Faded Copies:
Reduplication as Sharing of Activity

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Reduplication as Sharing of Activity

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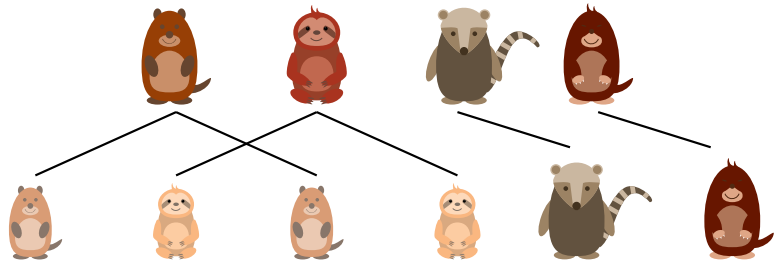
Proposal

1. Reduplication is weakening of all elements involved in the copying.

Underlying:

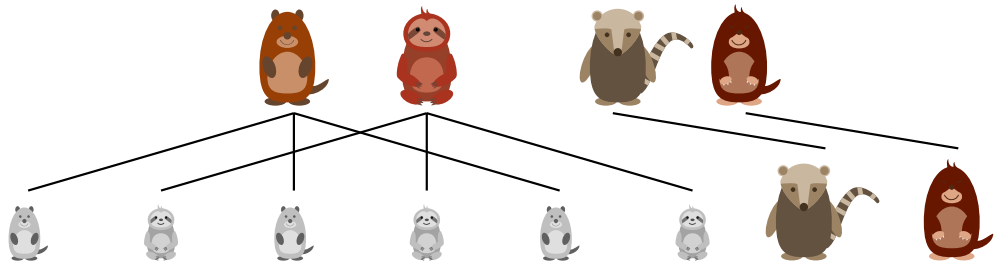
Output:



2. Every copy operation gradiently weakens elements.

Underlying:

Output:



Assumptions

1. All linguistic symbols have **activity** that can **gradiently** differ.
2. Reduplication is **fission** to fill empty prosodic nodes.
3. Fission is **distribution of underlying activity**.

Avant: Reduplication and Prosody

- partial reduplication: an affix 'whose canonical shape is constant [...] but whose segmental content varies in an obvious way depending on the base to which it is attached' (McCarthy, 1993, 187)

  → **a prosodically delimited copy is added to express morphological meaning**

(1) Partial reduplication in Ilokano: A heavy syllable (McCarthy, 1993, 187)

kaldíŋ	'goat'	kal∼kaldíŋ	'goats'
púsa	'cat'	pus∼púsa	'cats'
róʔot	'litter'	roː∼róʔot	'litter' PL
tràk	'truck'	traː∼tràk	'trucks'

Avant: Reduplication and Fixed Segmentism (Alderete et al., 1999)

- a reduplicative morpheme also contains an **invariant part** (phonologically predictable epenthesis or lexically stored)

(2) Fixed V-Reduplication in Lushootseed (Urbanczyk, 1999, 2001)

gʷədíl	'sit'	gʷ**í**∼gʷədil	'sit down briefly'
bədáʔ	'child'	b**í**∼bədaʔ	'small child'
qʷɬayʔ	'log'	qʷ**í**∼qʷɬayʔ	'stick'
duːkʷ	'knife'	d**í**∼duːkʷ	'small knife'

(3) Fixed C-reduplication in Nuu-chah-nulth (Stonham, 1994, 2004)

haw'a	haː**c**∼haw'acsupt'aːɬ	'they had an eating contest'
hina	hiː**c**∼hinḥsacpeʔi	'the ones on the beach side'
tɬa	tɬaː**c**∼tɬaːḥsa	'it was standing at the edge'

Avant: Reduplication Terminology

(4)

'Traditional': Reduplicant Base

kal ~ kaldíŋ

Here:
(phonological account)

kal ~ kal - díŋ → Copying is symmetrical

Copied Not copied

□ ~ kal díŋ

kal ~ kal díŋ → Empty prosody triggers copying

Copy-Exponent Copied base

1. Copying as Weakening: Empirical Picture

1.1. Copying Enables Reduction

A. C-Reduction in the Copy Exponent: Gitksan (Brown, 2008)

- fixed segmentism reduplication with /i/ (and /a/ next to gutturals)

