The gradience of ghosts
An account of unstable segments

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Main Claims

(1)

	/pan👻/	/tump/
Phonological context 1:	pan	tump
Phonological context 2:	pan**k**-u	tump-u

- Ghost segments are best analysed as **weakly active elements**.
- Ghost segments can only **gradiently contribute to markedness** if they surface.
- The original Gradient Symbolic Representation (Smolensky and Goldrick, 2016; Rosen, 2016) system should be modified and assume **gradient activity in the output**.

Gradient Symbolic Representation (=GSR; Smolensky and Goldrick, 2016)

Symbols in a linguistic representation can have **different degrees of presence** or numerical activities.

1. A **unified account** for various types of lexical exceptional behaviour in the phonology:
   - liaison consonants in French (Smolensky and Goldrick, 2016)
   - semi-regularity of Japanese Rendaku (Rosen, 2016)
   - allomorphy in Modern Hebrew (Faust and Smolensky, 2017)
   - lexical accent in Lithuanian (Kushnir, 2017)
   - lexical stress in Moses Columbian Salishan (Zimmermann, to appear)
   - tone sandhi in Oku (Nformi and Worbs, 2017)
   - tone allomorphy in San Miguel el Grande Mixtec (Zimmermann, 2017*a*,*b*)

Arguments for Gradient Symbolic Representation

2. Allows **true gradience**: More than a weak/strong distinction and multiple classes of differently-behaving phonological elements.
   - 6 different 'degrees' of stress preferences for morphemes in Moses Columbian Salishan (Zimmermann, to appear)

3. Embedded in a general **computational architecture for cognition** (=Gradient Symbolic Computation Smolensky and Goldrick, 2016)

4. Exceptional elements can **contribute weakly to markedness**.

Ghost Segments in Nuu-chah-nulth

Ahousaht (Kim, 2003*a*,*b*)

- one of 12 varieties of Nuu-chah-nulth (Southern Wakashan)
- spoken on Flores Island (West Coast of Vancouver Island)

Ghost segments in Ahousaht Nuu-chah-nulth (Kim, 2003*b*)

- some suffixes surface with their initial consonant post-vocalically (2-i) and loose it post-consonantally (2-ii)

(2) *Exceptional suffixes with unstable consonants (Kim, 2003*a*, 178)*

a.	i.	ʔatɬa–(q)umɬ	ʔatɬaqumɬ
		two–round	‘two dollars’
	ii.	tɬ’is–(q)umɬ	tɬ’isumɬ
		white–round	‘sth. white and round’
b.	i.	sapniː–(q)iːl	sapniːqiːɬ
		bread–to.make	‘to make bread’
	ii.	mamuːkʷ–(q)iːl	mamuːkʷiːɬ
		basket–to.make	‘to make baskets’
c.	i.	ʔu–(k)ɬaː–siʃ Eun-Sook	ʔukɬaːsiʃ
		it–to.be.called–1Sg.Ind Eun-Sook	‘My name is Eun-Sook’
	ii.	kʷis–(k)ɬaː–k’uk–ʔiʃ	kʷisɬaːk’ukʔiʃ
		different–to.be.called–1Sg.Ind	‘It seems like he has a different name’

Phonological Generalization: 👻-Consonants in Nuu-chah-nulth

- a ghost consonant only surfaces
  if it does **not create a marked structure**

(3) *Avoidance of a coda consonant for /–👻V/ suffixes*

/V-👻V/	V.**C**$_{👻}$V	
/VC-👻V/	V.CV	*VC.**C**$_{👻}$V

(4) *Avoidance of a cluster for /–👻CV/ suffixes*

/V-👻CV/	V**C**$_{👻}$.CV	
/VC-👻CV/	VC.CV	*VC**C**$_{👻}$.CV

Ghost segments in Ahousaht Nuu-chah-nulth: Challenge I

- other consonant-initial suffixes retain their initial consonant in all contexts (5)
  ➙ **idiosyncratic property** of consonants in certain morphemes

