Reduction
in

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Aleksei Nazarov

University of Massachusetts Amherst

anazarov@linguist.umass.edu

Outline

✳ Hypothesis: Dutch has prosodic domain larger than syllable, smaller than foot

✳ "Reduction Domain" (RD):
full vowel σ + optional schwa σs

✳ Evidence from morphotactics and vowel reduction

✳ RDs: an instance of foot recursion?

✳ or a language-specific prosodic unit?

Introduction

* English: only schwa in (non-word final) unstressed position

  * àgmèntéɪʃən ~ àgməntéɪʃən (after Pater 2000)

* Dutch: both full vowels and schwa in unstressed position

  * má.jo̠.nɛ́:.zə "mayonnaise"

  * má.jə̠.stɛ̀it "(Your) Majesty"

Introduction

* Dutch standardly analyzed as a quantity-sensitive trochaic language (Oostendorp 1997 and references therein)

* LL-final words: penultimate main stress

    * (mà.ka)(ró.ni) "macaroni"

* LH-final words: antepenultimate main stress

    * le(ó.ni)(d<u>às</u>) "Leonidas"

Introduction

- Antepenultimate stress:

  - Non-Finality forces stress to shift to penultimate foot if last syllable is heavy (Oostendorp 1997, references therein)

  - This yields antepenultimate stress when the penult is light (i.e., a foot dependent)

    - leonidas → le(ó.ni)(dàs);   *le(ò.ni)(dás)

Introduction

* Reality of unstressed full vowels:

* If all full vowels were stressed, avoidance of final main stress could never yield antepenultimate stress

    * leonidas → *le(ò)(ní)(dàs)

    * leonidas *?→* le(ó)(nì)(dàs)

Introduction

* Standard metrical analyses of Dutch:

  (mà.jo)(nέ:.zə)   (má.jə)(stὲit)

* Van der Hulst & Moortgat (1980) propose: Dutch has nested foot structure

* Smaller foot constituents - "Reduction Domains" - are like English feet (all full-vowel syllables are heads)

  <mà>$_{RD}$ <jo>$_{RD}$ <nέ:.zə>$_{RD}$
     <má.jə>$_{RD}$ <stὲit>$_{RD}$

Introduction

* Standard metrical analyses of Dutch:

  (mà.jo)(nɛ́:.zə)   (má.jə)(stɛ̀it)

* Van der Hulst & Moortgat (1980) propose: Dutch has nested foot structure

* Larger foot constituents determine stress and are oblivious to vowel quality

  (<mà>   <jo>) (<nɛ́:.zə>)
  (<má.jə>   ) (<stɛ̀it>   )

Introduction

* Standard metrical analyses of Dutch:

  (mà.jo)(nɛ́:.zə)   (má.jə)(stɛ̀it)

* Van der Hulst & Moortgat (1980) propose: Dutch has nested foot structure

  * See McCarthy (1982) and others for similar contemporary proposals of nested foot structure

Introduction

* In this talk: empirical evidence for Van der Hulst & Moortgat's proposal of smaller foot constituent (Reduction Domain/RD) for Dutch:

    * Morphotactic restrictions line up precisely with RDs

    * RDs allow deriving prosodic conditioning of vowel reduction from stress placement

    * Extra: tentative evidence from imperfect rhyme

Morphotactics

* Dutch underived verb and adjective stems:

  * May not contain more than one full vowel

    * Confirmed experimentally (Don & Erkelens 2006)

    * ʋan.dəl "stroll" *ʋan.dal_V
      o.pən   "open" *o.pun_A

  * See Trommelen (1989)

Morphotactics

* Underived verb/adjective stems (not containing pseudo-prefixes bə-/ɣə-) coincide precisely with a RD:

  * <ʋan.dəl>   <o.pən>

* Furthermore, every inflected form of underived verbs/adjectives is a RD:

  * No full vowels in inflectional affixes

    <ʋan.dəl-ən>   <ʋan.dəl-t>
    "stroll (inf.)"   "strolls"