(5) Plural reduplication (Brown, 2008, 147+148)

dzap	dz i p ∼ dz a p	'make, do'
dulpx^{w}	d i l ∼ d u l px^{w}	'to be short'
ʔisx^{w}	ʔ a s ∼ ʔ i s x^{w}	'stink, smell'

- deaffricativization, deglottalization (+predictable voicing), and depalatalization in the copy-exponent

(6) Plural reduplication and C-reduction (Brown, 2008, 147+148)

m'ats	m i s ∼ m' a ts	'to hit, strike'	ts	→	s
t'u:ts'x^{w}	d i s ∼ t' u: ts' x^{w}	'be black'	X'	→	X
maʃx^{w}	m i s ∼ m a ʃ x^{w}	'white'	ʃ	→	s
iʃxw	a s ∼i ʃ xw	'stink, smell'			

A. C-Reduction in the Copy Exponent: Gitksan

(7) Plural reduplication and C-reduction (Brown, 2008, 147+148)

m'atɬs	m i s ∼ m' a tɬ	'to hit, strike'	tɬ	→	s
t'u:tɬ'x^{w}	d i s ∼ t' u: tɬ' x^{w}	'be black'	X'	→	X
maʃx^{w}	m i s ∼ m a ʃ x^{w}	'white'	ʃ	→	s
iʃxw	a s ∼i ʃ xw	'stink, smell'			

- no such reduction outside of reduplication contexts

(8) Preservation of glottalization and affricates (Brown, 2008, 127)

ɬi–tɬ'aqt	'the tip of it' (+DEF-prefix)/
si–tɬ'aq'	'dig, gather clams' (+INTR-prefix)/

B. V-Reduction in the Copied Base: Lushootseed

(Broselow, 1983; Bates et al., 1994; Urbanczyk, 2001)

- alternation between fixed vowel reduplication /Ci–/ and /CV–/

(9) Diminutive Reduplication (Urbanczyk, 2001, 195-207)

a. *Fixed V in copy-exponent*

dúːk^{w}	'knife'	d íː d uːk^{w}	'small knife'
g^{w}ədíl	'sit'	g^{w} íː g^{w} ədil	'sit down briefly'

b. *V-Reduction without fixed V*

júbil	'die, starve'	jú ~ jə bil	'small animal dies'
s–túləkʷ	'river'	s– tú ~ tə ləkʷ	'creek'

c. *V-Deletion without fixed V*

pástəd	'white person'	pá ~ p stəd	'white child'
ʔúsil	'dive'	ʔú ~ ʔ sil	'shallow dive'

C. Reduction in Copy Exponent and Copied Base: Kwak'wala

(Boas, 1947; Kalmar, 2003; Saba Kirchner, 2010)

- suffixation of /m'uːt/ 'refuse, useless' accompanied by reduplication

(10) Reduction in the copied base (Saba Kirchner, 2010, 177-80)

a.	səl	'drill'	səl ~ sə muːt	'left after drilling'
	kən	'scoop up'	kən ~ kə muːt	'left after scooping up'
b.	k'aːp	'(mouse) gnaw'	k'aː ~ k'əp m'uːt	'gnawings of mouse'
	tiːɬ	'bait'	tiː ~ təɬ m'uːt	'remains of bait'

(11) Reduction in the copy exponent (Saba Kirchner, 2010, 176-79)

a.	məndz	'cut kindling wood	mə ~ mən dzəmuːt	'left after cutting kindling woods'
	c'əm'	'melt'	c'ə ~ c'əm' əm'uːt	'left after melting'
b.	q^{w}'aːl'	'scorch'	q^{w}'ə ~ q^{w}'aːl' əmuːt	'embers'
	saːq^{w}'	'peel bark'	sə ~ saːq^{w}' əmuːt	'left after peeling bark'

C. Reduction in Copy Exponent and Copied Base: Kwak'wala

- reduction avoids stress clashes (*HH) and builds unmarked iambic feet LH, LL, H (H=Vː or sonorant coda) (Struijke, 2000; Saba Kirchner, 2010)

(12)

	e.g.	*expected			surface	
		H	H	H	LH	H
a.	səl	(səl)	(səl)	(muːt)	(sə . səl)	(muːt)
		H	H	H	LH	H
b.	k'aːp	(k'aːp)	(k'aːp)	(muːt)	(k'ə . k'aːp	(muːt)
		H	H	LH	LH	LH
c.	məndz	(mən)	(mən)	(dzə.muːt)	(mə . mən)	(dzə.muːt)