(5) *Creation of consonant sequences (Kim, 2003a, 178)*

a.	waʔitʃ–swi–ʔiʃ	wa.ʔitʃs.wi.ʔiʃ
	to.sleep–beyond.normality-3Sg.Ind	'S/he slept in'
b.	nup–qʔitʃħ	nupq.ʔitʃħ
	one-year(s)	'one year'

Syllables in Nuu-chah-nulth: CV(V)(C)(C)(C) (Kim, 2003*a*, 125ff)

- obligatory onset, no onset clusters
- up to three coda consonants
- no sonority sequencing effect

👻-Consonants in Nuu-chah-nulth: Challenge II

(6) *–👻V Suffixes*

			*Coda	*CC	Max👻
i.	/V–👻V/	☞ a. V.**C**👻V			
		b. V.V			*!
ii.	/VC–👻V/	a. VC.**C**👻V	*!		
		☞ b. V.CV			*

***Coda must outrank Max👻**

(7) *–👻CV Suffixes*

			*CC	Max👻	*Coda
i.	/V–👻CV/	☞ a. V**C**👻.CV			*
		b. V.CV		*!	
ii.	/VC–👻CV/	a. VC**C**👻.CV	*!		*
		☞ b. VC.CV		*	*

Max👻 must outrank *Coda

Theoretical Account Based on Gradience

Gradient Symbolic Representations and HG

- symbols in a linguistic representation can have **different degrees of presence**
- grammatical computation inside **Harmonic Grammar**
  (Legendre et al., 1990; Potts et al., 2010)
- any **change in activity is a faithfulness violation**

(8)

$b_1a_1t_1$-$p_{0.5}$	MAX 5	
a. batp		0
b. bap	-1	-5
☞ c. bat	-0.5	-2.5

Prediction

Elements active to a lesser degree are **easier to delete**.

Gradient Symbolic Representations in the Output (Zimmermann, 2017*a*,*b*)

- output elements can be weakly active as well
- every marked structure M violates a markedness constraint *M by the **mean activity** (MA)* of elements in the scope of M

(*MA= $\frac{\text{sum of activities of all its elements}}{\text{number of all its elements}}$)

(9)

$b_1a_1t_1$-$p_{0.5}$	*CC]$_\sigma$ 3	Dep 2	Max 1	
a. $b_1a_1t_1p_1$	-1	-0.5		-4
b. $b_1a_1t_1p_{0.5}$	-0.75			-2.25
☞ c. $b_1a_1t_1$			-0.5	-0.5

Prediction

Elements active to a lesser degree are not **as bad a markedness problem or not as good a markedness solution**.

👻-Consonants in Nuu-chah-nulth as Weak Segments

Weak C's in Nuu-chah-nulth are weakly active $C_{0.5}$

- weakly active C's are **easier targets for deletion** and not realized if they result in a marked structure
- the ranking paradox (6)&(7) vanishes since weakly active C's are **not as bad a markedness problem**:
  - if a weakly active C 'pushes' a fully active C in coda position, a repair is necessary:
    /VC–👻V/ → V.CV, *VC.**C**👻V
  - but a weakly active C in coda-position is tolerated:
    /V–👻CV/ → V**C**👻.CV, *V.CV

Constraints

(10)

a. *Coda
Assign -X violation for every [coda position]$_{MA=X}$ within a syllable that is filled.

b. *CC
Assign -X violations for every pair of [adjacent consonants]$_{MA=X}$ in the same syllable edge.

c. Full!
Assign 1-X violations for every segment in the output with activity X.

