.97	4
ti	hyytää 'freeze'	--	--	1	--	--	0	–0.61	0
	vuotaa 'seep'	41	26	15	0	0	0	–0.70	27
	säätää 'decree'	12	8	13	0	0	0	–1.00	11
	jäätää 'freeze'	1	1	--	0	0	--	–1.07	1
	syytää 'spew'	5	5	--	0	0	--	–1.08	3
	jäytää 'afflict'	1	2	4	0	0	0	–1.09	2
	hoitaa 'care'	242	237	126	0	0	0	–1.10	202
	noutaa 'fetch'	10	13	9	0	0	0	–1.22	11
	sortaa 'oppress'	2	3	2	0	0	0	–1.26	2
	joutaa 'have.time'	4	4	1	0	0	0	–1.28	3
	sietää 'tolerate'	--	--	3	--	--	0	–1.48	1
	kyntää 'plough'	11	4	3	0	0	0	–1.53	6
	suotaa 'filter'	--	--	--	--	--	--	--	0

(95) Total number of tokens 7,887
Average frequency of a verb 110
Average frequency of a *si*-verb 292
Average frequency of a *ti~si* verb 63
Average frequency of a *ti*-verb 22

(96) (a) All verbs where *ti* potentially results from antihomophony are low frequency: *vuoti* (27), *nouti* (11), *hääti* (6), *kynti* (6), *liiti* (4), *jouti* (3), *sorti* (2), *jääti* (1), *suoti* (0).
(b) The only verb where *si* potentially results from antihomophony is high-frequency: *tunsi* (204).

(97) Evidence against antihomophony: no blocking because of lexical frequency.

/huuta-i/ → huusi	'shout-PAST'	/huusi/ → huusi	'outhouse'
/pyytä-i/ → pyysi	'ask-PAST'	/pyy-si/ → pyysi	'partridge-2P.PX'

Average lexical frequencies: *huuti~huusi* (84), *pyyti~pyysi* (444)

(98) Lexical frequency can even tear homonyms apart. Test (Google, December 27, 2003): /pyytä-i-vät/ 'catch with a trap'/'ask'-PAST-3P.PL'

	'catch with a trap'	'ask'	
ti	81% [38]	19% [9]	Total = 47
si	0% [0]	84% [47]	Total = 47

8. Summary

(99) (a) Finnish Assibilation seems to exhibit paradigm uniformity and antihomophony effects (Laalo 1988).
(b) A better analysis is available in terms of level ordering and prosody. No reference to paradigms is required.

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