
Vowel Harmony and Licensing: Stress Sensitivity in Metaphony

Topic:

- **Stress-targeted vowel harmony**
 - Vowel harmony that targets a stressed position.
 - Perceptual motivation.
 - Case studies of Central Veneto and Grado.
 - Relation to other vowel patterns.
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1 Introduction

- (1) **Metaphony**
A vowel harmony, occurring in certain Romance languages, in which a stressed vowel assimilates to a post-tonic vowel. Most commonly involves raising.¹

- (2) *Question*
What causes assimilation between positions of asymmetric prosodic prominence?

- (3) **Two-fold answer**
- a. **Perceptual grounding**
Metaphony causes feature(s) in a perceptually difficult segment to be expressed in a prosodically strong position.
 - b. **Licensing constraint**
In formal terms, metaphony is driven by a licensing constraint which requires that perceptually marked elements belong to a strong position.

2. Metaphony in Central Veneto and Grado

- Veneto: Minor Romance language group spoken in the Veneto region and the island of Grado.

¹ The label “metaphony” has been used in reference to various vowel raising phenomena in Romance, including “a) an incipient phonetic process, b) historic residue, and c) a productive, synchronic process” (Dyck 1995:10) (in some cases restricted to certain morphological categories). The focus here is on type (c).

- Metaphony observed in the Central Veneto variety spoken in the provinces of Rovigo, Vicenza, Padova, and bordering areas of Verona.
- Grado (Friuli region) likewise presents a robust metaphony. Grouped by many scholars with Venetan varieties, because it shows close ties.

Data from Walker (2005) and citations therein. (Other work that discusses the formal analysis of Veneto metaphony includes Calabrese 1988, 1998, Kaze 1989.)

- (4) **Vowel inventory:** ([ATR] contrast among mid vowels after Calabrese 1988, 1998)

	Front	Back	
High	i	u	+ATR
Mid	e	o	+ATR
	ɛ	ɔ	-ATR
Low		a	-ATR

- /ɛ, ɔ/ raise to [e, o] when unstressed.
 - In post-tonic inflectional syllables, the inventory is reduced to [i, e, a, o].
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Data

- **Stressed /e, o/ raise to [i, u] when followed by a high vowel in a suffix.**
Stress typically falls on one of the last three syllables of the word. Observe that:
 - Trigger vowels may be in the final syllable or penult;²
 - Trigger vowels may belong to an inflectional suffix or the stem;
 - Metaphony raises stressed vowels regardless of root/inflectional status;
 - Harmony may terminate at the stressed syllable;³
 - Initiating trigger and stressed target are not restricted to adjacent syllables.⁴Forms marked as “alternate” represent alternate pronunciations for speakers who show variable metaphony, i.e. who produce both raised and unraised forms.

- (5) **Central Veneto**
- | | | |
|----------------|----------------|------------------------------|
| a. b[é]v-o | b[í]v-i | ‘drink’ (1sg/2sg) |
| b. m[ó]v-o | m[ú]v-i | ‘move’ (1sg/2sg) |
| c. sk[ó]lt-o | sk[ú]lt-i | ‘listen’ (1sg/2sg) |
| d. kant-[é]-se | kant-[í]-si-mo | ‘sing’ (1sg/1pl impf. subj.) |
| e. kals-[é]t-o | kals-[í]t-i | ‘sock’ (m sg/pl) |
- (/-et-/ (dim.), lexicalized in this form)

² For some speakers, the pattern shows more variability if the trigger is in the penult.

³ Raising of mid vowels in Central Veneto can variably persist to pretonic vowels as well. See Walker (2005) for discussion.

⁴ For some speakers of Central Veneto, metaphony is obligatory only if the trigger and target belong to adjacent syllables. Such variability is not reported for Grado.

f.	v[í]ndit-a	‘sale, shop’ (f sg)
	(cf. alternate v[é]ndita)	
g.	g[ú]m(b)i-o	‘elbow’ (m sg)
	(cf. alternate g[ó]m(b)io)	
h.	bev-[é]-se	‘drink’ (1sg/2sg impf. subj.)
i.	kont[é]nt-o	‘contented’ (m sg/pl)
j.	[ó]rd[e]n-o	‘order’ (1sg/2sg)

