

Phonologically Conditioned Affix Order

Johanna Benz
Universität Leipzig
benz.johanna@web.de

1 Introduction

Claim: Affix order can be phonologically conditioned. This phenomenon can contribute to our understanding morphology-phonology interactions.

Today:

- What characterizes phonologically conditioned affix order (PCAO)?
- A closer look at Washo: Data and a Stratal OT analysis
- Failing alternatives: Parallel OT and Subcategorization
- What phonological information is available to morphology? Insights from PCAO
- Phonologically Conditioned Clitic Placement (PCCP) as PCAO on a later stratum

2 PCAO

- “phonologically conditioned affix order”: semantically and/or morphologically unexpected affix order triggered by phonological constraint(s)
- note: phonological factors could (accidentally) also contribute to “expected” affix orders, but these patterns would be difficult to detect

- a first example of “unexpected” affix order: in Witsuwit’en (Athabaskan), the negative prefix *s-* and various tense/aspect prefixes such as the progressive prefix *ε-* appear in two different respective orders (Hargus & Tuttle 1997):

- (1) a. we-c’-ε-s-ʔεnʔ
 NEG-OBJ-PROG-NEG-see
 “s/he doesn’t see anything”
 b. we-c’-[ə]-s-ε-xw-ʔεnʔ
 NEG-OBJ-[epenth]-NEG-PROG-2PL-see
 “you (pl.) don’t see anything”

- according to Hargus & Tuttle (1997) (1-b) is the underlying order, but negative *-s* prefers to be syllabified in coda position and can undergo metathesis to achieve this (1-a) *unless* doing so results in a violation of *COMPLEX
- object markers in Moro (Niger-Congo) occur as prefixes or suffixes depending on tonal properties of the roots and the markers themselves (Jenks & Rose 2015), in that H-bearing object markers occur as prefixes on verb forms with the “default” tone pattern but as suffixes on verbs with the “all-H” or “no-H” pattern

- (2) PROXIMAL IMPERFECTIVE WITH 3SG OBJECT MARKER
- a. g-a-wándaṭ-a g-a-ḡó-wándaṭ-a “watch”
 b. g-a-váleḏ-a g-a-ḡó-váleḏ-a “pull”
- (3) PROXIMAL IMPERATIVE WITH 3SG OBJECT MARKER
- a. wándaṭ-ó wándaṭ-ó-ḡó “watch”
 b. váleḏ-ó váleḏ-ó-ḡó “pull”

- analysis in Jenks & Rose 2015: the object markers are suffixes by default (corresponding to the postverbal positions of objects in Moro), but can appear in prefix position in order to contribute to the “default” tone pattern (essentially as a low-cost way of getting a high tone to the left edge of the macrostem)¹

¹this analysis uses a very high number of theoretical devices, such as construction-specific cophologies producing the three tone patterns, lexically specified positions for all affixes *except* the object markers and several prosodic domains (macrostem, inflectional stem, verb stem, verb) which also introduce cophologies

- Kim (2008, 2010) shows that certain affixes in Huave verbs appear either as prefixes or suffixes depending on the phonological properties of the base to which they attach²

- (4)
- a. i-**m**-a-rang
FUT-SB-TV-do
“s/he will do (it)”
 - b. mojk-o-**m**
face.down-TV-SB
“ (that) s/he lies face down”
 - c. **m**-e-mojk-o-r
SB-2-face.down-TV-2I
“ (that) you (sg.) lie face down”

