

Vowel Reduction is Conditioned by Quality and Quantity Interactions: Evidence from Bolognese

Linguistic Society of America Annual Meeting
January 09, 2026

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Introduction

I propose that vowel reduction processes can be sensitive to the total sonority value of segments.

- Multiple independent domains contribute to sonority, including length (Parker 2002, 2008, Gordon et al., 2012)
- Two reduction patterns for /e/ and /ɛ/ contingent upon length
- Parallel patterns are paradoxical under IDENT(HEIGHT)
 - /e, ɛ/ → [i], /eː, ɛː/ → [a]

A new faithfulness constraint MAINTAIN(SONORITY) favors smaller changes in sonority during vowel reduction.

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
'mɔŋt	muŋta'no:la	'mountain'
'grop:	gru'pat:	'group'
'lɛŋgwa	liŋ'gweŋna	'language'
ma'nes:a	mani'seŋna	'wrench'



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

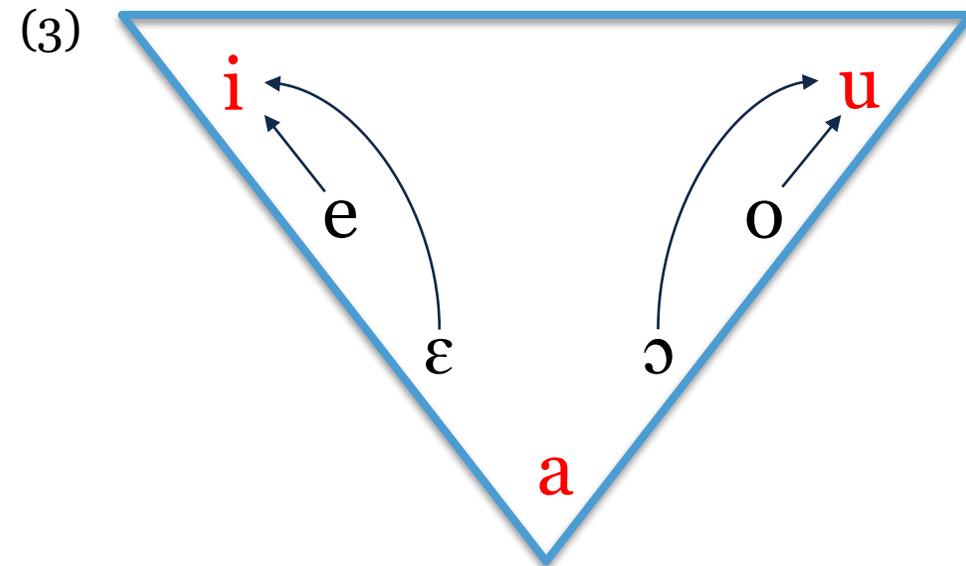
*University of Utah

Bolognese Vowel Reduction

- Seven possible qualities of short vowels: /i, e, ε, a, ɔ, o, u/
- Non-peripheral vowels reduce to [+HIGH]
- Peripheral vowels surface faithfully

(2)

Bol.	Bol. + suffix	Gloss
ka'va: s :ter	kava' a 'treŋ	'rope'
'spe: l a	spi' i leŋna	'pin'
stu'd ε ŋt	stud i ŋ'teŋna	'student'
'fro: s :ta	fru' u steŋ	'whip'
gab' j ɔŋ	gab j uŋ'θeŋ	'gabion'