(6) **Grado**

a.	n[é]gr-o	n[í]gr-i	‘negro’ (m sg/pl)
b.	r[ó]s-o	r[ú]s-i	‘red’ (m sg/pl)
c.	r[ó]mp-o	r[ú]mp-i	‘break’ (1sg/2sg)
d.		m[ú]nig-a	‘nun’ (f sg)
		(cf. Trieste: <i>mòniga</i> , Std. Italian: <i>mònaca</i>)	
e.		t[ú]rbi-o	‘cloudy’ (m sg)
		(cf. Std. Italian: <i>tórbido</i>)	
f.	torn-[é]-v-o	torn-[í]-v-i	‘returned, was returning’ (1sg/2sg impf. ind.)
g.	albor-[é]t-o	albor-[í]t-i	‘tree’ (m sg/pl dim.)
h.	mor[ó]s-o	mor[ú]s-i	‘lover’ (m sg/pl)
i.	[é]n[e]n-e	[í]n[í]n-i	‘shin’ (m sg/pl)

- [-ATR] vowels /ε, ɔ, a/ are not affected by metaphony.

(7) **Central Veneto**

a.	v[é]t[ʃ]-o	v[é]t[ʃ]-i	‘old man’ (m sg/pl)
b.	t[ó]k-i	t[ú]k-i	‘piece’ (m pl)
c.	g[á]t-i	g[ú]t-i	‘cat’ (m pl)

(8) **Grado**

a.	b[é]l-o	b[é]l-i	‘beautiful’ (m sg/pl)
b.		m[ó]rt-i	‘dead’ (m pl)
c.		st[á]z-i	‘cellar, storage room’ (m pl)

- When [a] occurs between a trigger and potential target in Central Veneto, it blocks metaphony. (No exx. found in Grado where /a/ intervened between post-tonic /i/ and stressed /e o/.)

(9) **Central Veneto**

la(v)[ó]r-a-v-a	la(v)[ó]r-a-v-i	‘worked, was working’ (1sg/2sg)
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3. Phonetic Foundation for Metaphony

(10) **Proposal: Metaphony is motivated by perceptual markedness of trigger**
Metaphony improves perceptibility of height feature(s) in a vowel that is perceptually difficult (or *perceptually marked*) by causing them to also be expressed in a stressed syllable.

- (11) Related research:
Harmonies that produce assimilation through the full word (i.e. not targeting stressed vowels) motivated by perceptual difficulty (Suomi 1983, Kaun 1995, 2004, Steriade 1995b, Jiménez 1998, Walker 2005).
On modeling phonetic grounding within Con, see Hayes (1999), Smith (2002).

Evidence

- (12) *Perceptual markedness of metaphonic triggers*
- Featural**
 - High vowels
 - Lower amplitude
 - Shorter (e.g. House & Fairbanks 1953, Wells 1962)⁵
 - Prosodic**
 - Unstressed syllable
 - Shorter
 - Lower amplitude
 - Lacks salient pitch contour (Some related observations noted by Majors 1998)
- (13) *Contrastiveness of spreading feature*

a. **Inventory sensitivity:**

Cross-linguistically, phonetically high vowels trigger metaphony only under circumstances of a high/mid contrast in suffix vowels (Dyck 1995).

Lena (Central Asturias region, Spain): Only [u] triggers metaphony:

Underlying suffix Vs		Phonetic realization of suffix Vs	
e	u	i/e	u
	o		o
a		a	

b. **Mid vowels raised due to unstressed vowel reduction are inactive as triggers:**

Only underlying [+high] vowels trigger metaphony in Northern Salentino (Calabrese 1988). Ex. /pareti/ → [paríti], but /parete/ → [paréti] ‘wall’ (pl/sg)

⁵ High and mid Vs might each present perceptual challenges. The perceptual difficulties of high Vs are discussed here. Steriade (1995b) suggests that mid Vs are disadvantaged by being nonperipheral (see also Crosswhite 1999). In Bantu height harmony wherein suffix high Vs assimilate to mid Vs, Steriade suggests that marked [nonperipheral] spreads. But see Hyman (1998, 1999) for a different analysis in terms of ‘plateauing.’