- in Kim’s account, the “mobile” affixes are attached cyclically, and are aligned to the right by default (by a general morphological alignment constraint requiring them to be suffixes) *unless* that would result in a violation of *COMPLEX, in which case they appear as prefixes instead
- the position of the theme vowel in Huave is lexically specified, leading Wolf (2008) to speculate that the mobile affixes might simply stay adjacent to the theme vowel, giving the illusion of a phonological condition. (4-c) shows that this is not a valid alternative.
- an ideal case of PCAO should:
 1. affect more than one affix, to make clear that the process refers to general phonological properties, and affect all affixes that *have* the relevant phonological properties
 2. affect affixes which are longer than one segment, to rule out purely phonological metathesis
 3. (resist reanalysis as infixation or allomorphy)
- Washo fulfills these criteria
- in addition, phonological constraints in Washo not only trigger but also block PCAO

²see Fulmer (1991) for a similar claim for Afar verbs

3 Washo: a closer look

- affix order in Washo is *non-transitive* (cf. Ryan 2010) and *opaque* (cf. Stiebels 2003), **but the deviations from “expected” affix order are not random, they can be explained by a phonological condition on affix order: NONFINALITY-triggered avoidance of a stem-final stressed syllable**
- Washo (isolate, North America) is polysynthetic, mostly suffixing
- data from Jacobsen (1964, 1973), who also identified the pattern as phonologically conditioned

- (5) geyúliyé:sha
ge-yúli-é:s-ha
IMP-die-NEG-CAUS
“Don’t kill it!”

First observations and further information:

- affix order in (5) is semantically opaque
- stress behaves much like lexical stress: in particular, we will see that some affixes, such as negative *-é:s*, and most verbal roots always bear stress independently of their position in the word
- usually in Washo, causative *-ha* appears close to the verbal root, while negative *-é:s* appears relatively late in the stem³

- (6) yúlihayayʔi
∅-yúli-ha-ayʔ-i
3 SBJ-die-CAUS-INT.PST-IND
“He killed it.”

- (7) lémaʔášaʔé:si
le-ímeʔ-ášaʔ-é:s-i
1 SBJ-drink-NEAR.FUT-NEG-IND
“I am not going to drink.”

³Abbreviations: 1 SBJ: first person subject, DU.INCL: dual inclusive, PL.INCL: plural inclusive, NEAR.FUT: near future, DIST.FUT: distant future, INT.FUT: intermediate future, IND: independent mood, NEG: negation, Q: interrogative, DEP: dependent mood, REDUN: redundant, OPT: optative, CAUS: causative, REC.PST: recent past INT.PST: intermediate past, IMP: imperative, DUR: durative, TRANS: transitory, INCH: inchoative, SR: switch reference

Table 1: Partial template of the Washo verb based on Jacobsen (1964)

slot	-1	0	+1	+2	+3	+4	+5	+6	+7
morphemes	PERS.SUBJ	Verb	INCH	PL.INCL	NEAR.FUT	NEG	REC.PST	IND	SR
	PERS.OBJ		TRANS	DU.INCL		Q	DIST.FUT	DEP	
	IMP			CAUS			INT.FUT	REDUN	
				DUR				OPT	

- with this in mind, consider (8) and (9) (repeated from (7))

(8) lémeʔhuyášaʔi
 le-ímeʔ-**hu-ášaʔ-i**
 1 SBJ-drink-**PL.INCL-NEAR.FUT-IND**
 “We (incl.) are going to drink.”

(9) lémaʔášaʔé:si
 le-ímeʔ-**ášaʔ-é:s-i**
 1 SBJ-drink-**NEAR.FUT-NEG-IND**
 “I am not going to drink.”

- from (8)-(9) we might infer: if **PL.INCL-NEAR.FUT** and **NEAR.FUT-PL.INCL**, then **PL.INCL-NEG**

- instead, we find *non-transitive* **NEG-PL.INCL**

(10) lémeʔé:shuyi
 le-ímeʔ-**é:s-hu-i**
 1 SBJ-drink-**NEG-PL.INCL-IND**
 “We (incl.) are not drinking.”

More affixes in unexpected places:

(11) lémeʔé:silegi
 le-ímeʔ-**é:s-ši-leg-i**
 1 SBJ-drink-**NEG-DU.INCL-REC.PST-IND**
 “We (both of us) didn’t drink.”