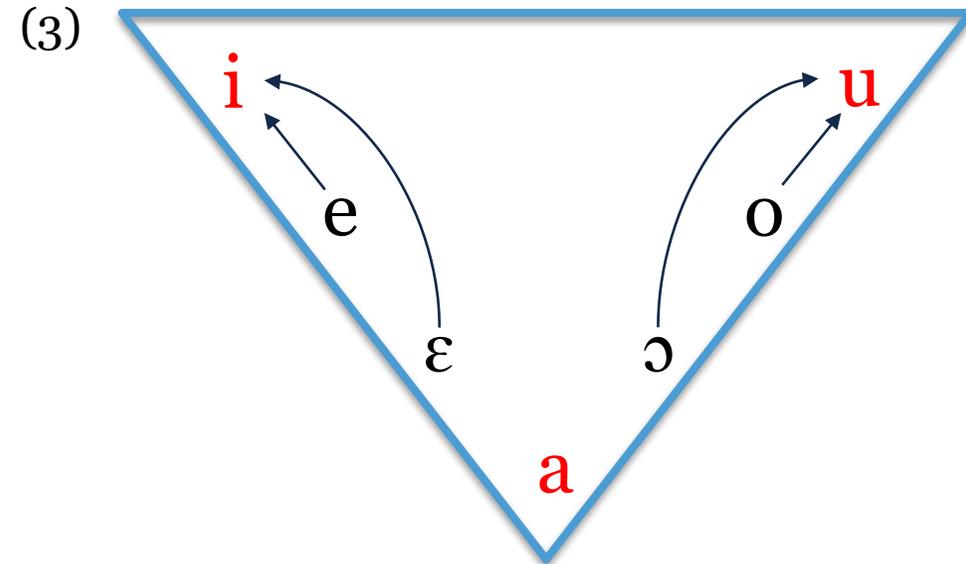


Bolognese Vowel Reduction

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

(2)

Bol.	Bol. + suffix	Gloss
ka'va: s :ter	kava'treŋ	'rope'
'spe: k a	spi'leŋna	'pin'
stu'd ɛ ŋt	stud i ŋ'teŋna	'student'
'fro: s :ta	fru'steŋ	'whip'
gab'j ɔ ŋ	gabj u ŋ'θeŋ	'gabion'



Bolognese Vowel Reduction

Non-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)	/sp ^e p'leŋna/	LIC.NONPERIPH	FAITH
	☞ a. sp ⁱ p'leŋna		*
	b. sp ^e p'leŋna	*! W	L

(5)	/piθ ^ɔ n'θeŋ/	LIC.NONPERIPH	FAITH
	☞ a. piθ ^u n'θeŋ		*
	b. piθ ^ɔ n'θeŋ	*! W	L

Bolognese Vowel Reduction

Faithfulness constraints against height changes:

- 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]: Raising is preferred over lowering.

(6)

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

(7)

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

Bolognese Vowel Reduction

Faithfulness constraint against rounding changes:

- 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	L

(9)

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

Bolognese Vowel Reduction

- Length is contrastive
- Under VR, all vowels are short

(10)

Short	Gloss	Long	Gloss
'm e l:	'thousand'	'm e l	'honey'
's a k:	'dry'	's a k	'sack'
's o	'up, above'	's o :	'his/her/their'

(11)

Bol.	Bol. + suffix	Gloss
kar'j o :la	karju'leŋna	'wheelbarrow'
ban'di r a	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)

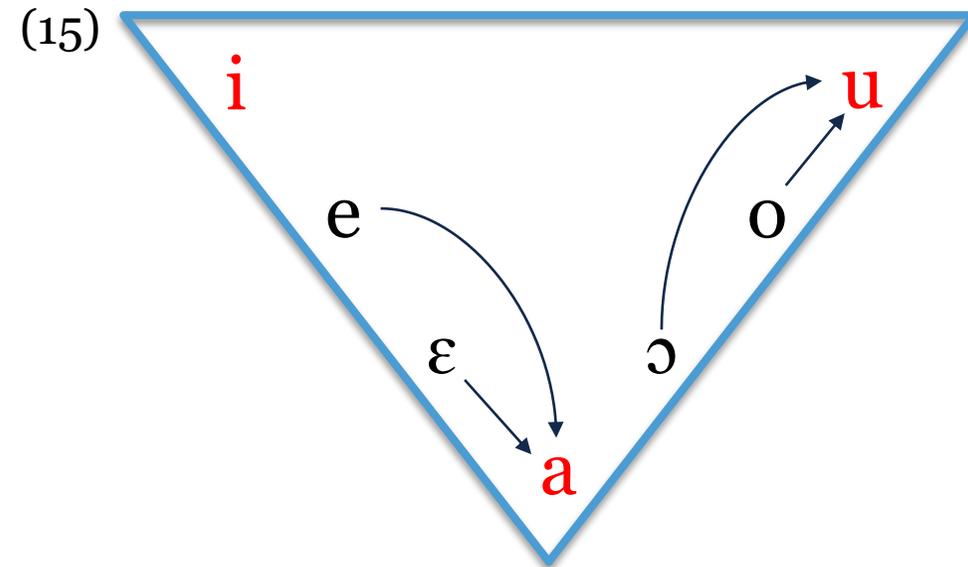
Because WSP is never violated by the winning candidate, it is undominated in the ranking.

