Quality and Quantity Contribute Independently to Sonority: Evidence from Bolognese Vowel Reduction

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Introduction

- Two reduction patterns for /e/ and /ɛ/ contingent upon length
- Parallel patterns are paradoxical under IDENT(HEIGHT)
  - /e, ɛ/ → [i], /eː, ɛː/ → [a]

- Phonology is sensitive to sonority (Clements, 1990; Crosswhite, 2000; Crowhurst & Michael, 2005; Krämer & Zec, 2020; Parker, 2012)
- Multiple independent domains contribute to sonority (Parker 2002, 2008, Gordon et al., 2012)

I propose that phonological processes are sensitive to the total sonority of segments

Bolognese Vowel Reduction

- Bolognese (Gallo-Italic; Bologna, Italy): Vowel Reduction (VR) occurs when primary stress shifts (here: adding a diminutive suffix)

(1)

Bol.	Bol. + suffix	Gloss
ˈmɔŋt	muŋtaˈɲoːla	‘mountain’
ˈgropː	gruˈatː	‘group’
ˈlɛŋgwa	liŋˈgweŋna	‘language’
maˈnesːa	maniˈseŋna	‘wrench’

Data from the fieldwork of Edward Rubin*, Lepri & Vitali (2009), and Vitali (2009, 2022).

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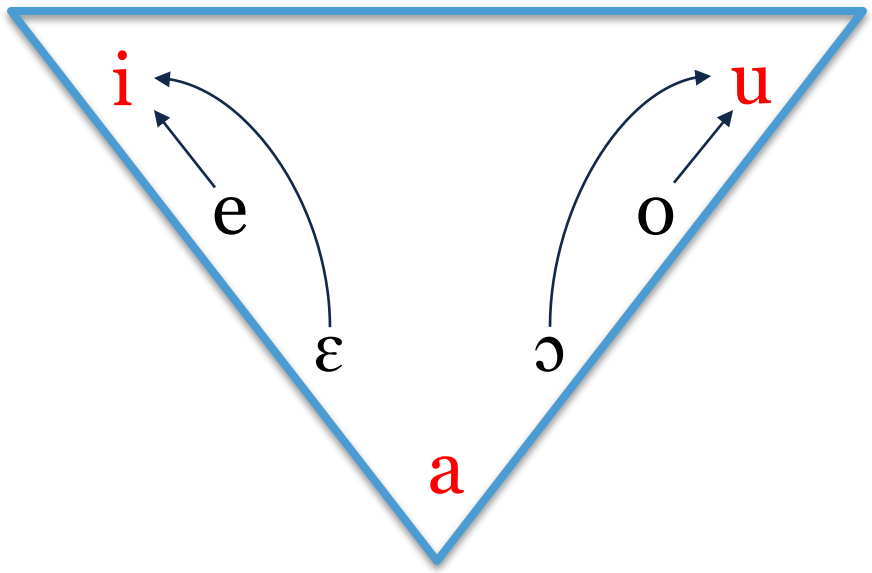
Bolognese Vowel Reduction

- Seven possible qualities: /i, e, ɛ, a, ɔ, o, u/
- Non-peripheral vowels reduce to [+HIGH]

(2)

Bol.	Bol. + suffix	Gloss
ka'vasːter	kava'treŋ	‘rope’
'spelːa	spi'leŋna	‘pin’
stu'dɛŋt	studiŋ'teŋna	‘student’
'frosːta	fru'steŋ	‘whip’
gab'jɔŋ	gabjuŋ'θeŋ	‘gabion’

(3)