(14) *Improvements for perceptually marked feature in metaphony*

a. Membership in stressed syllable

- Stressed syllables lengthen in Italian (D’Imperio & Rosenthal 1999)
- Increased amplitude

b. Membership in multiple syllables

- Increased duration

(15) *Cross-linguistic implicational hierarchy* (Maiden 1991)

If closed syllables are targeted in metaphony, then open syllables are too.

- Vowels are longer in open syllables in Italian (Maiden 1991, D’Imperio & Rosenthal 1999, D’Imperio 2000).

(16) *Speech perception vs production factors*

a. Coarticulation might favor [i] as metaphony trigger

- In Italian, [i] shows strongest coarticulatory influence (Farnetani et al. 1985).
- [i] tends to show weakest coarticulatory effects from other Vs (e.g. Beddor et al. 2002).

b. Coarticulatory factors play only a secondary role

- [u] can also trigger metaphony; in some cases it is the only trigger.
- Unstressed Vs undergo more V-to-V coarticulation than stressed (e.g. Majors 1998).
- Metaphonic triggers consistently show comparative perceptual weakness (shorter, lower amplitude), and metaphony consistently improves perception of triggers’ height features through their expression in stressed syllable.

4. Analysis: Central Veneto and Grado Metaphony

4.1 Licensing Account

Proposal: Licensing constraint drives metaphony

The grammatical need for perceptually-marked structure to have membership in a prosodically-strong position is instantiated in terms of licensing constraints.

(17) **LICENSE(F, S-Pos)**: “Feature [F] is licensed by association to strong position S.”

The case of perceptually-driven prosodic licensing:

Let: i. *f* be an occurrence of feature [F] in an output O

(optional restrictions: (a) *f* is limited to a specification that is perceptually difficult, (b) *f* belongs to prosodically weak position, (c) *f* occurs in a perceptually difficult feature combination),

ii. *s* be a structural element (e.g. σ , μ , segment root) belonging to perceptually strong position S in O,

iii. and s δ f mean that *s* dominates *f*.

Then ($\forall f$) ($\exists s$) [s δ f].

Walker (2001a, 2005) building on Zoll (1996, 1998). Formulations in a similar spirit discussed by Majors (1998), Crosswhite (1999), and Revithiadou et al. (2005). Other applications and extensions of the positional markedness mode of licensing include Ringen & Vago (1998), Balassa (2000), and Alber (2001), a.o. (also see Goldsmith 1990, Flemming 1993 and Steriade 1995b on indirect feature licensing). On basis for linguistic positional privilege see Steriade (1995b), Beckman (1997, 1998), Zoll (1996, 1997), a.o.⁶

(18) **LICENSE([+high]post-tonic, $\acute{\sigma}$)**:

“[+high] in a post-tonic syllable must be associated with a stressed syllable.”

Restriction to post-tonic syllables:

- Maiden (1995) argues that post-tonic syllables compose a prosodic domain in minor Romance languages of Italy. Evidence includes the following patterns:
 - Vowel reduction (in Southern Lucanian).
 - Vowel neutralization (in Lazio variety of Sant’ Oreste).
 - Vowel deletion (in Central Italian vocatives).
 - Vowel harmony (in Servigliano).
- Not clear whether asymmetrical patterning of pretonic vs. post-tonic syllables has a basis in phonetic weakness or is more abstract in nature (but see Crosswhite 1999, 2004 on Brazilian Portuguese). Further research is needed.

(19) Exemplification

a. Licensing: satisfied

b í v i
 √
 [+high]

b. Licensing: violated

b é v i
 | |
 [-high][+high]

Why licensing?

- Licensing (a.k.a. positional markedness approach) is necessary.
- Patterns in which stressed syllable is the *target* of spreading are not attributable to prioritization of faithfulness in stressed position (Majors 1998, Walker 2001a, 2005).

Compare positional faithfulness (Beckman 1997, 1998)

(20) Hypothesized constraint: **IDENT- $\acute{\sigma}$ -IO(high)**

A segment in a stressed syllable in the output and its correspondent in the input must have identical specifications for [high] (Majors 1998).

⁶ See Frigeni (2004) for a different kind of licensing requirement in the “metaphony” of Southern Sardinian. Note also that prosodic domains play a different role in Southern Sardinian’s vowel harmony from the patterns discussed here.

- (21) Positional faithfulness is inadequate for strong target positions
 “☞” marks attested form, “☹” marks form wrongly selected by tableau.