Dual Pattern Problem

- Front-mid vowels /e/, /ɛ/ change output targets contingent on length
- Long /eː/ and /ɛː/ reduce to [a], not [i]

(14)

Bol.	Bol. + suffix	Gloss
sar'ves:i	sarvis'jeŋ	service
laŋ'te:rna	laŋtar'neŋna	lantern
'dɛŋt	diŋ'teŋ	tooth
'gɛːbja	gab'joːla	cage



Dual Pattern Problem

- The current constraint ranking:
– {WSP, IDENT[ROUND]}; {LICNONPERIPH., IDENT[LOW]} >> IDENT[HIGH]
- This ranking captures /e, ε/ → [i] and is attested cross-linguistically (Harris, 1998)
- If IDENT[HIGH] >> IDENT[LOW]: then /eː, εː/ → [a] and is attested cross-linguistically (Recasens, 1991)

Dual Pattern Problem

- Current constraint ranking cannot simultaneously generate both patterns

(16)

/bɛ:r'beŋna/	WSP	IDENT[ROUND]	IDENT[LOW]	LIC.NONPERIPH	IDENT[HIGH]
a. bɛ:r'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)

/e:r'beŋna/	LIC.NONPERIPH <i>w</i> = 3	IDENT[LOW] <i>w</i> = 2	IDENT[HIGH] <i>w</i> = 1	MAX[MORA] <i>w</i> = 1	H
☞ a. ar'beŋna		-1		-1	-3
☛ b. ir'beŋna			-1	-1	-2
c. e:r'beŋna	-1				-3

(19)

/gardle'neŋna/	LIC.NONPERIPH <i>w</i> = 3	IDENT[LOW] <i>w</i> = 2	IDENT[HIGH] <i>w</i> = 1	MAX[MORA] <i>w</i> = 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)
 - $A \&_d B$: 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 vowel qualities, identical syllable contexts, different outputs contingent on input length
- Only *front-mid* vowels
- The pattern depends on combinations of vowel quality and quantity: /e, ε/ → [i], /eː, εː/ → [a]

(20)

Bol.	Bol. + suffix	Gloss
pas'teΛ:a	pasti'Λeŋna	'lozenge/pill'
'ske:rθ	skarθ'teŋ	'joke'
'fro:s:ta	frus'teŋ	'whip/whisk'
'no:x:n	nu'neŋ	'grandfather'

Dual Pattern Problem

- Multiple factors contribute to sonority, including length (Parker 2002, 2008; 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, where both factors contribute to a segment's total sonority.

- Vowel height contributes independently to sonority

High < Mid < Low

- Vowel length contributes independently to sonority

$X < X:$, 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	
<i>high</i>	/i, u/	1	/iː, uː/	2
<i>mid-high</i>	/e, o/	2	/eː, oː/	4
<i>mid-low</i>	/ɛ, ɔ/	3	/ɛː, ɔː/	6
<i>low</i>	/a/	4	/aː/	8

Proposal

- Non-peripheral vowels reduce to a peripheral vowel
- Competing pressures to reduce sonority while moving minimally along the proposed sonority thresholds determine VR outcomes

$i/u < i:/u:, e/o, \varepsilon/\vartheta < a < a:, e:/o:, \varepsilon:/\vartheta:$

(21)

Height	Short		Long	
<i>high</i>	/i, u/	1	/i:, u:/	2
<i>mid-high</i>	/e, o/	2	/e:, o:/	4
<i>mid-low</i>	/ε, ϑ/	3	/ε:, ϑ:/	6
<i>low</i>	/a/	4	/a:/	8

Analysis

A process of comparing the distance in sonority between two elements is already discussed in the literature:

- 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: $\text{MAINTAIN}(X\text{-SCALE})$

$\text{MAINTAIN}(X\text{-SCALE})$:

- Assign N violations for every output segment that differs in value of the defined scale X from its input correspondent, where N is the absolute value difference between the input and output values of the defined scale X .