Morphotactics

※ Account with constraint against more than one full vowel in particular morphological domains possible

　　※ However, this involves counting: undesirable

※ Any constraint designating full vowels as a cumulative property implies some prosodic domain for this cumulativity

　　※ RD is perfect fit (see Appendix for constraint)

Vowel reduction

* Dutch has an optional process of vowel reduction (Kager 1989, Booij 1995, Oostendorp 1995, Geerts 2008)

    * tomát ～ təmát "tomato"
      fìlosóf ～ fìləsóf "philosopher"

* Vowel reduction conditioned by many factors (vowel quality, syllable structure, word prosody, lexical identity, ...)

    * Will focus on word prosody here

Vowel reduction

* Prosodic conditioning:

* In a non-word final 'dactylic' sequence (Strong, Weak, Weak):

  * <u>Second</u> weak syllable can only be reduced if <u>first</u> weak syllable is, too

  * fònoloɣí ~ fònələɣí ~ fò<u>nə</u>loɣí "phonology"

    *fò<u>nol</u>əɣí

Standard account

- Standard approach (Oostendorp 1995):

  - Assume that dactylic sequences are parsed (S W) (W)

    - (fòno)(lo)(ɣí)

Standard account

* Standard approach (Oostendorp 1995):

* One constraint against full Vs outside a foot head: **Project-Ft**

  (fònə)(lo)(ɣí), *(fò**no**)(lo)(ɣí)

* One constraint against full Vs outside the head of a binary foot: **Project-Ft$_2$**

  (fònə)(lə)(ɣí), *(fònə)(**lo**)(ɣí), *(fò**no**)(**lo**)(ɣí)

Standard account

* Partial reduction when
  Project-Ft >> Faith >> Project-Ft$_2$

/fonoloɣi/	Project-Ft	Faith	Project-Ft
(fo.no)(lo)(ɣi)	*!		**[*]
☞(fo.**nə**)(lo)(ɣi)		*	*[*]
(fo.no)(**lə**)(ɣi)	*!	*	*[*]
(fo.**nə**)(**lə**)(ɣi)		**!	[*]

Standard account

- Ungrammatical *fònoləɣí ruled out because it is harmonically bounded by (fo.nə)(lo)(ɣi)

- Reduction in first weak syllable eliminates violations of Project-Ft AND Project-Ft₂

/fonoloɣi/	Project-Ft	Faith	Project-Ft
(fo.no)(lo)(ɣi)	✳		✳✳[✳]
(fo.**nə**)(lo)(ɣi)		✳	✳[✳]
✘ (fo.no)(**lə**)(ɣi)	✳	✳	✳[✳]
(fo.**nə**)(**lə**)(ɣi)		✳✳	[✳]

Standard account

- Ungrammatical *fònoləɣí ruled out because it is harmonically bounded by (fo.nə)(lo)(ɣi)

- Reduction in second weak syllable eliminates violation of Project-Ft$_2$ only

/fonoloɣi/	Project-Ft	Faith	Project-Ft
(fo.no)(lo)(ɣi)	*		**[*]
(fo.**nə**)(lo)(ɣi)		*	*[*]
✗ (fo.no)(**lə**)(ɣi)	*	*	*[*]
(fo.**nə**)(**lə**)(ɣi)		**	[*]

Standard account

* Problem with this account:

  * Assumes that SWW is always parsed as (SW)(W)

  * and that there are constraints that demand reduction in foot heads just because their foot is not binary.