/bevi/	IDENT-ó(high)	SPREAD(high)	IDENT(high)
a. ☞ bívi	*!		*
b. bévi		*!	
c. ☹ béve			*

Metaphonic trigger determined by phonological positional privilege?

No, while word-final syllables might be special by virtue of edge status, non-final post-tonic syllables are not a privileged position.

Key rankings

- (22) Recall principal pattern:

- Post-tonic high vowels trigger raising of stressed /e, o/ to [i, u].

➤ **Licensing for [+high] produces alternations in stressed syllable.**

- Licensing constraint must outrank IDENT-IO(high) and stressed-syllable faith.

- (23) LIC(+high) >> IDENT-ó-IO(high), IDENT-IO(high)

/bevi/	LIC(+high)	IDENT-ó(high)	IDENT(high)
a. ☞ bívi		*	*
b. bévi	*!		

(Sub-optimality of [béve] is addressed presently.)

➤ **Harmony terminates at stressed syllable.**

- Licensing yields harmony extending to prosodic target and no farther.

- (24) Pretonic vowels are not affected

/morosi/	LIC(+high)	IDENT(high)
a. ☞ morúsi		*
b. murúsi		**!
c. morósi	*!	

➤ **Stressed vowel raising gives way to unstressed vowel lowering.**

- Ranking thus far is silent on which vowel controls assimilation. If resort to morphologically-based faithfulness, lowering of an unstressed suffix V is actually expected to be more harmonic given Root-Faith >> Affix-Faith (McCarthy & Prince 1994).

- (25) LIC(+high) >> IDENT(high)_{Rt} >> IDENT(high)_{Af}

/bev-i/	LIC(+high)	IDENT(high) _{Rt}	IDENT(high) _{Af}
a. ☞ bívi		*!	
b. bévi	*!		
c. ☹ béve			*

Discussion

- *A conceivable solution: Rank Affix-Faith over Root-Faith?*
 - Would not regularly determine control by the unstressed vowel, because metaphony also operates affix-to-affix and among stem Vs.
 - Ranking affix faith over root faith is undesirable on cross-linguistic and functional grounds (cf. Majors 1998, Krämer 2001).
- *Is root recoverability truly sacrificed?* Yes, metaphony has capacity to neutralize lexical/root contrasts in Central Veneto:

(26) a. ségar ‘to mow (wheat)’ ség-o/te **sf-g-i** (1 sg/2 sg)
 b. sigar ‘to shout, to cry out’ sf-g-o/te **sf-g-i** (1 sg/2 sg)
- *Could affix control be achieved by avoiding inflectional merger?* No, metaphony occurs even where affix lowering would not produce neutralization in paradigm.⁷

(27) a. mov-e-v-i → muvúvi ‘move, was moving’ (2sg impf. ind.) *movéve
 No –e-v-e imperfective structure
 b. fas-e-vi-mo → fasúvimo ‘did’ (1pl impf. ind.) *fasévemo
 No –e-ve-mo imperfective structure
- *Would stipulating regressive feature extension assist?* No, such constraints evaluate output configurations only; hence (25a) and (25c) tie on regressive feature extension.

Proposal: Unstressed high vowels control harmony via prominence reduction

Prominence reduction (Prince & Smolensky 1993/2004, Kenstowicz 1996, Crosswhite 1999)
 “The weak get weaker”

- (28) Prominence reduction scale: (Crosswhite 1999)
 *ǃ/Son≥a >> *ǃ/Son≥e,ɔ >> *ǃ/Son≥e,o >> *ǃ/Son≥i,u

Independent activity in languages of Italy:

- Raising of unstressed /ε, ɔ/ → [e, o] in Veneto and Std. Italian (Crosswhite 1999).
- Raising of unstressed /ε, ɔ, e, o/ → [i, u] in Northern Salentino (Calabrese 1985).

⁷ See Dillon (2004) for a proposal that certain metaphony patterns are an effect of morpheme realization interacting opaquely in the system to produce double-exponence of a morpheme.

- (29) Kinds of unstressed syllable markedness: [e o] vs. [i u]
- Prominence reduction: [e o] more marked.
 - Perceptibility (e.g. of a distinctive height feature): [i u] more marked.
- Although unstressed non-high vowels are tolerated in Veneto, structures that *derive* this marked structure from high vowels are avoided.