Analysis

- MAINTAIN[SONORITY]: assign N violations for every output segment that differs in total sonority from its input correspondent, where N 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 thresholds from input to output.

Analysis

i/u < i:/u:/, e/o, ε/ɔ < a < a:/, e:/o:/, ε:/ɔ:/

(22)

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

(23)

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

Analysis

i/u < i:/u:/, e/o, ε/ɔ < a < a:/, e:/o:/, ε:/ɔ:/

(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)

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

Complete Analysis

- Constraint ranking:
 - WSP; {IDENT[ROUND], LICNONPERIPH} >> MAINT[SON] >> * [+LOW]
- Sonority thresholds in Bolognese:
 $i/u < i:/u:, e/o, \epsilon/\text{ɔ} < a < a:, e:/o:, \epsilon:/\text{ɔ}:$
- Vowel quality and quantity interact to influence candidate optimality
- Prominence Reduction and Contrast Enhancement interact to drive VR in Bolognese

Conclusion

- Vowel reduction processes can be 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 hierarchies 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 thresholds
- Phonological phenomena are sensitive to the distance between adjacent segments along the sonority hierarchy (Ladefoged, 1973; Clements, 1990; Parker, 2002).
- I propose restrictions on the input-output correspondence of a relative scalar position

Remaining Issues

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

An investigation into this phenomenon is forthcoming.

(26)

Bol.	Bol. + suffix	Gloss
lu'k=atː	luk∅='t=enɟ	'lock'
a'n=ɛːl	an∅='l=enɟ	'ring'
'maila	'm∅l=enɟna	'apple'

Acknowledgements

This work stems from collaboration with Edward Rubin and Aaron Kaplan (University of Utah) as an undergraduate research assistant and was overseen by Brian Hsu (UNC Chapel Hill) as an M.A. thesis advisor.

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Appendix

i/u < i:/u:/, e/o, ε/ɔ < a < a:/, e:/o:/, ε:/ɔ:/

(27)

/bandi'reŋna/	WSP	IDENT[ROUND]	LIC.NONPERIPH	MAINT.[SON]	*[+LOW]
a. bandi'reŋna	*! W			L	
 b. bandi'reŋna				*	
c. banda'reŋna				*	*! W
d. bandu'reŋna		*! W		*	

(28)

/sarveθ'jeŋ/	WSP	IDENT[ROUND]	LIC.NONPERIPH	MAINT.[SON]	*[+LOW]
a. sarveθ'jeŋ			*! W	L	
 b. sarviθ'jeŋ				*	
c. sarvaθ'jeŋ				*	*! W
d. sarvuθ'jeŋ		*! W		*	

Appendix

i/u < i:/u:, e/o, ε/ɔ < a < a:, e:/o:, ε:/ɔ:

(29)

/lantɛ:r'neŋna/	WSP	IDENT[ROUND]	LIC.NONPERIPH	MAINT.[SON]	*[+LOW]
a. lantɛ:r'neŋna	*! W		* W	L	L
b. lantir'neŋna				***! W	L
 c. lantar'neŋna				*	*
d. lantur'neŋna		*! W		*** W	L

(30)

/dɛn'teŋ/	WSP	IDENT[ROUND]	LIC.NONPERIPH	MAINT.[SON]	*[+LOW]
a. dɛn'teŋ			*! W	L	
 b. din'teŋ				*	
c. dan'teŋ				*	*! W
d. dun'teŋ		*! W		*	

Appendix

i/u < i:/u:/, e/o, ε/ɔ < a < a:/, e:/o:/, ε:/ɔ:/

(31)

/kanpε:'neŋna/	WSP	IDENT[ROUND]	LIC.NONPERIPH	MAINT.[SON]	*[+LOW]
a. kanpε:'neŋna	*! W		* W	L	L
b. kanpi'neŋna				***! W	L
 c. kanpa'neŋna				*	*
d. kanpu'neŋna		*! W		*** W	L