    * Prediction: there should be languages in which degenerate feet are stressed but reduce

      /palaka/ → (pála)(kə̀)

RD account

* RDs allow for an alternative explanation:

  * Partial reduction motivated by desire for branching structure in strong position

  * Full reduction motivated by generic constraint against unstressed full vowels

RD account

* Intuition behind account:

* Because of RDs, reduced and unreduced variants have different prosodic structures

  * (\<fi>\<lo>)(\<sof>)

  * (\<fi.lə>)(\<sof>)

RD account

- Intuition behind account:

  - Proposal: reduction in directly post-tonic position motivated by preference for branching RDs in foot head position

    - (<fi><lo>)sof: non-branching RDs

    - (<fi.lə>)   sof: branching RD

RD account

- Reminiscent of Stress-to-Weight Principle (Prince 1990):

  - "stressed" RDs are augmented to obey need for branching structure in stressed position

  - instead of segmental epenthesis, the scope of the stressed RD is widened:

    - <fi>losof (non-branching)

    - <fi.lə>sof (branching)

RD account

* SWP(RD): One violation mark for every non-branching RD that is in a foot head position

RD account

* SWP(RD): One violation mark for every non-branching RD that is in a foot head position

  * SWP(RD) >> Ident(V) leads to reduction

/fonoloɣi/	SWP(RD)	Ident(V)
(<fo><no><lo>)(<ɣi>)	*![*]	
☞(<fo.nə><lo>)(<ɣi>)	[*]	*

RD account

* SWP(RD): One violation mark for every non-branching RD that is in a foot head position

  * Ident(V) >> SWP(RD): no reduction

/fonoloɣi/	Ident(V)	SWP(RD)
☞(<fo><no><lo>)(<ɣi>)		*[*]
(<fo.nə><lo>)(<ɣi>)	*!	[*]

RD account

* How to decide between fully reduced and partially reduced candidate?

  * General reduction constraint *FullV/Weak

    * *FullV/Weak >> Ident(V): full reduction

/fonoloɣi/	*FullV/Weak	Ident(V)
(<fo><no><lo>)(<ɣi>)	*!*	
(<fo.nə><lo>)(<ɣi>)	*!	*
☞(<fo.nə.lə>)(<ɣi>)		**

RD account

- How to decide between fully reduced and partially reduced candidate?

  - SWP(RD) >> Ident(V) >> *FullV/Weak: partial reduction

/fonoloɣi/	SWP(RD)	Ident(V)	*FullV/Weak
(<fo><no><lo>)(<ɣi>)	*! [*]		**
☞(<fo.nə><lo>)(<ɣi>)	[*]	*	*
(<fo.nə.lə>)(<ɣi>)	[*]	**!	

RD account

* Since feet are L-headed in Dutch:

* Only first RD in a dactylic sequence can be in foot head position:

    * *(<fo><no.lə>)(<ɣi>) harmonically bounded by (<fo.nə><lo>)(<ɣi>)

/fonoloɣi/	SWP(RD)	Ident(V)	*FullV/Weak
☞(<fo.nə><lo>)(<ɣi>)	[*]	*	*
(<fo><no.lə>)(<ɣi>)	*[*]	*	*

RD account

- Since feet are L-headed in Dutch:

  - Only first RD in a dactylic sequence can be in foot head position

  - Prosodic conditioning derived from SWP:

    - a constraint needed for unrelated phenomena (lengthening under stress) across languages

    - a constraint already needed to motivate partial reduction

Summary

✳ To summarize:

  ✳ Ident(V) >> SWP(RD), *FullV/Weak: no reduction

/fonoloɣi/	Ident(V)	SWP(RD)	*FullV/Weak
☞(\<fo>\<no>\<lo>)(\<ɣi>)		*[*]	**
(\<fo.nə>\<lo>)(\<ɣi>)	*!	[*]	*
(\<fo>\<no.lə>)(\<ɣi>)	*!	*[*]	*
(\<fo.nə.lə>)(\<ɣi>)	*!*	[*]	

Summary

* To summarize:

  * SWP(RD) >> Ident(V) >> *FullV/Weak: partial reduction (impossible partial reduction blocked by harmonic bounding)

/fonoloɣi/	SWP(RD)	Ident(V)	*FullV/Weak
(<fo><no><lo>)(<ɣi>)	*! [*]		**
☞(<fo.nə><lo>)(<ɣi>)	[*]	*	*
(<fo><no.lə>)(<ɣi>)	*! [*]	*	*
(<fo.nə.lə>)(<ɣi>)	[*]	**!	