Avoidance of derived marked structure

- An effect of local conjunction (Smolensky 1993, 1997) of markedness and faithfulness constraints (Lubowicz 2002; see also Bakovic 2000, Itó & Mester 2003, cf. McCarthy 2002).

(30) * \check{O} /Sonze,o &seg IDENT-IO(high):

If a segment violates * \check{O} /Sonze,o, it must not violate IDENT-IO(high), and vice versa.

(31) Evaluating violations of * \check{O} /Sonze,o & IDENT(high): Schematic vowel pairings

Input	Output	* \check{O} /Sonze,o & IDENT-IO(hi)	* \check{O} /Sonze,o	IDENT-IO(hi)
e • i	é • e high \check{v} lowering	*	*	*
e • i	í • i mid \acute{v} raising			*
e • e	é • e Both Vs faithful		*	

- In order to compel raising, the local conjunction and licensing outrank stressed syllable faithfulness and root faithfulness.

(32) * \check{O} /Sonze,o & IDENT-IO(high), LIC(+high) >> IDENT- \acute{o} -IO(high), IDENT(high)_{Rt}

/bev-/i	* \check{O} /Sonze,o & IDENT(hi)	LIC (+high)	IDENT- \acute{o} (high)	IDENT (high) _{Rt}	IDENT (high) _{Af}
a. $\text{b}^{\text{e}}\text{v}^{\text{i}}$ bívi			*	*	
b. béve	*!				*
c. bévi		*!			

(33) Further details

- [-ATR] vowels /e, o, a/ do not raise: *[+high, -ATR], IDENT-IO(ATR) >> LIC(+high).
- * \check{O} /Sonze,o & IDENT-IO(high) >> LIC(+high) to prevent post-tonic high Vs from lowering in cases where licensing is violated (ex. [béli] ‘beautiful (masc. pl.)’ *[bele]).
- Blocking by /a/ in Central Veneto. Attributable to universal illformedness of gapped feature linkage (Archangeli & Pulleyblank 1994, 2002, Pulleyblank 1996, Walker 1998, Ni Chiosáin & Padgett 2001, note also Gafos 1996 on Articulatory Locality).

(34) Summary

- Metaphony driven by licensing: perceptually-difficult height features require membership in a stressed syllable.
- Prominence reduction determines capitulation of stressed vowel in favor of unstressed.
- Positional faithfulness (prosodic, morphological) does not determine the pattern.
- Core ranking:
* \check{O} /Sonze,o &seg IDENT(high), LIC(+high) >> IDENT- \acute{o} (high), IDENT(high)_{Rt}
i.e. “No- \check{O} -Lowering,” “Licensing” >> Stressed- σ -Faith, Root-Faith
- Some contributions of OT:
 - Ranked and violable nature of constraints allows reconciliation of harmonies whose trigger is regulated by markedness (e.g. metaphony) vs. harmonies whose trigger is regulated by faithfulness to a strong position.
 - Conjunction of prominence reduction and faith obtains derived environment effect using independently motivated simplex constraints.

4.2 Alternatives

(35) To prevent suffix lowering:

Split IDENT(+high)/(-high) and prioritize IDENT(+high) in metaphony.

- Not clear that faith specific to individual *height* feature specifications is firmly motivated or necessary. At least two studies of height harmony suggest not (Beckman 1997, Bakovic 2000; the latter chiefly [ATR]).
- Cross-linguistic study supports scale of faithfulness constraints for vowel height wherein faith for *non-high* vowels is prioritized (Howe & Pulleyblank 2004).
- Misses connection to activity of prominence reduction in Veneto and many other Romance languages — unstressed vowels may raise but resist lowering. True even when [+high] is not involved (e.g. /e, o/ → [e, o]).

(36) Harmony imperative:

Blind leftward spreading in metrical foot, no reference to stress (Flemming 1993)

- Lacks perceptual grounding. Therefore misses generalization that metaphony is triggered by high vowels across Romance.
- Targeting of foot head is epiphenomenal. Does not capture perceptual advantage of extending [+high] to a prosodically strong position. (Note also patterns in §5 which involve other licensed features and other licensing positions.)
- Foot form: When a final high V triggers raising in antepenult it is not clear that trigger and target belong to same foot. A suggested scenario involves adjunction of extrametrical syllable to final binary foot (Flemming 1993), a debatable structure.

