
Weighted Scalar Constraints Capture the Typology of Loanword Adaptation

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1. Overview

Loanwords are often subject to different phonological restrictions than the native vocabulary. There are three main patterns (Kenstowicz 2005):

- Loanwords are subject to weaker restrictions than native vocabulary.
- Loanwords are subject to stronger restrictions than native vocabulary.
- Loanwords respond to restrictions in different ways than native vocabulary.

Core-periphery models of the lexicon aim to capture these distinctions across the lexicon, and reflect the general implicational nature of the patterns (e.g., Itô & Mester 1995, 1999).

- Implementation within OT comes at the expense of metaconstraints that can make undesirable predictions.

Claim of this paper: This range of patterns is accounted for if constraints are **weighted** as in Harmonic Grammar (HG; Legendre, Miyata & Smolensky 1990; Smolensky & Legendre 2006), and **scaled** according to degree of nativization.

- Basic constraint interaction predicts the typology of loanword patterns.
- Implicational patterns in the repair of individual marked structures are predicted.
- Metaconstraints on constraint rankings / weights are not required.

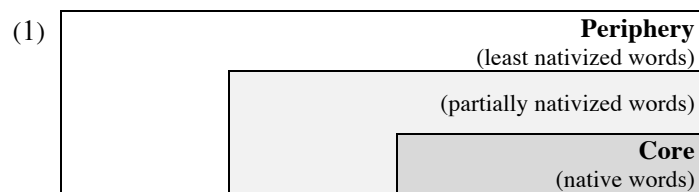
Outline of the talk

- §2 Implicational process application across loanword strata
- §3 Generating the typology with scalar constraints
- §4 Ranked constraint alternatives
- §5 Conclusion

2. Implicational process application across loanword strata

Numerous loanword patterns suggest that the lexicon is organized into a *core-periphery structure* (Saciuk 1969; Holden 1976; Paradis & Lebel 1994; Itô & Mester 1995; Davidson & Noyer 1997):

- Individual lexical items are specified with a *degree of nativization*.
- Phonological restrictions that apply within the core vary in how far they extend into the less nativized periphery (Holden 1976).



There are three basic ways in which loanwords pattern differently from more nativized words (Kenstowicz 2005), all of which can be modeled based on the core-periphery structure.

A. Superset at periphery: Structures banned in native words are permitted in loanwords. Loanwords are subject to weaker restrictions than native vocabulary.

- Oshikwanyama (Steinbergs 1985): Native words do not permit [ɹ] or consonant clusters. These structures are adapted in older loans, but permitted in newer borrowings.
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|--|--|
| <p>(2) <i>Older loans: Repair of [ɹ] by substitution</i>
 Eng. <i>seraph</i> > [ʃelafi]
 Ger. <i>radio</i> > [oladijo]</p> | <p>(3) <i>Older loans: Cluster repair by epenthesis</i>
 Eng. <i>farm</i> > [ofalama]
 Ger. <i>brot</i> > [ombolota] ‘bread’</p> |
| <p>(4) <i>Newer borrowings: No repair of [ɹ]</i>
 Eng. <i>beer</i> > [obira]</p> | <p>(5) <i>Newer borrowings: No repair of clusters</i>
 Eng. <i>ice cream</i> > [oajskrima]</p> |

Looking at loanwords with both marked structures reveals the implicational relationship between the processes.

- Oshikwanyama: Cluster simplification in a given word implies substitution, but not vice versa.
 - Ex. *ice cream* cannot be adapted with cluster simplification, but without substitution of *r*: *[oaysikirima]
- Consonant clusters are tolerated in strata closer to the core than *r*.

(6)	(core)	Eng. <i>farm</i>	>	[ofalama]	*[ɹ], *CC enforced
	↕	Eng. <i>blackboard</i>	>	[blækbolda]	*[ɹ] enforced
	(periphery)	Eng. <i>ice cream</i>	>	[oajskrima]	

- For the superset-at-periphery case, *impossible nativization effects* can be stated as the following generalizations in the core-periphery model:
 - If a structure *M* is tolerated within words of a given stratum, *M* is tolerated for words in all *more* peripheral strata (further from the core).
 - If a structure *M* is repaired within words of a given stratum, *M* is repaired for words in all *less* peripheral strata (closer to the core).
- Other illustrations of implicational patterns in superset-at-periphery patterns:
 - Turkish (Zimmer 1985)
 - Québec French (Paradis & Lebel 1994, Hsu & Jesney 2017)
 - Japanese (Itô and Mester 1995, 1999)
 - German (Itô and Mester 2001)
 - Guaraní (Pinta 2013, Pinta & Smith 2017)

B. Subset at periphery: Structures permitted in native words are banned in loanwords. Loanwords are subject to stronger restrictions than native vocabulary.