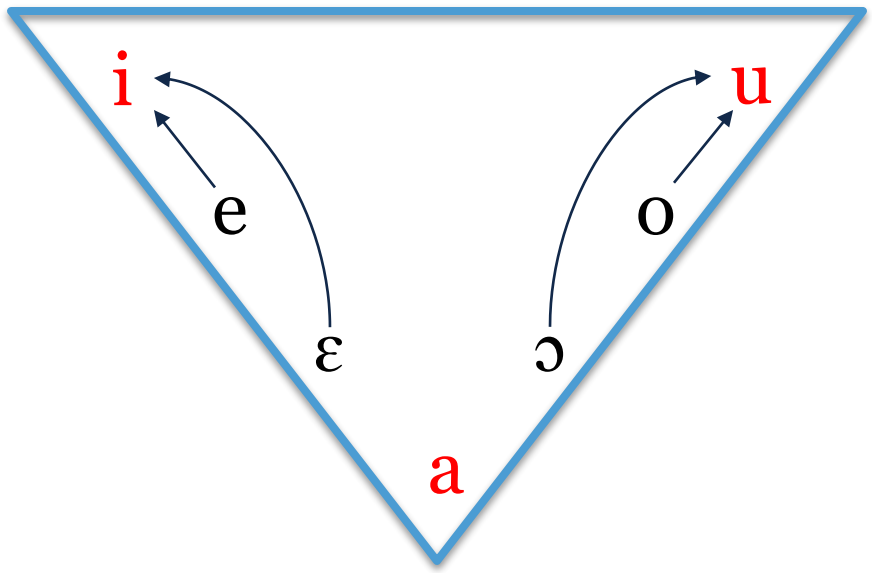
Bolognese Vowel Reduction

- Pattern motivated by contrast enhancement (Crosswhite 1999)
  - Vowel space is maximally dispersed (Lindblom, 1986)

(2)

Bol.	Bol. + suffix	Gloss
ka'vasːter	kava'treŋ	‘rope’
'spelːa	spi'leŋna	‘pin’
stu'dɛŋt	studiŋ'teŋna	‘student’
'frosːta	fru'steŋ	‘whip’
gab'jɔŋ	gabjuŋ'zeŋ	‘gabion’

(3)



Bolognese Vowel Reduction

Peripheral vowels are licensed only under stress (Crosswhite, 1999; Walker, 2011).

- LICENSENON-PERIPHERAL/STRESS: assign one violation for each non-peripheral vowel in an unstressed position (Crosswhite, 1999)

Bolognese Vowel Reduction

LIC.NONPERIPHERAL ≫ FAITH: Non-peripheral vowels do not surface.

(4)

/spep'leŋna/	LIC.NONPERIPH	FAITH
☞ a. spip'leŋna		*
b. spep'leŋna	*! W	L

(5)

/piθɔn'θeŋ/	LIC.NONPERIPH	FAITH
☞ a. piθun'θeŋ		*
b. piθɔn'θeŋ	*! W	L

Bolognese Vowel Reduction

Vowels are faithful to height.

- IDENT[LOW]: assign one violation for every output segment whose specification for the feature [LOW] differs from that of its input correspondent.

- IDENT[HIGH]: assign one violation for every output segment whose specification for the feature [HIGH] differs from that of its input correspondent.

Bolognese Vowel Reduction

IDENT[LOW] ≫ IDENT[HIGH], FAITH: Vowels are faithful to [LOW].

(6)

/spe'leŋna/	LIC.NONPERIPH	IDENT[LOW]	IDENT[HIGH]	FAITH
a. spe'leŋna	*! W		L	L
☞ b. spi'leŋna			*	*
c. spa'leŋna		*! W	L	*

(7)

/θas'teŋ/	LIC.NONPERIPH	IDENT[LOW]	IDENT[HIGH]	FAITH
☞ a. θas'teŋ				
b. θus'teŋ		*! W	* W	* W
c. θis'teŋ		*! W	* W	* W

Bolognese Vowel Reduction

Vowels are faithful to rounding.

- IDENT[ROUND]: assign one violation for every output segment whose specification for the feature [ROUND] differs from that of its input correspondent.

Bolognese Vowel Reduction

IDENT[ROUND]: Vowels are faithful to the feature [ROUND].

(8)

/pulɛ'teŋna/	IDENT[ROUND]	LIC.NONPERIPH	IDENT[LOW]	IDENT[HIGH]
a. pulɛ'teŋna		*! W		L
b. pulu'teŋna	* W			*
☞ c. puli'teŋna				*
d. pula'teŋna	* W		*! W	L

(9)

/bjɔn'deŋ/	IDENT[ROUND]	LIC.NONPERIPH	IDENT[LOW]	IDENT[HIGH]
a. bjɔn'deŋ		*! W		L
☞ b. bjun'deŋ				*
c. bjin'deŋ	* W			*
d. bjan'deŋ	* W		*! W	L

Bolognese Vowel Reduction

- Length is contrastive
- Under VR, all vowels shorten

(10)

Short	Gloss	Long	Gloss
'melː	‘thousand’	'meːl	‘honey’
'sakː	‘dry’	'saːk	‘sack’
'so	‘up, above’	'soː	‘his/her/their’

(11)

Bol.	Bol. + suffix	Gloss
kar'joːla	karju'leŋna	‘wheelbarrow’
ban'diːra	bandi'reŋna	‘flag’

Bolognese Vowel Reduction

Vowels are short in unstressed syllables

- WEIGHT-TO-STRESS PRINCIPLE: assign one violation for each heavy syllable in an unstressed position (Prince, 1990)

Bolognese Vowel Reduction

WSP: Long vowels do not surface.