(12) lémeʔhéhé:šhugabi
 le-ímeʔ-**hé:š-hu-gab-i**
 1 SBJ-drink-**Q-PL.INCL-DIST.FUT-IND**
 “Are we (incl.) going to drink?”

- (13) gayáhayetihé:šha-i-š
ge-yáha-eti?-**hé:š-ha**-i-š
3OBJ-hurt-INCH-Q-CAUS-IND-SR
“Perhaps it started to hurt him.”
- (14) lakLášdimé:shayiŋa
le-kLášdim-**é:s-ha**-i=ŋa
3SBJ.1OBJ⁴-hide-NEG-CAUS-IND=but
“But (they) don’t conceal it from me.”
- (15) ʔumk’uyéʔešlelhé:šušī
ʔum-k’uyéʔeš-lel-**hé:š-uš**-i
2SBJ-swim-TRANS-Q-DUR-IND
“Have you been swimming any?”

- common to all these cases: an unstressed affix appears further to the right than expected
- as we will see, this position is the right edge of the stem
- I will analyze this dislocation of an unstressed suffix to the right as a repair mechanism triggered by NONFINALITY
- NONFINALITY is never violated at the word level on the surface in finite verbs because of the unstressed word-level suffixes
- at the stem level, however, stems ending in a stressed suffix such as negative *-é:s* or interrogative *-hé:š* would violate NONFINALITY, triggering reordering of the affixes
- informally: instead of shifting or deleting the stress, the language shifts the entire affix

4 Washo verbs in Stratal OT


- Stratal Optimality Theory is a version of OT that abandons completely parallel evaluation
- completely parallel OT often fails where rule-based accounts rely on cyclic rule application or opaque rule interactions (Kiparsky 2015)

⁴sic

- in Stratal OT, forms are evaluated several times, (at least) once per stratum. The ranking of constraints at each stratum can be different.
- stratal organization of Washo morphology and phonology:
- Stratum 0 “extended root”: reduplication, stress assignment (see Yu 2005)
- Stratum 1 “stem”: affixation stem-level affixes, **PCAO**
- Stratum 2 “word”: affixation word-level affixes
- Stratum 3 “phrase”
- suffixes in Washo form two classes: *stem-level* (cf. Jacobsen 1964 stem-formative suffixes) and *word-level* (cf. Jacobsen 1964 prefinal and final suffixes, slots +5 and +6 in Table 1). Evidence for the “cut-off point” comes from imperatives and nominalizations, which include stem-level, but not word-level affixes. Some stem-level suffixes bear inherent stress, all word-level suffixes are unstressed.

- (16) lémeʔé:shuyi
 le-ímeʔ-é:s-hu-i
 1 SBJ-drink-NEG-PL.INCL-IND
 “We (incl.) are not drinking.”

Stratum 1: Stem-level suffixes (simplified)

	/ímeʔ/, /hu/, /é:s/	NONFINALITY	NEG-R	INCL-R
(17)	a. ímeʔ-hu-é:s	*!		*
	 b. ímeʔ-é:s-hu		*	

- morphemes are unordered in the Input, only stem-level affixes present
- NEG-R: assign * for every morpheme intervening between NEG and the right edge of PrWd (compare McCarthy & Prince 1993)
- NONFINALITY: assign * for a stressed syllable that is final in PrWd (Prince & Smolensky 2004)
- in addition, at least two further phonological constraints have to be considered:

- MÁX: assign * for a syllable that is stressed in the Input but not in the Output (cf. Pater 2000)
- *CLASH: assign * for a stressed syllable that is immediately followed by another stressed syllable (Kager 1999)
- morphologically preferred order (**semantically transparent, transitive**) encoded in morpheme alignment constraints (also see Potter 1996, who relates alignment constraints to the Mirror Principle (Baker 1985))
- **NONFINALITY can cause violation of alignment**, but alignment is violated minimally
- if the last syllable is not stressed in the candidate with the order of affixes corresponding to the ranking of alignment constraints at the time of evaluation of Stratum 1, NONFINALITY will be satisfied and the order will stay as expected, as in (18) (repeated from (8))

- (18) lémeʔhuyášaʔi
 le-ímeʔ-**hu-ášaʔ**-i
 1 SBJ-drink-**PL.INCL-NEAR.FUT-IND**
 “We (incl.) are going to drink.”