- Colloquial Czech (Mathesius 1934, Saciuk 1969): /k/ in loanwords is adapted as [g] in word-initial, intervocalic, and liquid-adjacent positions, even though these contexts permit [k] in native words.
- | | |
|--|---|
| <p>(7) <i>Loanwords: [k] → [g]</i>
 Eng. <i>couch</i> > [g]auč ‘couch’
 It. <i>balcone</i> > bal[g]ón ‘balcony’
 Ger. <i>plakat</i> > pla[g]át ‘poster’</p> | <p>(8) <i>Native vocabulary [k] → [k]</i>
 [k]aše ‘pulp, mash’
 pá[k]a ‘bat’
 pla[k]at ‘to cry’</p> |
|--|---|

While subset-at-periphery patterns are rarer than superset-at-periphery patterns, they appear to follow similar implicational patterns.

- Hungarian (Nádasdy 1989; Magyar 2014): Singleton consonants following short vowels are geminated in loanwords.¹ This gemination does not apply systematically to older loans (pre-1750) or in native vocabulary.

¹ Gemination applies to loanwords of various origins (mostly English, German, French), independent of orthography. The productivity of the process varies according to individual consonants and quality of the preceding vowel (Nádasdy 1989, Magyar 2014).

- (9) *Loanwords: Gemination enforced*
 Eng. *fit* > Hungarian [fit:]
 Fr. *choc* > Hungarian [sok:] 'shock'
- (10) *Native vocabulary: Contrastive consonant length*
 [kos] 'dirt' ~ [ros:] 'bad'
 [vitsɛ] 'janitor' ~ [vit:sɛ] 'his/her joke'
 (Magyar 2014)

(11)	(core)	Native vocabulary	<i>singletons and geminates contrast</i>
	↕	Older (pre-1750) loans	<i>gemination is sporadically enforced</i>
	(periphery)	New loanwords	<i>gemination enforced</i>

- For subset-at-edge patterns, the implicational generalization can be phrased as follows:
 - If a structure *M* is tolerated within words of a given stratum, *M* is tolerated for words in all *less* peripheral strata (closer to the core).
 - If a structure *M* is repaired within words of a given stratum, *M* is repaired for words in all *more* peripheral strata (further from the core).

C. Divergent repair: Loanwords differ from native words in the repairs used to avoid a marked structure. Loanwords respond to restrictions in different ways than native vocabulary.

- Japanese (McCawley 1968; Smith 2006): Unsyllabified consonants are repaired by deletion in native (Yamato) vocabulary, but by vowel epenthesis in modern loanwords.

- (12) *Loanwords: Vowel epenthesis*
 /kak+ruu/ → [ka.kuu] 'write-NONPAST'
 /tob+ruu/ → [to.buu] 'fly-NONPAST'
- (13) *Native vocabulary: Deletion*
 Eng. *cream* > [ku.ri:.muu]
 Eng. *brand* > [bu.ran.do]

- Korean (Kang 1996): Obstruent+nasal sequences are repaired by obstruent nasalization in native and mostly nativized Sino-Korean words, but by epenthesis in newer loans.

(14)	(core)	Native:	/kuk-mul/ → [kummul] 'soup'	<i>nasalization</i>
	↕	Sino-Korean:	/kuk-min/ → [kuŋmin] 'people'	<i>nasalization</i>
	(periphery)	Foreign:	/p ^h ɪkɲɪk/ → [p ^h ɪkɪnik] 'picnic'	<i>epenthesis</i>

Overall generalization: The subset-at-periphery, superset-at-periphery, and divergent repair patterns are all instances of a general implicational restriction:

- If a process or restriction applies at some stratum *d* of nativization, but fails to apply at stratum *d + 1*, it also fails to apply at all strata beyond *d + 1*.

3. Generating the typology with scalar constraints

Proposal: There are no distinct constraints indexed to lexical strata in Harmonic Grammar. Instead, constraint violations are **scaled** based on distance from the lexical core.