Summary

- To summarize:

  - *FullV/Weak >> Ident(V): full reduction

/fonoloɣi/	SWP(RD)	*FullV/Weak	Ident(V)
(\<fo>\<no>\<lo>)(\<ɣi>)	*! [*]	**	
☞(\<fo.nə>\<lo>)(\<ɣi>)	[*]	*!	*
(\<fo>\<no.lə>)(\<ɣi>)	*! [*]	*	*
(\<fo.nə.lə>)(\<ɣi>)	[*]		**

Summary

- RD approach makes it possible to derive prosodic conditioning of vowel reduction from stress facts of Dutch

- Does not base itself on static structural difference (e.g., foot dependent vs. foot head) between first and second Weak syllable in SWW sequence

  - (SW)(W)...   or   (SW)W....

- Does not predict across-the-board reduction in unary feet

Imperfect rhyme

* Extra source of evidence: imperfect rhyme in Dutch (Oostendorp & Köhnlein, to appear)

  * Imperfect rhyme accepted only if corresponding syllables have a full vowel

    lέs.bɔs ~ ɑr.ɣɔs ✔   hé.dəl X brá.kəl ✘

* Oostendorp & Köhnlein: match accepted if it could potentially form a foot

  (lέs.bɔs) ~ (ár.ɣɔs) | (bɔs) and (ɣɔs) <u>could</u> be feet
  (hé.dəl) X (brá.kəl) | (dəl), (kəl) <u>couldn't</u> be feet

Imperfect rhyme

⁂ Extra source of evidence: imperfect rhyme in Dutch (Oostendorp & Köhnlein, to appear)

 ⁂ Imperfect rhyme accepted only if corresponding syllables have a full vowel

 lɛ́s.bɔs ~ ɑr.ɣɔs ✔   hé.dəl X brá.kəl ✘

⁂ But with RDs: no need to appeal to counterfactual parses

 (<lɛ́s>.<bɔs>) ~ (<ár>.<ɣɔs>) |matching RDs
 (<hé.dəl>)   X (<brá.kəl>) |no matching RDs

Discussion

- Proposal: Reduction Domains
  $< \sigma_{FullV} \; (\sigma_{schwa})_0 >$

  - Influence word shape (V/Adj roots)

  - Trigger partial vowel reduction through Stress-to-Weight Principle

  - Are the unit of reference for imperfect rhyme

Discussion

- Broader implications of argument:

  - Natural languages must allow prosodic constituents between feet and syllables

    - Previous work on recursive feet (Martinez-Paricio 2013 and others): rhythmic, tonal, segmental processes point towards sub-foot units

    - Dutch: sub-foot constituents are referred to as a unit

Discussion

* Sub-foot constituents allowed by Recursive Foot theory (Martinez-Paricio 2013, Bennett 2012, 2013, Kager 2012)

  * Feet may exhibit direct recursion up to one level

    ((fo.nə)lo)(ɣi)

* RDs could be Minimal Feet

* (Account of prosodic conditioning based on SWP not easily transferable to this framework)

Discussion

- Alternative idea:

  - RDs could be a prosodic domain specific to Dutch

  - Language-specific prosodic domains found in other languages as well

Discussion

* Alternative idea:

  * Georgian has so-called harmonic clusters, which are consonant sequences that are processed as a unit (Chitoran et al. 2002)

  * Khmer and related languages have so-called "minor syllables" (Matisoff 1973)

  * Hungarian (Hammond 1987) has prosodic units (cola) that are larger than stress feet but smaller than prosodic words

Discussion

* Alternative idea:

  * The local attestation of these structures contrasts with the ubiquity of feet and syllables

  * Could it be that harmonic clusters, minor syllables, cola are language-specific units induced from data?

    * Question that may be investigated computationally in the future

Discussion

* Alternative idea:

  * Dutch Reduction Domains are quite robust in the data

  * Could it be that this attestation is enough for a learner to induce this unit?