Fully Active C's: Consonant Clusters Are Created

(11)

$w_1a_1ʔ_1i_1ʧ_1$–$s_1w_1i_1$	DEP$_S$ 20	MAX$_S$ 20	*CC 10	*CODA 7	
☞ a. $w_1a_1.ʔ_1i_1ʧ_1s_1.w_1i_1$			-1	-1	-17
b. $w_1a_1.ʔ_1i_1ʧ_1.w_1i_1$		-1		-1	-27
c. $w_1a_1.ʔ_1i_1.ʧ_1ə_1s_1.w_1i_1$	-1			-1	-27
d. $w_1a_1.ʔ_1i.w_1i_1$		-2			-40
e. $w_1a_1.ʔ_1i.{}_1ʧ_1ə_1.s_1ə_1.w_1i_1$	-2				-40

(12)
a. MAX$_S$ ≫ *CC (a. – b.)
b. DEP$_S$ ≫ *CC (a. – c.)
c. 2xMAX$_S$ ≫ *CC + *CODA (a. – d.)
d. 2xDEP$_S$ ≫ *CC + *CODA (a. – e.)

Weak Segments Remain Weak in the Output

(13)

ʔ$_1$a$_1$tɬ$_1$a$_1$–q$_{0.5}$u$_1$m$_1$ɬ$_1$		DEP$_S$ 20	MAX$_S$ 20	FULL! 12	
☞	a. ʔ$_1$a$_1$.tɬ$_1$a$_1$.q$_{0.5}$u$_1$m$_1$ɬ$_1$			-0.5	-6
	b. ʔ$_1$a$_1$.tɬ$_1$a$_1$.q$_1$u$_1$m$_1$ɬ$_1$	-0.5			-10
	c. ʔ$_1$a$_1$.tɬ$_1$a$_1$.u$_1$m$_1$ɬ$_1$		-0.5		-10

(14) a. DEP$_S$ ≫ FULL! (a.–b.)

b. MAX$_S$ ≫ FULL! (a.–c.)

/–ʔV/ after V: Realization

(15)

ʔ$_1$a$_1$tɬ$_1$a$_1$–q$_{0.5}$u$_1$m$_1$ɬ$_1$		MAX$_S$ 20	FULL! 12	*CC 10	*CODA 7	
☞ a.	ʔ$_1$a$_1$.tɬ$_1$a$_1$.q$_{0.5}$u$_1$m$_1$ɬ$_1$		-0.5	-1	-1	-23
b.	ʔ$_1$a$_1$.tɬ$_1$a$_1$.u$_1$m$_1$ɬ$_1$	-0.5		-1	-1	-27

(16) MAX$_S$ ≫ FULL!

/–ʔV/ after C: Not Realized to Avoid Coda

(17)

tɬ$_1$i$_1$s$_1$–q$_{0.5}$u$_1$m$_1$ɬ$_1$	MAX$_S$ 20	FULL! 12	*CC 10	*CODA 7	
a. tɬ$_1$i$_1$s$_1$.q$_{0.5}$u$_1$m$_1$ɬ$_1$		-0.5	-1	-2	-30
☞ b. tɬ$_1$i$_1$.s$_1$u$_1$m$_1$ɬ$_1$	-0.5		-1	-1	-27

(18) 0.5xFULL! + *CODA ≫ 0.5xMAX$_S$

/–CV/ after V: Realization (Despite Being a Coda!)

(19)

ʔ$_1$u$_1$–k$_{0.5}$ɬ$_1$aː$_1$	MAX$_S$ 20	FULL! 12	*CC 10	*CODA 7	
☞ a. ʔ$_1$u$_1$k$_{0.5}$.ɬ$_1$aː$_1$		-0.5		-0.5	-9.5
b. ʔ$_1$u$_1$.ɬ$_1$aː$_1$	-0.5				-10

(20) 0.5xMAX$_S$ ≫ 0.5xFULL! + 0.5x*CODA

/–CV/ after C: Not Realized to Avoid Cluster

(21)

$k^w{}_1i_1s_1–k_{0.5}ɬ_1a:_1$	MAX$_S$ 20	FULL! 12	*CC 10	*CODA 7	
a. $k^w{}_1i_1s_1k_{0.5}.ɬ_1a:_1$		-0.5	-0.75	-1	-20.5
☞ b. $k^w{}_1i_1s_1.ɬ_1a:_1$	-0.5			-1	-17