Some previous uses of weighted scalar constraints:

- Kimper (2011) – scaling based on locality and properties of triggers / targets in vowel harmony
- McPherson & Hayes (2016) – scaling based on morphosyntactic distance between triggers and targets in vowel harmony
- Pater (2012) – scaling based on nucleic sonority to model Berber syllabification
- Pater (2016) – scaling based on weight and sonority to model compatibility with stress
- Coetzee & Kawahara (2013) – scaling based on lexical frequency
- Linzen, Kasanyenko & Gouskova (2013) – scaling based on similarity and lexical factors

- Jesney (2015) – scaling based on sonority cline to model syllable contact effects
- Hsu & Jesney (2015, 2016) – scaling to reflect implicational patterns at prosodic and morphosyntactic boundaries
- Flemming (2001), Cho (2011), McAllister Byun (2011), Ryan (2011) – scaling based on real phonetic values

Here: Scaling of constraint values based distance from the core – i.e., the total penalty for a constraint violation is $w + s(d)$, where w is the base constraint weight and s is a scaling factor that increases based on distance d from the core (cf. Linzen et al. 2013).

(15) *Scaled Faithfulness*
 Given a basic constraint weight w ,
 a scaling factor s , and a distance from the core d ,
 For each input structure that is not realized faithfully in the output,
 Assign a weighted violation score of $w + s(d)$

(16) *Scaled Markedness*
 Given a basic constraint weight w ,
 a scaling factor s , and a distance from the core d ,
 For each instance of the the marked structure
 Assign a weighted violation score of $w + s(d)$

A. Superset-at-periphery patterns

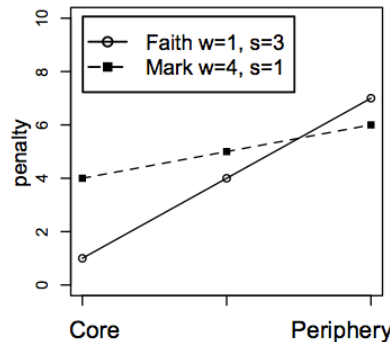
In general, superset-at-periphery patterns arise when:

- The basic weight of Markedness is greater than the basic weight of Faithfulness – $w(M) > w(F)$
- The Faithfulness scaling factor is greater than the Markedness scaling factor – $s(F) > s(M)$

(17) $w(\text{FAITH}) = 1$
 $s(\text{FAITH}) = 3$

 $w(\text{MARK}) = 4$
 $s(\text{MARK}) = 1$

 at Core $d = 0$
 at Periphery $d = 2$



Core Faithfulness penalty = $1 + 3(0) = 1$
 Core Markedness penalty = $4 + 1(0) = 4$

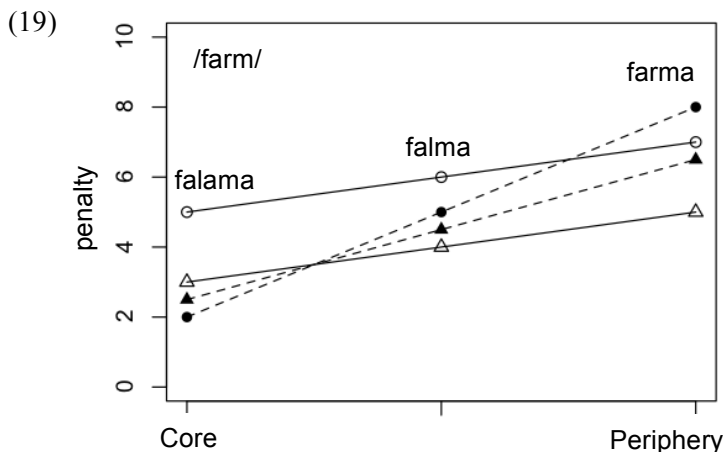
 Periphery Faithfulness penalty = $1 + 3(2) = 7$
 Periphery Markedness penalty = $4 + 1(2) = 6$

 ... for these values, the Faithfulness penalty exceeds the Markedness penalty for all values $d > 1.5$

For each marked structure, the implication will hold: If a marked structure becomes licit at distance d from the core, then it will be licit at all distances $\geq d$.