	/ímeʔ/, /hu/, /ášaʔ/	*CLASH	MÁX	NONFIN	NEAR.FUT-R	INCL-R
(19)	☞ a. ímeʔ-hu-ášaʔ					*
	b. ímeʔ-ášaʔ-hu				*!	

- NONFINALITY-driven reordering is blocked exactly in the cases where it would give rise to a clash, as in (20) (repeated from (7), (9))

- (20) lémaʔášaʔé:sɪ
 le-ímeʔ-**ášaʔ-é:s**-i
 1 SBJ-drink-**NEAR.FUT-NEG-IND**
 “I am not going to drink.”

	/ímeʔ/, /ášaʔ/, /é:s/	*CLASH	MÁX	NONFIN	NEG-R	NEAR.FUT-R
(21)	☞ a. ímeʔ-ášaʔ-é:s			*		*
	b. ímeʔ-ášaʔ-es		*!			*
	c. ímeʔ-é:s-ášaʔ	*!			*	
	d. ímeʔ-es-ášaʔ		*!		*	

- on Stratum 2, prefixes and word-level suffixes are added. The word-level suffixes are never stressed, so they never violate the phonological constraints active at the stem level
- note that re-ranking is not crucial here: what *is* crucial is that the final suffix *-i* is evaluated late, too late to satisfy NONFINALITY at the stem level

(22)

/ímeʔé:shu/, /le/, /i/	P-L	MOOD-R	*CLASH	MAX-STR	NONFIN
a. le-ímeʔé:shu-i		*!			
☞ b. le-ímeʔé:shu-i					
c. ímeʔé:shu-le-i	*!				

5 Evaluating alternatives

- two crucial aspects of this analysis: its use of $P \gg M$ and its use of a strata

5.1 Subcategorization

- Paster (2006a,b, 2009) claims that all cases of PCAO can be reanalyzed as segmental metathesis or infixation
- claim for Washo: “[...] stressed suffixes subcategorize for a foot to their left.” (Paster 2006a:229)

(23) lémaʔášaʔé:shuyi
 le-ímeʔ-ášaʔ-é:s-hu-i
 1 SBJ-drink-NEAR.FUT-NEG-PL.INCL-IND
 “We (incl.) aren’t going to drink”

(24) a. *le-[ímeʔ]_{Ft}-é:s-hu-ášaʔ-i
 b. *le-[ímeʔ]_{Ft}-hu-[ášaʔ]_{Ft}-é:s-i
 c. (i) le-[ímeʔ]_{Ft}-ášaʔ-hu ½
 (ii) le-[ímeʔ]_{Ft}-[ášaʔ]_{Ft}-é:s-hu-i

- (23) is a more complex example where plural inclusive *-hu* is displaced to the right across two other affixes
- (24) shows that the subcategorization approach fails to predict the attested affix order

- this is not surprising considering that Paster (2009) explicitly states that subcategorization predicts only pairwise ordering effects
- in the $P \gg M$ system, the more global reordering effects in (23) are predicted and accounted for

	/ímeʔ/, /hu/, /ášaʔ/, /é:s/	*CLASH	MÁX	NONFIN	NEG-R	N.FUT-R	INCL-R
	a. ímeʔ-hu-ášaʔ-é:s			*!		*	**
(25)	b. ímeʔ-hu-ášaʔ-es		*!			*	**
	☞ c. ímeʔ-ášaʔ-é:s-hu				*	**	
	d. ímeʔ-é:s-hu-ášaʔ				**!		*
	e. ímeʔ-é:s-ášaʔ-hu	*!			**	*	