(22) $0.5\text{x}\textsc{Full!} + 0.75\text{x}^*\text{CC} \gg 0.5\text{x}\textsc{Max}_S$

Core of the Account: Gradient Markedness Violations

(23) */–ʔCV/: C realized after a V*

ʔ$_1$u$_1$–k$_{0.5}$ɬ$_1$aː$_1$	MAXS 20	FULL! 12	*CC 10	*CODA 7	
☞ a. ʔ$_1$u$_1$k$_{0.5}$.ɬ$_1$aː$_1$		-0.5		-0.5	-9.5
b. ʔ$_1$u$_1$.ɬ$_1$aː$_1$	-0.5				-10

0.5xMAXS ≫ **0.5x**FULL! + **0.5x***CODA

(24) */–ʔV/: C not realized after a C*

tɬ$_1$i$_1$s$_1$–q$_{0.5}$u$_1$m$_1$ɬ$_1$	MAXS 20	FULL! 12	*CC 10	*CODA 7	
a. tɬ$_1$i$_1$s$_1$.q$_{0.5}$u$_1$m$_1$ɬ$_1$		-0.5	-1	-2	-30
☞ b. tɬ$_1$i$_1$.s$_1$u$_1$m$_1$ɬ$_1$	-0.5		-1	-1	-27

0.5xFULL! + *CODA ≫ **0.5x**MAXS

Alternatives

Gradient Activity only in the Input? (Smolensky and Goldrick, 2016; Rosen, 2016)

- can in principle predict patterns of 'exceptional unmarkedness' as in Nuu-chah-nulth (=deletion of weak elements is 'easier')

- the specific Nuuch pattern can not follow under the assumption that all output elements are fully active since **no distinction possible between a marked structure that is created by a weak element and a marked structure that is created because of a weak element**

Nuu-chah-nulth with Full Activity in the Output?

(25) *All weak elements must be neutralized to fully active ones in the output*

ʔ$_1$a$_1$tɬ$_1$a$_1$–q$_{0.5}$u$_1$m$_1$ɬ$_1$	MAXS 26	DEPS 20	
☞ a. ʔ$_1$a$_1$.tɬ$_1$a$_1$.q$_1$u$_1$m$_1$ɬ$_1$		-0.5	-10
b. ʔ$_1$a$_1$.tɬ$_1$a$_1$.u$_1$m$_1$ɬ$_1$	-0.5		-13

vs. (Smolensky and Goldrick, 2016; Rosen, 2016) where MAXS is a rewarding constraint; no influence on the weighting paradox

Nuu-chah-nulth with Full Activity in the Output?

(26) *Exceptional /–(C)V/: C not realized after C to avoid coda*

tɬ$_1$i$_1$s$_1$–q$_{0.5}$u$_1$m$_1$ɬ$_1$	MAX$_S$ 25	DEP$_S$ 20	*CC 10	*CODA 7	
a. tɬ$_1$i$_1$s$_1$.q$_1$u$_1$m$_1$ɬ$_1$	-0.5		-1	-2	-34
☞ b. tɬ$_1$i$_1$.s$_1$u$_1$m$_1$ɬ$_1$		-0.5	-1	-1	-30

0.5xDEP$_S$ + *CODA ≫ **0.5x**MAX$_S$

(27) *Exceptional /–(C)CV/: C wrongly not realized after a vowel*

ʔ$_1$u$_1$–k$_{0.5}$ɬ$_1$aː$_1$	MAX$_S$ 25	DEP$_S$ 20	*CC 10	*CODA 7	
☛ a. ʔ$_1$u$_1$k$_1$.ɬ$_1$aː$_1$		-0.5		-1	-17
☞ b. ʔ$_1$u$_1$.ɬ$_1$aː$_1$	-0.5				-13