(18) **Oshikwanyama pattern:**

Core:	*r > FAITH-r	*CC > DEP-V	/farm/ → [falama]
Intermediate:	*r > FAITH-r	DEP-V > *CC	/farm/ → [falma]
Periphery:	FAITH-r > *r	DEP-V > *CC	/farm/ → [farma]



Legend for Figure 19:
 ○ *r $w=5, s=1$
 △ *CC $w=3, s=1$
 ▲ Faith-r $w=2.5, s=2$
 ● Dep-V $w=2, s=3$

Each marked structure is subject to its own set of conflicting constraints, and so their admissibility is determined separately. Here:

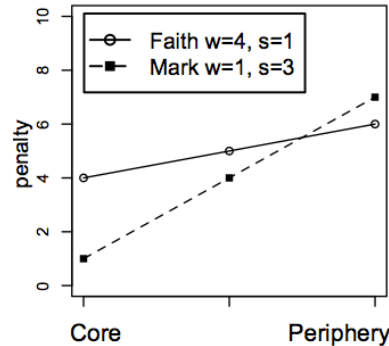
- Clusters are admitted for all values $d > 0.5$
- [r] is admitted for all values $d > 1.5$

B. Subset-at-periphery patterns

In general, subset-at-periphery pattern arise when:

- The basic weight of Faithfulness is greater than the basic weight of Markedness – $w(F) > w(M)$
- The Markedness scaling factor is greater than the Faithfulness scaling factor – $s(M) > s(F)$

(20) $w(\text{FAITH}) = 4$
 $s(\text{FAITH}) = 1$
 $w(\text{MARK}) = 1$
 $s(\text{MARK}) = 3$
 at Core $d = 0$
 at Periphery $d = 2$



Core Faithfulness penalty = $4 + 1(0) = 4$
 Core Markedness penalty = $1 + 3(0) = 1$

Periphery Faithfulness penalty = $4 + 1(2) = 6$
 Periphery Markedness penalty = $1 + 3(2) = 7$

... for these values, the Markedness penalty exceeds the Faithfulness penalty for all values $d > 1.5$

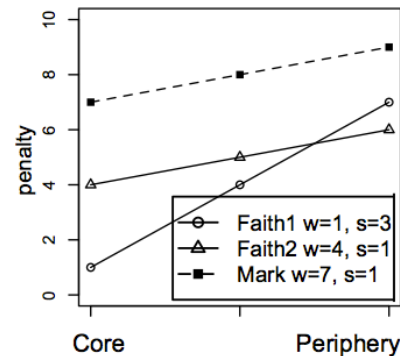
For each marked structure, the implication will hold: If a marked structure becomes illicit at distance d from the core, then it will be illicit at all distances $\geq d$.

C. Divergent repair patterns

In general, subset-at-periphery pattern arise when:

- There is a high-weighted Markedness constraint whose penalty is consistently greater than that of the conflicting Faithfulness constraints
- The basic weight of one Faithfulness constraints exceeds the basic weight of a second Faithfulness constraint – $w(F1) > w(F2)$
- The scaling factor of the second Faithfulness constraint is greater than the scaling factor of the first Faithfulness constraint – $s(F2) > s(F1)$

(21) $w(\text{FAITH1}) = 1$
 $s(\text{FAITH1}) = 3$
 $w(\text{FAITH2}) = 4$
 $s(\text{FAITH2}) = 1$
 $w(\text{MARK}) = 7$
 $s(\text{MARK}) = 1$
 at Core $d = 0$
 at Periphery $d = 2$



Core Faithfulness1 penalty = $1 + 3(0) = 1$
 Core Faithfulness2 penalty = $4 + 1(0) = 4$

Periphery Faithfulness1 penalty = $1 + 3(2) = 7$
 Periphery Faithfulness2 penalty = $4 + 1(2) = 6$

... for these values, the Faithfulness1 penalty exceeds the Faithfulness2 penalty for all values $d > 1.5$

... the Markedness penalty exceeds the Faithfulness penalty for all values $d > 3$

For each marked structure, the implication will hold: If a particular repair becomes preferred at distance d from the core, then it will continue to be preferred at all distances $\geq d$.

4. Ranked constraint alternatives

In ranked constraint grammars, the attested patterns are typically modeled in one of two ways:

- Indexation of constraints to apply to individual lexical strata (e.g., Itô & Mester 1999).
- Defining separate co-phonologies (Orgun 1996, Inkelas & Zoll 2007) for individual lexical strata.