- these repairs are bound to copy exponents and copied bases

(13)

surface			*repair	
H	H	H	LH	LH
(tsʼóː)	(lʼàm)	(yʼàː)	(tsʼə.lʼàm)	(yʼə.yʼàː)

Summary: Copying = Weakening

(14) a. Reduction in the copy-exponent*

□ + sapo ✧ sə ∼ sa po

(McCarthy and Prince, 1995; Becker and Flack Potts, 2011)

e.g. Gitksan, Shuswap, Sanskrit…

b. Reduction in the the copied base

□ + sapo ✧ sa ∼ sə po

(Shaw and Howe, 1999; Struijke, 2000)

e.g. Tohono O'odham, Heiltsuk, Mainland Sliammon,…

c. Reduction in both copy-exponent and copied base

□ + sapo ✧ sə ∼ sə po

(Struijke, 2000)

e.g. Kwakwala, Hausa, Tagalog,…

*'TETU in the reduplicant'=one main argument for correspondence-theory (McCarthy and Prince, 1995)

1.2. More Copying Enables More Reduction

Multiple Reduplication

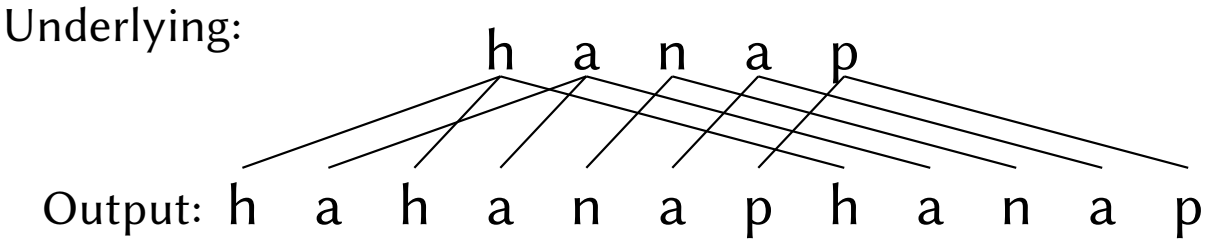
(15) *Multiple Reduplication*
The presence of two or more reduplicative morphemes in a word.

(16) Reduplication in Tagalog (Mattes, 2007, 126)

a. nag- du ∼duman siya bulan ∼ bulan
BEG.AV-IPFV∼DEM.DIST 3.SG.AF PL∼month
'S/he goes there every month'

b. ini an ha ∼ hanap ∼ hanap -on
DEM.PROX PB IPFV∼PL∼look.for-UG
'here (they are) continuously searching'

(17) Multiple Copying



A. Avoidance of Multiple Reduplication: Ahousaht Nuuchahnulth

- some meanings are expressed by reduplication alone (18-a)
- many suffixes trigger prefixing reduplication (=underlined) (18-b)

(18) a.

maɬtiː	‘house’	
ma ∼ ma ɬtiː	‘houses’	(PL-maɬtiː)
nuːk	‘song’	
nu ː∼ nuː k	‘songs’	(PL-nuːk)
naʔa	‘to hear’	
na ∼ na ʔa	‘to understand’	(DER-naʔa)

b. mi ∼ mi ɬk’ukʔicuːʃ

RED∼miɬ-k’uk-ʔitʃuːʃ

to.resemble∼same-to.resemble-2PL.IND

‘both of you look alike’

(Kim, 2003*b*, 136+138)

A. Avoidance of Multiple Reduplication: Ahousaht Nuuchahnulth

(Kim, 2003*a*,*b*, 2008)

- two reduplication-triggering morphemes in a word only result in a single copy-exponent

(19) a. na ∼ na ʔak'ukʔiʃ (* na ∼ na ∼ na ʔak'ukʔiʃ)
DER-naʔa-k'uk-ʔiʃ
DER-to.hear-to.resemble-3SG.IND
's/he seems to be knowledgeable'

b. t'u ∼ t'u c'iːħ (* t'u ∼ t'u ∼ t'u c'iːħ)
PL-t'uc'(up)-ʔiːħ
PL-sea.urchin-to.gather/fish
'gathering more than one sea urchin'

(Kim, 2003*b*, 138)

- a pattern that can be found in basically all Southern Wakashan languages (Rose, 1981; Stonham, 1994, 2004)