    * material for Hidden Structure learning simulations (Tesar 1997, 2004, Jarosz 2013, and many others) in the future

Conclusion

- Reduction Domains (polysyllabic domains with one full vowel syllable) robustly attested in Dutch:

  - Underived verb and adjective stems have the shape of a Reduction Domain

  - Reduction Domains provide principled account of conditioning of vowel reduction

- Strengthens previously collected evidence for sub-foot, suprasyllabic constituents

Bedankt!

Thank you!

Many thanks to:

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Appendix

Appendix

☀ Verb/adjective root morphotactics can be represented by this (undominated) constraint:

V/Adj–Root ⊂ RD:
　　One violation for every verb or adjective root which is not contained within a Reduction Domain.

　☀ <ʋan.dəl>$_V$　≻　*<ʋan><dal>$_V$

　☀ <o.pən>$_A$　≻　*<o><pun>$_A$

Appendix

- SWP(RD): One violation mark for every non-branching RD that is in foot head position

  - (<fi.lə>)sof
    0 non-branching RDs
    in foot head position

  - ☞ (<fi><lo>)sof
    1 non-branching RD
    in foot head position

  - (<fo.nə><lo>)ɣi
    0 non-branching RDs
    in foot head position

  - ☞ (<fo><no><lo>) ɣi
    1 non-branching RD
    in foot head position

Appendix

- Prosodic conditioning of vowel reduction depends on vowel quality

  - Hierarchy of relative "reducibility" (Kager 1989, Oostendorp 1995, 2000):
  e > a > o, ø > u, i, y

  - Based on Oostendorp (1995):
  Ident(high) >> Ident(round) >> Ident(low) >> Ident(V)

Appendix

※ Prosodic conditioning of vowel reduction depends on vowel quality

 ※ Reduction of only second W in SWW sequences possible iff second W is higher on reducibility scale than first W

 ※ (fonolo)ɣi ~ (fonəlo)ɣi, *(fonolə)ɣi

 ※ BUT (dekora)tif ~ (dekəra)tif ~ (dekorə)tif

  ※ because /a/ is more reducible than /o/

Appendix

- This falls out if hierarchy of vowel quality faithfulness is ranked variably w.r.t. SWP(RD) and *FullV/Weak

- Ident(W1) >> SWP, *FullV/W >> Ident(W2) yields reduction in second Weak vowel only

/dekoratif/	Ident(o)	SWP	*FullV/W	Ident(a)
(\<de>\<ko>\<ra>)(\<tif>)		*[*]	**!	
(\<de.kə>\<ra>)(\<tif>)	*!	[*]	*	
☞ (\<de>\<ko.rə>)(\<tif>)		*[*]	*	*

Appendix

- This falls out if hierarchy of vowel quality faithfulness is ranked variably w.r.t. SWP(RD) and *FullV/Weak

- Ident(W1) >> SWP, *FullV/W >> Ident(W2) yields reduction in second Weak vowel only

/anakolut/	Ident(o)	SWP	*FullV/W	Ident(a)
(\<a>\<na>\<ko>)(\<lut>)		*[*]	**!	
☞(\<a.nə>\<ko>)(\<lut>)		[*]	*	*
(\<a>\<na.kə>)(\<lut>)	*!	*[*]	*	

Appendix

- This falls out if hierarchy of vowel quality faithfulness is ranked variably w.r.t. SWP(RD) and *FullV/Weak

- Ident(W1) >> SWP, *FullV/W >> Ident(W2) yields reduction in second Weak vowel only

/fonoloɣi/	Ident(o)	SWP	*FullV/W	Ident(a)
☞(\<fo>\<no>\<lo>)(\<ɣi>)		*[*]	**!	
(\<fo.nə>\<lo>)(\<ɣi>)	*!	[*]	*	
(\<fo>\<no.lə>)(\<ɣi>)	**!	*[*]	*	