BUT: In both approaches maintaining the implicational generalizations requires metaconditions on possible rankings across strata.

One proposal – **Ranking Consistency** (Itô & Mester 1999):

- Let F and G be two types of IO-faithfulness constraints (e.g., IDENTPLACE and IDENT-μ). These are no strata A, B such that the relative rankings of the indexed versions of F and G are inconsistent with each other. If F/A >> G/A for some stratum A, then there is no stratum B such that G/B >> F/B

Ranking consistency is effective for capturing the implications in superset-at-periphery patterns, but it encounters difficulties in less canonical cases.

- The Korean divergent repair pattern in obstruent+nasal repair is generated by ranking IDENTNASAL >> DEP for foreign words, while the reverse holds for the Sino-Korean and native strata.

(22) *Korean divergent repair pattern (implicational)*

(core)	Native:	/kuk-mul/ → [kummul] 'soup'	<i>nasalization</i>
	↑↓		
	Sino-Korean:	/kuk-min/ → [kuŋmin] 'people'	<i>nasalization</i>
(periphery)	Foreign:	/p ^h ɪknɪk/ → [p ^h ikɪnik] 'picnic'	<i>epenthesis</i>

a. Ranking for native stratum: *OBSNAS >> DEP_N >> IDENTNASAL_N *nasalization*

b. Ranking for Sino-Korean: *OBSNAS >> DEP_{S-K} >> IDENTNASAL_{S-K} *nasalization*

c. Ranking for foreign stratum: *OBSNAS >> IDENTNASAL_F >> DEP_F *epenthesis*

If we remove all restrictions on possible rerankings across strata, however, a non-implicational Korean' pattern is also predicted:

(23) *Unattested Korean' divergent repair (non-implicational)*

(core)	Native:	/kuk-mul/ → [kummul] 'soup'	<i>nasalization</i>
	↑↓		
	Sino-Korean:	/kuk-min/ → [kukimin] 'people'	<i>epenthesis</i>
(periphery)	Foreign:	/p ^h ɪknɪk/ → [p ^h innik] 'picnic'	<i>nasalization</i>

a. Ranking for native stratum: *OBSNAS >> DEP_N >> IDENTNASAL_N *nasalization*

b. Ranking for Sino-Korean: *OBSNAS >> IDENTNASAL_{S-K} >> DEP_{S-K} *epenthesis*

c. Ranking for foreign strata: *OBSNAS >> DEP_F >> IDENTNASAL_F *nasalization*

The issue also cannot be eliminated through a fixed ranking of each indexed series of constraints. The problematic ranking is consistent with rankings where all Foreign-indexed constraints dominate Sino-Korean-indexed constraints, which in turn dominate Native-indexed constraints.

(24) *OBSNAS >> DEP_F >> IDENTNASAL_F >> IDENTNASAL_{S-K} >> DEP_{S-K} >> DEP_N >> IDENTNASAL_N

Generating the typology of loanword adaptations while maintaining the implicational generalizations requires a metacondition that ensures the following restriction:

- Only one reversal in the relative ranking of a constraint pair is permitted while moving from core to periphery.**

The relevant metaconditions can be formulated as follows:

- For indexed constraints:* If F >> G at stratum A and G >> F at stratum B, where B is a more peripheral stratum, G >> F in all strata more peripheral than B.
- For cophonologies:* If F >> G in cophonology A and G >> F in cophonology B, where B is associated with a more peripheral stratum, G >> F in all cophonologies for strata more peripheral than B.

In contrast, the implicational generalizations are predicted in the scalar constraint approach without any additional stipulation. All that is needed is for constraint weights to be scaled monotonically based on distance from the core.

5. Conclusions

- Three primary patterns of loanword adaptation are generated in Harmonic Grammar if Markedness and Faithfulness constraint penalties can be scaled based on a lexical item's degree of nativization d .
- The role of degree of nativization in determining patterns has long been recognized (e.g., Saciuk 1969, Holden 1976). Here it is directly captured as a variable in the grammar – d .
- A more graded model of relative nativization is readily available without needing to postulate multiple strata and associated constraints.
- Implicational patterns of repair vs. non-repair arise from basic patterns of constraint interaction, without the metaconditions required in ranked constraint alternatives.
- This overall approach unites the treatment of loanword phonology with other areas of gradient phonological behaviour.

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