5. Other Strong Target Vowel Patterns

(37) **Stressed syllable:**
Ranking: LICENSE(Weak-struc, ó) >> IDENT-ó

(38) Umlaut:

- **Old High German:** High front vowel or glide in unstressed syllable produces fronting of preceding stressed back vowels (Ellis 1953, Robinson 1976, Flemming 1993).

<u>Unfronted</u>		<u>Fronted</u>	
fáran	‘to go’	fērit	‘goes’
kálb	‘calf’	kélbir	‘calves’
gást	‘guest’	gésti	‘guests’

cf. No fronting triggered by stressed Vs: [kráftliħ] ‘strong’ *[kréftliħ]

(39) Metathesis: Licensing also supercedes LINEARITY

- **Kwara’ae:** Final vowel undergoes devoicing or deletion in normal or rapid speech, with compensatory transfer of final vowel content to stressed syllable (“compensatory metathesis,” Blevins & Garrett 1998).

<u>Citation form</u>	<u>Normal form</u>	
físi	huĩsĩ	‘cat’
kádo	kaqdo	‘thin’
láde	laeg’d	‘coral gravel’
asíla	asiql	‘salty, sweet’

(40) **Root/stem syllable:**
Ranking: LICENSE(Weak-struc, Root/Stem) >> IDENT-Root/Stem

(41) Raising triggered by high (elided) suffix vowel:

- **Nzebi:** Latent suffix /-i/ induces raising of nearest preceding full root vowel. Latent suffix vowel is pronounced in deliberate speech or when followed by an enclitic (Guthrie 1968, Clements 1991; see Kirchner 1996 for analysis of step-wise raising).

<u>Unraised</u>	<u>Raised</u>	
-bet-	bit(-i)	‘to carry’
-kolən-	kulin(-i)	‘to go down’
-βeed-	βeed(-i)	‘to give’
-niod-	niod(-i)	‘to drink’
-sal-	sel(-i)	‘to work’
-kasəl-	kesil(-i)	‘to tear’

- **Vata:** Optional raising of stem /e, o/ before suffixal [-i] (Kaye 1982).

<u>Singular</u>	<u>Plural</u>		
bova	buv̥i ~ bovi	‘crab’	
jele	jili ~ jeli	‘lizard’	(tones omitted)

(42) Other licensing by root/stem:

- **Somali:** Determiner suffixes cause final vowel in noun stem to harmonize (Saeed 1993, Borowsky 2000).

meelo	‘places’	meeláħa	‘the places’	(accent marks high tone)
furé	‘key’	furáħa	‘the key’	
báre	‘teacher’	baríħii	‘the teacher’	(remote)

- **Hungarian:** a mid short front suffix vowel must be preceded by a round vowel in the root (morphologically strong) or a rounded vowel other than a short mid vowel (Ringen & Vago 1998; Kaun 1995 argues that rounding in front, non-high Vs is perceptually weak).

fül	‘ear’	fül-höz	(allative)
víz	‘water’	víz-hez	(allative)
		víz-ünk-höz	(1pl poss. allative)

6. Concluding Remarks

(43) Complexity of markedness: Diverse factors

Metrical: Prominence reduction and loss of contrast in an unstressed syllable.

- “unmarked” vowel quality is often high.

Contrast perception: Perceptibility of mid/high contrast in an unstressed syllable.

- “unmarked” vowel quality can be mid. Advantages: greater duration and amplitude.

Articulation: Minimizing effort in production.

- “unmarked” vowel quality can be non-peripheral, e.g. mid or [ə]. Alternatively, coarticulation could favor vowel harmony.

Implications for epenthetic vowel qualities merits further exploration. (Uffmann 2004 provides some relevant discussion. See Campos 2006 for a proposal to encode contrastiveness of features explicitly in the representation.)

(44) Weak trigger control

- Source of control by weak positions in patterns in §5 (excepting Hungarian) remains to be determined within the context of each linguistic system. Morphological factors might play a role (cf. Dillon 2004).
- “Too-many-solutions” problem: Stress does not shift to a high unstressed suffix vowel. See Blumenfeld (to appear) for a proposal.