(32)

/mudan'teŋ/	WSP	IDENT[ROUND]	LIC.NONPERIPH	MAINT.[SON]	*[+LOW]
 a. mudan'teŋ					*
b. mudin'teŋ				**! W	L
c. mudun'teŋ		*! W		** W	L

Appendix

i/u < i:/u:, e/o, ε/ɔ < a < a:, e:/o:, ε:/ɔ:

(33)

	/pa:ɖzi'neŋna/	WSP	IDENT[ROUND]	LIC.NONPERIPH	MAINT.[SON]	*[+LOW]
a.	pa:ɖzi'neŋna	*! W			L	*
b.	piɖzi'neŋna				***! W	L
 c.	paɖzi'neŋna				*	*
d.	puɖzi'neŋna		*! W		*** W	L

(34)

	/mɔnta'no:la/	WSP	IDENT[ROUND]	LIC.NONPERIPH	MAINT.[SON]	*[+LOW]
a.	mɔnta'no:la			*! W	L	
b.	miɳta'no:la		*! W		*	
c.	maɳta'no:la		*! W		*	* W
 d.	munta'no:la				*	

Appendix

i/u < i:/u:/, e/o, ε/ɔ < a < a:/, e:/o:/, ε:/ɔ:/

(35)

/prupɔ:s'teŋna/	WSP	IDENT[ROUND]	LIC.NONPERIPH	MAINT.[SON]	*[+LOW]
a. prupɔ:s'teŋna	*! W		* W	L	
b. prupis'teŋna		*! W		***	
c. prupas'teŋna		*! W		* L	* W
 d. prupus'teŋna				***	

(36)

/po'teŋ/	WSP	IDENT[ROUND]	LIC.NONPERIPH	MAINT.[SON]	*[+LOW]
a. po'teŋ			*! W	L	
b. pi'teŋ		*! W		*	
c. pa'teŋ		*! W		*	* W
 d. pu'teŋ				*	

Appendix

i/u < i:/u:/, e/o, ε/ɔ < a < a:/, e:/o:/, ε:/ɔ:/

(37)

	/karjɔːleŋna/	WSP	IDENT[ROUND]	LIC.NONPERIPH	MAINT.[SON]	*[+LOW]
a.	karjɔːleŋna	*! W		* W	L	
b.	karjiːleŋna		*! W		***	
c.	karjaːleŋna		*! W		* L	* W
 d.	karjuːleŋna				***	

(38)

	/fuːgaːdeŋ/	WSP	IDENT[ROUND]	LIC.NONPERIPH	MAINT.[SON]	*[+LOW]
a.	fuːgaːdeŋ	*! W			L	
b.	figaːdeŋ		*! W		*	
c.	fagaːdeŋ		*! W		*	* W
 d.	fugaːdeŋ				*	

Appendix

The three-way lax contrast /ε, a, ɔ/ appears to likely have collapsed to something like [a] for younger speakers (Canepari & Vitali 1995), though the distinction is maintained in Vowel Reduction.

(39)

Bol.	Bol. + suffix	Gloss
stu'dεŋt	stud <i>i</i> ŋ'teŋna	'student'
'sa:sɪt	sa's'teŋ	'basket'
pi'sɔŋ	pi <u>s</u> ŋ'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.

(40)

Bol.	Bol. + suffix	Gloss
'v ai der	vid'reŋ	'glass'
mun' ai da	muni'deŋna	'coin'
an' au d	anv <u>u</u> 'deŋ	'nephew'
't au rta	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

(41)	/va i d'reŋ/	WSP	MAX[+HIGH]	FAITH
a.	va i d'reŋ	*! W		L
☞ b.	vi d 'reŋ			*
c.	va d 'reŋ		*! W	*

(42)	/pska u 'reŋ/	WSP	MAX[+HIGH]	FAITH
a.	pska u 'reŋ	*! W		L
☞ b.	pska u 'reŋ			*
c.	pska a 'reŋ		*! W	*

Diphthongs

- It is unclear where along the sonority threshold 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

(43)

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

(44)

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