(12)

/skuplɔːˈteŋ/	WSP	IDENT[ROUND]	LIC.NONPERIPH	IDENT[LOW]	IDENT[HIGH]
a. skuplɔːˈteŋ	* W		*! W		L
☞ b. skupluˈteŋ					*
c. skuplaˈteŋ		* W		*! W	L

(13)

/fuːgaˈdeŋ/	WSP	IDENT[ROUND]	LIC.NONPERIPH	IDENT[LOW]	IDENT[HIGH]
a. fuːgaˈdeŋ	* W				
☞ b. fugaˈdeŋ					
c. figaˈdeŋ		* W			

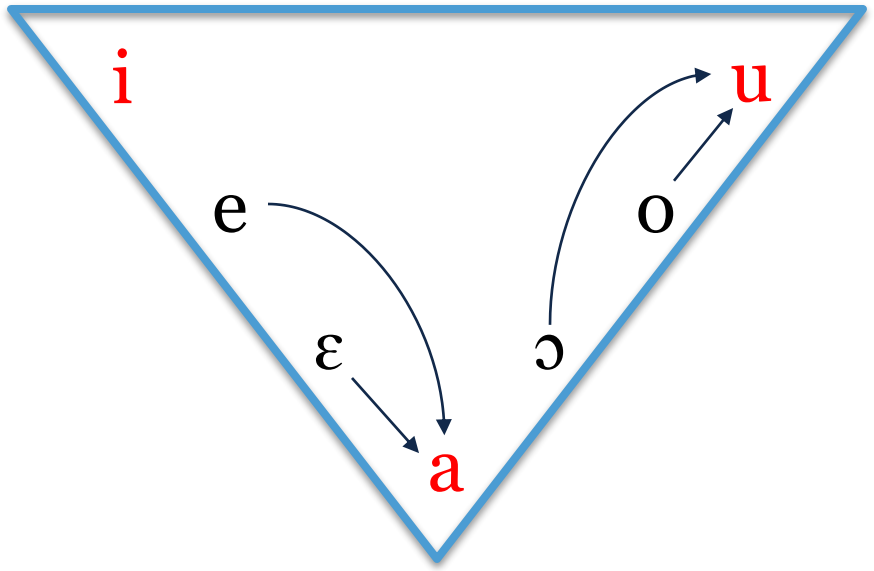
Dual Pattern Problem

- Front-mid vowels /e/, /ɛ/ change output targets contingent on length

(14)

Bol.	Bol. + suffix	Gloss
sarˈvesːi	sarvisˈjeŋ	service
laŋˈteːrna	laŋtarˈneŋna	lantern
ˈdɛŋt	diŋˈteŋ	tooth
ˈgɛːbja	gabˈjoːla	cage

(15)



Dual Pattern Problem

- The current constraint ranking:
  - {WSP, IDENT[ROUND]}; {LICNONPERIPH., IDENT[LOW]} ≫ IDENT[HIGH]

- This ranking captures /e, ɛ/ → [i] and is attested cross-linguistically (Harris, 1998)

- If IDENT[HIGH] ≫ IDENT[LOW]: then /eː, ɛː/ → [a] and is attested cross-linguistically (Recasens, 1991)

Dual Pattern Problem

- Current constraint ranking cannot simultaneously generate both patterns

(16)

/bɛːr'beŋna/	WSP	IDENT[ROUND]	IDENT[LOW]	LIC.NONPERIPH	IDENT[HIGH]
a. bɛːr'beŋna	* W		L	* W	
💣 b. bir'beŋna			L		* W
☞ c. bar'beŋna			*		

(17)

/prɛnzi'peŋ/	WSP	IDENT[ROUND]	IDENT[LOW]	LIC.NONPERIPH	IDENT[HIGH]
a. prɛnzi'peŋ				*! W	L
☞ b. prinzi'peŋ					*
c. pranzi'peŋ			*! W		L

Dual Pattern Problem

- Asymmetry cannot be addressed by a Gang-Effect of Harmonic Grammar; no asymmetric tradeoff (Pater, 2009).