5.2 Completely Parallel OT

- the first and most obvious problem for capturing Washo PCAO in a completely parallel OT analysis is that it cannot be triggered by NON-FINALITY: because of the word-level suffixes, the stressed affixes are never final in finite verbs (the analysis would still work for imperatives but only because they never take word-level suffixes, see strata justification above)
 - this problem could be avoided by bracketing the stem as a prosodic domain and relativizing NONFINALITY to this domain, but that would amount to reintroducing levels by force into a system that should not have them
 - an alternative trigger: foot parsing into syllabic trochees⁵
- (26)
- *ge-(yúli)-ha-é:s → ge-(yúli)-(é:s-ha)
 - *le-(ímeʔ)-hu-(ášaʔ)-é:s-i → le-(ímeʔ)-(ášaʔ)-(é:s-hu)-i
 - *le-(ímeʔ)-ši-é:s-leg-i → le-(ímeʔ)-(é:s-ši)-leg-i
- however, (26) shows that neither the prefixes nor the prefinal and final suffixes can *count* for foot parsing because parsing them would bleed the change in affix order. For example in (26-c), if the prefinal suffix *-leg* was visible to foot parsing, there would be no reason for *-ši* to dislocate because *-é:s* would already be the head syllable in a syllabic trochee:

⁵these feet are different from the ones in the subcategorization approach above. I have given each analysis the benefit of assuming the foot structure that gets closest to deriving the pattern

(27) *le-(íme?)-ši-(é:s-leg)-i

- ALL-FT-LEFT: Every foot stands at the left edge of the PrWd (Kager 1999:157), which would make the necessary distinction between (26-c) and (27) cannot be high-ranked in Washo because it would also left-align *-áša?* in the absence of *-é:s* or *-hé:š:* le-(íme?)-hu-(áša?)-i → *le-(íme?)-(áša?)-hu-i
- it follows that the same affixes that were invisible in the stratal approach by virtue of belonging to a different stratum have to be *made* invisible in the foot-parsing approach
- note that this idea has the unattractive property that the feet are constructed around pre-specified stress marks, they are not linked to stress assignment nor do they have any other visible effect on the phonology

6 The availability of phonological information

- in the analysis developed above, phonological constraints and morpheme alignment constraints are ranked inside a single module which is organized into several strata
- are the morpheme alignment constraints the weak point of this analysis? No:
- there is no consensus (or discussion) on how to get morphemes in order in Stratal OT. Kiparsky (2017) treats Stratal OT as the OT version of Lexical Morphology and Phonology (LMP), while Bermúdez-Otero (2012:fn 43) explicitly states that “ordering relationships are fully specified by the time phonological inputs have been assembled”, leaving the phonology compatible with a wider range of morphological theories

Excursus:

- but how compatible is it really with, for example, Distributed Morphology (DM)? imagine DM determines morpheme order and phonology later has the power to change it (Washo: NONFINALITY works against faithfulness to the input order instead of alignment)

1. phonology would still have to see and respect morpheme boundaries
2. morpheme order would be determined at least twice
3. obscuring locality in morphology
4. strata cannot straightforwardly be read off syntactic structure (see Newell 2015) - so how are parts of the structure assigned to each stratum?