B. Truncation in Multiple Reduplication Contexts: Sikaiana (Donner, 2012)

(20) Repetitive reduplication (Donner, 2012, 23+24)

a. *Bisyllabic repetitive reduplication*

sopo	sopo ∼ sopo	‘jump’
sepu	sepu ∼ sepu	‘dive’
motu	motu ∼ motu	‘snap’

b. *CV/C-reduplication in the plural*

sopo	s ∼ so po	so ∼ so po	‘jump’
sepu	s ∼ se pu	se ∼ se pu	‘dive’
moe	m ∼ mo e	mo ∼ mo e	‘sleep’

c. *Obligatory C-reduplication if both are combined*

sopo	sopo ∼ s ∼ so po	* sopo ∼ so ∼ so po	‘jump’
sepu	sepu ∼ s ∼ se pu	* sepu ∼ so ∼ se pu	‘dive’

Summary: More Copying = More Weakening

(21)

	No Reduplication	1 x Reduplication	2 x Reduplication	
Lg 1	Reduction			e.g. Palauan
Lg 2	No Reduction	Reduction		e.g. Lushootseed
Lg 3	No Reduction		Reduction	e.g. Sikaiana
Lg 4	No Reduction			e.g. Papapana

2. Copying as Weakening: Theoretical Modeling

2.1. Background Assumptions

Copying as Weakening: Assumptions

1. Reduplication Results from Prosodic Affixation
2. Gradient Symbolic Representation
3. Harmonic Grammar
4. Containment
5. **Fission is Distribution of Activity**

1. Reduplication Results from Prosodic Affixation

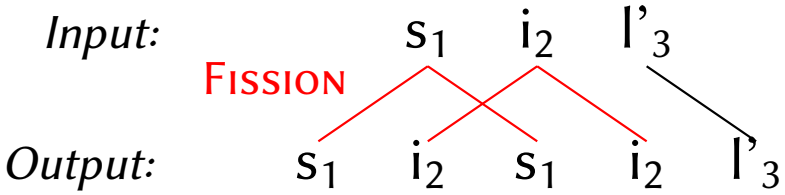
(Marantz, 1982; Pulleyblank, 2009; Saba Kirchner, 2010, 2013*a*,*b*)

- reduplicative morphemes contain **segmentally empty prosodic nodes** that are filled with 'copied' elements
- copying is a general phonological repair that applies to **fill these otherwise empty nodes**
  - no reduplication-specific mechanism, reduplication is just 'normal' affixation
  - explains the fixed prosodic size of copy exponents
  - explains non-concatenative allomorphy between reduplication and lengthening (Saba Kirchner, 2010, 2013*a*,*b*; Zimmermann, 2013)

1. Reduplication Results from Prosodic Affixation

- copying is **fission** of segments violating (22)
  (Spaelti, 1997; Struijke, 2000; Gafos, 2003; Nelson, 2003)

(22) INTS: Assign -1 violation to every pair of output segments that correspond to the same input segment.



(23)

	μ>V	DEPS	*V:	INTS
μ / s1 i2 l'3 (μ)				
a. μ μ / s1 i2 l'3	*!			
☞ b. μ μ / s1 i2 s1 i2 l'3				**

2. Gradient Symbolic Representation (Smolensky and Goldrick, 2016; Rosen, 2016)

- symbols in a linguistic representation can have **different activities**
- in the following, all output activity is 1
- different activities result in gradient faithfulness violations
  - weakly active elements are easier to delete than 'normal' segments
  - it is costly to realize weakly active elements

(24) Gradient activity = gradient faithfulness violations

b a t – p (1) (1) (1) (.5)	*CC	MAX	DEP
a. b a t p (1) (1) (1) (.5) [+.5]	-1		-0.5
☞ b. b a t (1) (1) (1)		-0.5	
c. b a p (1) (1) (.5) [+.5]		-1	-0.5

Intermezzo: Max and Dep and GSR

(25) a. Dep : For every pair of corresponding input output elements with underlying activity I and an output activity O where I<O: Assign -(O-I) violations.

b. Max : For every pair of corresponding input output elements with underlying activity I and an output activity O where I>O: Assign -(I-O) violations.