(18)

/eːr'beŋna/	LIC.NONPERIPH *w = 3*	IDENT[LOW] *w = 2*	IDENT[HIGH] *w = 1*	MAX[MORA] *w = 1*	H
☞ a. ar'beŋna		-1		-1	-2
b. ir'beŋna			-1	-1	-2
c. eːr'beŋna	-1				-3

(19)

/gardle'neŋna/	LIC.NONPERIPH *w = 3*	IDENT[LOW] *w = 2*	IDENT[HIGH] *w = 1*	MAX[MORA] *w = 1*	H
a. gardla'neŋna		-1			-2
☞ b. gardli'neŋna			-1		-1
c. gardle'neŋna	-1				-3

Dual Pattern Problem

- Local conjunction could capture the asymmetry, but makes unmotivated typological predictions (Pater, 2009; Potts et al., 2010)
  - $\mathrm{A}\ \&_d\ \mathrm{B}$: assign one violation if and only if both A and B are violated in the smallest domain evaluable by A and B (Smolensky, 2011)

Dual Pattern Problem

- Identical vowels, identical syllable contexts, different outputs contingent on input length
- Only *front-mid* vowels
- The pattern depends on combinations of vowel quality and quantity: /e, ɛ/ → [i], /eː, ɛː/ → [a]

(20)

Bol.	Bol. + suffix	Gloss
pas'teʎːa	pasti'ʎeŋna	‘lozenge/pill’
'skeːrθ	skarθ'teŋ	‘joke’
'frosːta	frus'teŋ	‘whip/whisk’
'noːn	nu'neŋ	‘grandfather’

Dual Pattern Problem

- Multiple factors contribute to sonority, including length (Parker 2002, Gordon et al. 2012).
- Higher vowels are less sonorous (Ladefoged, 1973; Parker, 2002, 2008).

- Prominence Reduction can motivate VR (Crosswhite 1999)
  - Vowel space minimizes sonority

Proposal

I propose that VR in Bolognese is sensitive to quality and quantity interactions. This interaction is explained via sonority.

- Vowel height contributes independently to sonority

  $High \prec Mid \prec Low$

- Vowel length contributes independently to sonority

  $X \prec X\text{ː}$, where X = vowel

Proposal

- Expository sonority values that capture the Bolognese pattern
- Length increases sonority value; total sonority thresholds are established by quality and quantity

(21)

Height	Short		Long	
high	/i, u/	1	/iː, uː/	2
mid-high	/e, o/	2	/eː, oː/	4
mid-low	/ɛ, ɔ/	3	/ɛː, ɔː/	6
low	/a/	4	/aː/	8

Proposal

- *Four* vowel sonority thresholds:

  i/u ≺ iː/uː, e/o, ɛ/ɔ ≺ a ≺ aː, eː/oː, ɛː/ɔː

- Competing pressures to <u>reduce sonority while moving minimally</u> along the sonority scale drive VR

(21)

Height	Short		Long	
high	/i, u/	1	/iː, uː/	2
mid-high	/e, o/	2	/eː, oː/	4
mid-low	/ɛ, ɔ/	3	/ɛː, ɔː/	6
low	/a/	4	/aː/	8

Analysis

- Restrictions on sonority distance between adjacent segments are well established (Ladefoged, 1973; Clements, 1990; Parker, 2002)

I propose similar restrictions on input-output correspondence captured via a new faithfulness constraint: MAINTAIN(X-SCALE)

MAINTAIN(X-SCALE):

- Let S_I and S_O be corresponding segments of the input and output. If S_I is specified [nX], then S_O is [nX].

Analysis

- MAINTAIN[SONORITY]: assign *X* violations for every output segment that differs in total sonority from its input correspondent, where *X* is the absolute value difference between the input and output sonority values.

- *[+LOW]: assign one violation for every output segment with the feature and specification [+LOW].

Vowels move minimally down the sonority scale from input to output.

Analysis

i/u ≺ iː/uː, e/o, ɛ/ɔ ≺ a ≺ aː, eː/oː, ɛː/ɔː

(22)

/pulɛ'teŋna/	LIC.NONPERIPH	MAINT.(SON)	*[+LOW]
a. pulɛ'teŋna	*! W	L	
☞ b. puli'teŋna		*	
c. pula'teŋna		*	*! W

(23)

/kutʃɛː'reŋ/	LIC.NONPERIPH	MAINT.(SON)	*[+LOW]
a. kutʃɛː'reŋ	*! W		L
b. kutʃi'reŋ		***! W	L
☞ c. kutʃa'reŋ		*	*

Analysis

i/u ≺ iː/uː, e/o, ɛ/ɔ ≺ a ≺ aː, eː/oː, ɛː/ɔː

(24)

/bartʃo'leŋ/	WSP	IDENT[ROUND]	LIC.NONPERIPH	MAINT(SON)	*[+LOW]
a. bartʃo'leŋ			*! W	L	
☞ b. bartʃu'leŋ				*	
c. bartʃa'leŋ		*! W		*	* W