- I conclude that a real $P \gg M$ analysis of PCAO is preferable to “staying neutral” about morphology
- there are disadvantages: one way affix order can be unexpected is by not conforming to the Mirror Principle - but the Mirror Principle does not follow from morpheme alignment constraints, their ranking is stipulated (while the expected transitivity *does* follow)
- $P \gg M$ has also been claimed to lack the necessary restrictions (Paster 2006, Embick 2010): why don’t we see global reordering of all morphemes in a word due to a phonological principle? (similarly: why are there locality restrictions on phonologically conditioned allomorphy?)
- this argument loses force in a theory that is not completely parallel (see Kim (2008) and Deal & Wolf (2017) (for PCSA))
- Bracket Erasure: the output of Stratum 1 enters evaluation at Stratum 2 in a single chunk, no internal morphological structure is visible or can be manipulated
- this is a major source of restriction because it means that morphemes cannot be reordered once they have passed through a stratum (or allomorphs reselected etc.)


7 PCCP

- according to Noyer (1994), the Warlmanpa (Pama–Nyungan) reflexive clitic =*nyanu* follows person and number clitics except for the second person =*n*, which it precedes

- (28) a. =na=nyanu
 =1=REFL
 b. =lu=nyanu
 =PL=REFL
 c. =pala=nyanu
 =DU=REFL
 d. *=n=nyanu
 =2=REFL
 e. =nyanu=n
 =REFL=2

- this can be analyzed as triggered by a phonological ban on (sonorant) geminates (Wolf 2008)

(29)

/nyanu/, /n/	*NN	REFL-R	PERS-R
a. =n=nyanu	*!		*
 b. =nyanu=n		*	

- in a Stratal OT system which allows for $P \gg M$, phonologically conditioned clitic placement (PCCP) is predicted, corresponding to PCAO at a higher level
- this level could be the word (that is presumably sufficient for the Warlmanpa data above) or phrase level (or potentially a dedicated clitic stratum as proposed by Rubach (2011))
- this proposal is in line with Anderson’s (1992, 2005) theory that clitics *are* phrasal affixes
- Anderson (2005) discusses second-position clitics in Tagalog
- when several second-position clitics co-occur in Tagalog, their order is monosyllabic pronouns before particles before disyllabic pronouns:

- (30) nakikita =ka =na =niya
 see =2SG =already =3SG.M
 “He sees you now.”

- according to Anderson, the difference in behavior between monosyllabic and disyllabic pronouns follows from the fact that while both are prosodically defective, the disyllabic clitics project their own foot,

which can only be adjoined to the prosodic word at the right edge - conflicting with a general pressure for the clitics to appear as far to the left as possible

8 Conclusion

- PCAO exists
- a $P \gg M$ approach in Stratal OT allows us to capture a complex interaction between morphology and phonology in a simple and transparent constraint system
- this approach predicts comparable phenomena at different strata
- however, each process of PCAO is contained within one stratum, restricting the globality of the process as well as potentially introducing opacity

References

- Anderson, Stephen R. (1992): *A-Morphous Morphology*. Cambridge University Press, Cambridge.
- Anderson, Stephen R. (2005): *Aspects of the theory of clitics*. Oxford University Press, Oxford.
- Baker, Mark C. (1985): 'The mirror principle and morphosyntactic explanation', *Linguistic Inquiry* **16**, 373–415.
- Bermúdez-Otero, Ricardo (2012): The architecture of grammar and the division of labour in exponence. In: J. Trommer, ed., *The morphology and phonology of exponence*. Oxford University Press, Oxford, pp. 8–83.
- Deal, Amy Rose and Matthew Wolf (2017): Outwards-sensitive phonologically-conditioned allomorphy in Nez Perce. In: V. Gribanova and S. Shih, eds, *The Morphosyntax-Phonology Connection*. Oxford University Press, Oxford, pp. 29–60.
- Embick, David (2010): *Localism versus globalism in morphology and phonology*. MIT Press, Cambridge.
- Fulmer, Sandra L. (1991): Dual-position affixes in Afar: An argument for phonologically-driven morphology. In: A. Halpern, ed., *Proceedings of the Ninth West Coast Conference on Formal Linguistics*. CSLI, Stanford, p. 189–203.
- Hargus, Sharon and Siri G. Tuttle (1997): 'Augmentation as affixation in Athabaskan languages', *Phonology* **14**, 177–220.