0.5xMAX$_S$ ≫ **0.5x**DEP$_S$ + *CODA

Autosegmental Defectivity

- ghost segments are **defective**; their phonological structure lacks material, e.g.
  - Spencer (1986) or Szypra (1992) on Polish jers: radically underspecified segmental root nodes that are devoid of any melodic features
  - Tranel (1995, 1996) on French liaison: consonants without a position on the skeletal tier
  - Faust (2013) on Modern Hebrew allomorphy: /t/ alternates with zero since its not associated to a skeletal CV-position

→ a representational account that is based on independently necessary representational contrasts

Autosegmental Defectivity for Nuu-chah-nulth I (Kim, 2003*a*, 180)

- ghost segments=floating features lacking a segmental root node; their realization implies violating $\textsc{Dep}_{\textsc{Rt}}$
- context-specific $\textsc{Dep}_{\textsc{Rt}}$ is sensitive to whether the inserted root node is preceded by a vowel or a consonant

(28) a.

ʔu–^{k}ɬaː	$\textsc{Dep}_{\textsc{Rt}(\text{C\_\_})}$	$\textsc{Max}_{\textsc{Subs}}$	$\textsc{Dep}_{\textsc{Rt}(\text{V\_\_})}$
☞ a. ʔuk.ɬaː			*
b. ʔu.ɬaː		*!	

b.

tɬis–^{q}umɬ	$\textsc{Dep}_{\textsc{Rt}(\text{C\_\_})}$	$\textsc{Max}_{\textsc{Subs}}$	$\textsc{Dep}_{\textsc{Rt}(\text{V\_\_})}$
a. tɬis.qumɬ	*!		
☞ b. tɬi.sumɬ		*	

Autosegmental Defectivity for Nuu-chah-nulth I: Discussion

- **problematic context-sensitivity** for faithfulness, crucially different from positional faithfulness (Beckman, 1998)?
- correlation to **markedness avoidance is purely coincidental**, Nuu-chah-nulth' (29) is equally well possible

(29) *Factorial Typology: Nuu-chah-nulth'*

a.

ʔu–^{k}ɬaː	DEP$_{RT(V__)}$	MAX$_{SUBS}$	DEP$_{RT(C__)}$
a. ʔuk.ɬaː	*!		
☞ b. ʔu.ɬaː		*!	

b.

tɬis–^{q}umɬ	DEP$_{RT(C__)}$	MAX$_{SUBS}$	DEP$_{RT(V__)}$
☞ a. tɬis.qumɬ			*
b. tɬi.sumɬ		*	

Autosegmental Defectivity for Nuu-chah-nulth II

- ghost segments are defective and remain defective in the output
- *Coda only 'sees' non-defective segments

(30) a.

tɬis–ᑫumɬ	*Coda	MaxS	FullSpec!
a. tɬis.ᑫumɬ	*!		*
☞ b. tɬi.sumɬ		*	

b.

ʔu–ᵏɬaː	*Coda	MaxS	FullSpec!
☞ a. ʔuᵏ.ɬaː			*
b. ʔu.ɬaː		*!	

Autosegmental Defectivity for Nuu-chah-nulth II

- What is this **'defectivity'**?
  - Underspecification for place, articulatory features,... not trivially possible since 👻-consonants contrast (q, k, j,...)
  - Lack of a root node – What then is the motivation/point of the root node to begin with if segments are happy without it?
- *Coda does not 'see' those defective C's but *CC has to (31)

  ➙ **arbitrary split of all markedness constraints** into two sets (one seeing all segments, the other ignoring an arbitrary class of them)

(31)

kʷis–ᵏɬaː	*Coda	*CC	Max$_S$	FullSpec!
a. kʷis.ᵏɬaː	*	*!		*
☞ b. kʷis.ɬaː	*		*	

Summary

Summary

- strengthened the argument for Gradient Symbolic Representations in showing that the **typology of predicted lexical exceptions straightforwardly includes ghost segments**
- showed that **gradient markedness** contribution is attested in the case study of ghost segments in Nuu-chah-nulth
- argued for Gradient Symbolic Representations in **the Output**
- showed that gradient markedness contributions naturally fall out from gradient activity but remain **challenging under an autosegmental defectivity account**

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