(25)

/tʃoːd'leŋ/	WSP	IDENT[ROUND]	LIC.NONPERIPH	MAINT(SON)	*[+LOW]
a. tʃoːd'leŋ	* W		*! W	L	
☞ b. tʃud'leŋ				***	
c. tʃad'leŋ		*! W		*	* W

Complete Analysis

- Constraint ranking:
  - WSP; {IDENT[ROUND], LICNONPERIPH} ≫ MAINT[SON] ≫ *[+LOW]
- Bolognese sonority scale:

  i/u ≺ iː/uː, e/o, ɛ/ɔ ≺ a ≺ aː, eː/oː, ɛː/ɔː

- Vowel quality and quantity interact to influence candidate optimality
- Prominence Reduction and Contrast Enhancement interact to drive VR in Bolognese

Remaining Issues

- Vowel deletion (VD) is observed in the same prosodic environment
  - VD may be morphologically driven, though with exceptions
  - /ɛː/ and /a/ appear to be the only candidates for this deletion.

An investigation into this phenomenon is forthcoming.

(26)

Bol.	Bol. + suffix	Gloss
lu'k=atː	lukØ='t=eŋ	'lock'
a'n=ɛːl	anØ='l=eŋ	'ring'
'maila	'mØl=eŋna	'apple'

Conclusion

- Bolognese VR is sensitive to interactions between vowel length and quality. This is best explained by sonority.

- Multiple independent domains can contribute to sonority (Parker 2002, Gordon et al. 2012).
- Phonology is sensitive to sonority scales influenced by other contributing domains (Crowhurst & Michael, 2005; Krämer & Zec, 2020).

Conclusion

- Bolognese VR is driven by competing pressures to reduce sonority while moving minimally along the sonority scale
- Phonological phenomena are sensitive to changes in the distance between adjacent segments along the sonority scale (Ladefoged, 1973; Clements, 1990; Parker, 2002).
- I propose similar restrictions on input-output correspondents of relative scalar position

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Appendix

The three-way lax contrast /ɛ, a, ɔ/ appears to likely have collapsed to something like [a] for younger speakers (Canepari & Vitali 2009), though the distinction is maintained in Vowel Reduction.

Bol.	Bol. + suffix	Gloss
stu'dɛŋt	studiŋ'teŋna	‘student’
'sasːt	sas'teŋ	‘basket’
pi'sɔŋ	pisuŋ'seŋ	‘pigeon’

Diphthongs

Bolognese has two diphthongs /ai, au/. These diphthongs also participate in VR. Though comprising of peripheral qualities, only the less sonorous quality is retained under VR.

Bol.	Bol. + suffix	Gloss
'vaider	vid'reŋ	‘glass’
mun'aida	muni'deŋna	‘coin’
an'vaud	anvu'deŋ	‘nephew’
'taurta	tur'teŋna	‘cake’

Diphthongs

While IDENT constraints penalize any change in the specification of a feature from input to output, DEP and MAX penalize the epenthesis and deletion of a specified feature (Zoll, 1996; Crosswhite 1999).

- MAX[+HIGH]: assign one violation for every input segment whose [+HIGH] feature lacks a correspondent in the output.

Vowel qualities must not delete the feature [+HIGH] if present.

Diphthongs

/vaid'reŋ/	WSP	MAX[+HIGH]	FAITH
a. vaid'reŋ	*! W		L
☞ b. vid'reŋ			*
c. vad'reŋ		*! W	*

/pskadau'reŋ/	WSP	MAX[+HIGH]	FAITH
a. pskadau'reŋ	*! W		L
☞ b. pskadu'reŋ			*
c. pskada'reŋ		*! W	*

Diphthongs

- It is unclear where along sonority diphthongs are located; thus, unclear how MAINTAIN[SONORITY] evaluates them

MAX[+HIGH] must outrank MAINTAIN[SONORITY], such that the less sonorous vowel is retained under VR regardless of any violation of this constraint.

Diphthongs

/vaid'reŋ/	WSP	MAX[+HIGH]	FAITH	MAINT(SON)	*[+LOW]
a. vaid'reŋ	*! W		L		
☞ b. vid'reŋ			*		
c. vad'reŋ		*! W	*		

/pskadau'reŋ/	WSP	MAX[+HIGH]	FAITH	MAINT(SON)	*[+LOW]
a. pskadau'reŋ	*! W		L		
☞ b. pskadu'reŋ			*		
c. pskada'reŋ		*! W	*		