- Jacobsen, William H. (1964): A grammar of the Washo language. PhD thesis, University of California, Berkeley.
- Jacobsen, William H. (1973): A rhythmic principle in Washo morphotactics. Presentation at Symposium on California Indian Linguistics.
- Jenks, Peter and Sharon Rose (2015): ‘Mobile object markers in Moro: the role of tone’, *Language* **91**, 296–307.
- Kager, René (1999): *Optimality Theory*. Cambridge University Press, Cambridge.
- Kim, Yuni (2008): Topics in the Phonology and Morphology of San Francisco del Mar Huave. PhD thesis, University of California, Berkeley.
- Kim, Yuni (2010): ‘Phonological and morphological conditions on affix order in Huave’, *Morphology* **20**, 133–163.
- Kiparsky, Paul (2015): Stratal OT: a synopsis and FAQs. In: Y. E. Hsiao and L.-H. Wee, eds, *Capturing phonological shades within and across languages*. Cambridge Scholars Publishing, Newcastle upon Tyne, pp. 2–44.
- Kiparsky, Paul (2017): Vindicating Lexicalism. Brugmann-Fellow lectures on Stratal OT in Phonology in Morphology given July 2017 in Leipzig.
- McCarthy, John J. and Alan Prince (1993): Generalized Alignment. In: G. E. Booij and J. van Marle, eds, *Yearbook of Morphology 1993*. Kluwer, Dordrecht, p. 79–153.
- Newell, Heather (2015): Phonology without strata. In: S. Vinerte, ed., *Actes du Congrès de l’ACL 2015 -2015 CLA Conference Proceedings*. .
- Noyer, Rolf (1994): Mobile affixes in Huave: Optimality and morphological wellformedness. In: E. Duncan, D. Farkas and P. Spaelti, eds, *Proceedings of the Twelfth West Coast Conference on Formal Linguistics*. CSLI, Stanford, pp. 67–82.
- Paster, Mary (2006a): Phonological Conditions on Affixation. PhD thesis, University of California, Berkeley.
- Paster, Mary (2006b): A survey of phonological affix order with special attention to Pulaar. In: L. Bateman and C. Ussery, eds, *Proceedings of NELS 35: Volume 2*. University of Massachusetts Graduate Linguistics Student Association, Amherst, p. 491–506.
- Paster, Mary (2009): ‘Explaining phonological conditions on affixation: Evidence from suppletive allomorphy and affix ordering’, *Word Structure* **2**, 18–47.
- Pater, Joe (2000): ‘Non-uniformity in English secondary stress : the role of ranked and lexically specific constraints’, *Phonology* **17**, 237–274.
- Potter, Brian (1996): Minimalism and the Mirror Principle. In: K. Kusumoto, ed., *Proceedings of NELS 26*. University of Massachusetts Graduate Linguistics Student Association, Amherst, pp. 289–302.

- Prince, Alan and Paul Smolensky (2004): *Optimality Theory: Constraint Interaction in Generative Grammar*. Blackwell, Oxford.
- Rubach, Jerzy (2011): 'Syllabic repairs in Macedonian', *Lingua* **121**, 237–268.
- Ryan, Kevin M. (2010): 'Variable affix order: grammar and learning', *Language* **86**, 758–791.
- Stiebels, Barbara (2003): Transparent, restricted and opaque affix orders. In: U. Junghanns and L. Szucsich, eds, *Syntactic structures and morphological information*. Mouton de Gruyter, Berlin, pp. 283–315.
- Wolf, Matthew (2008): Optimal Interleaving: Serial phonology-morphology interaction in a constraint-based model. PhD thesis, University of Massachusetts, Amherst.
- Yu, Alan C. L. (2005): 'Quantity, stress and reduplication in Washo', *Phonology* **22**, 437–475.