2. Gradient Symbolic Representation (=GSR)

1. Embedded in a general **computational architecture for cognition**
   (=Gradient Symbolic Computation Smolensky and Goldrick, 2016)
2. A **unified account** for different exceptional phonological behaviours:
   - liaison consonants in French (Smolensky and Goldrick, 2016)
   - semi-regularity of voicing in Japanese Rendaku (Rosen, 2016)
   - allomorphy in Modern Hebrew (Faust and Smolensky, 2017)
   - lexical accent in Lithuanian (Kushnir, 2017)
   - tone sandhi in Oku (Nformi and Worbs, 2017)
   - tone allomorphy in San Miguel el Grande Mixtec (Zimmermann, 2017*a*,*b*)
   - lexical stress in Moses Columbian Salishan (Zimmermann, to appear)
   - exceptional tone (non)spreading in San Molinos Mixtec (Zimmermann, 2018*a*)
   - interaction of phonological/lexical gemination/lenition in Italian (Amato, 2018)
   - compound stress in Sino-Japanese (Rosen, 2018)
   - compound tensing in Korean (Lee, 2019)
   - stress-syncope interaction in Levantine Arabic (Trommer, 2018)
   - (interacting) ghost segments in Welsh (Zimmermann, 2018*c*)
   - …

3. Harmonic Grammar (Legendre et al., 1990; Potts et al., 2010)

- constraints are **weighted**, not ranked

(26) Toy Example: Weighted Constraints

Input	C1 100	C2 60	C3 50	*Harmony Score*
☞ a. Output candidate 1	-1			-100
b. Output candidate 2		-1	-1	-110
c. Output candidate 3		-2		-120

- constraint ganging and threshold effects are predicted
  - though (26-b+c) only violate C2 and C3 with a lower weight than C1, they have a worse harmony score than (26-a) since the lower-weighted violations **gang up**

4. Containment (Prince and Smolensky, 1993/2004)

- non-realization of an element is setting its **activity to zero** (=gray)
- non-realized elements can be enough to fill prosodic nodes
  (Trommer, 2011; Trommer and Zimmermann, 2014; Zimmermann, 2017*c*)

(27) μ>V: Assign -1 violation for every μ that does not dominate a vowel.

(28) [μ>V]$_P$: Assign -1 violation for every μ that does not dominate a **phonetically interpreted** vowel.

(29)

μ + sopo	μ>V 100	Ints 10	[μ>V]$_P$ 5	Max 5	
a. μ μ μ / s o p o / 1 1 1 1	-1		-1		-105
☞ b. μ μ μ / s o ~ s o p o / 1 1 1 1 1 1		-2			-20
b. μ μ μ / s o ~ s o p o / 1 1 1 1 1 1 ; -1		-2	-1	-1	-30

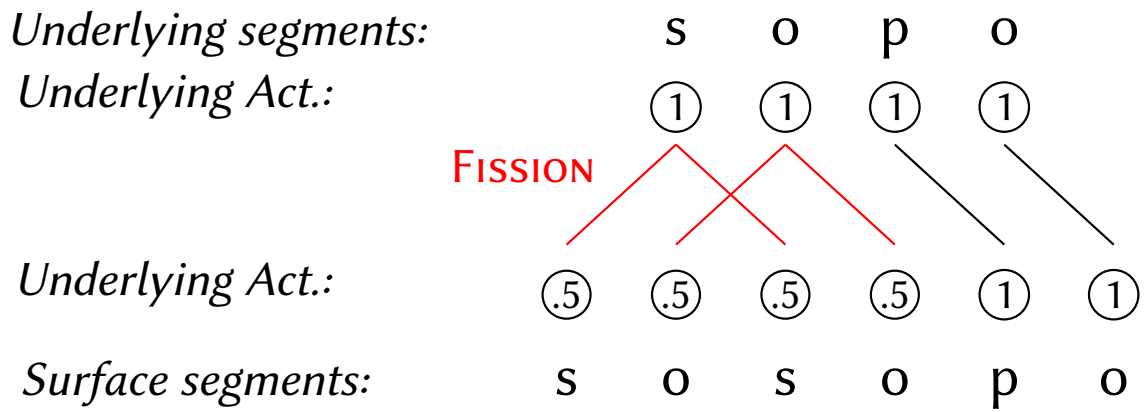
(to be modified soon)

2.2. Proposal: Fission is Distribution of Activity

5. Fission is Distribution of Activity

(30) GEN restriction on fission
Input element S_1 with activity A corresponds to x output elements S_1 with underlying activity A/x.

(31)

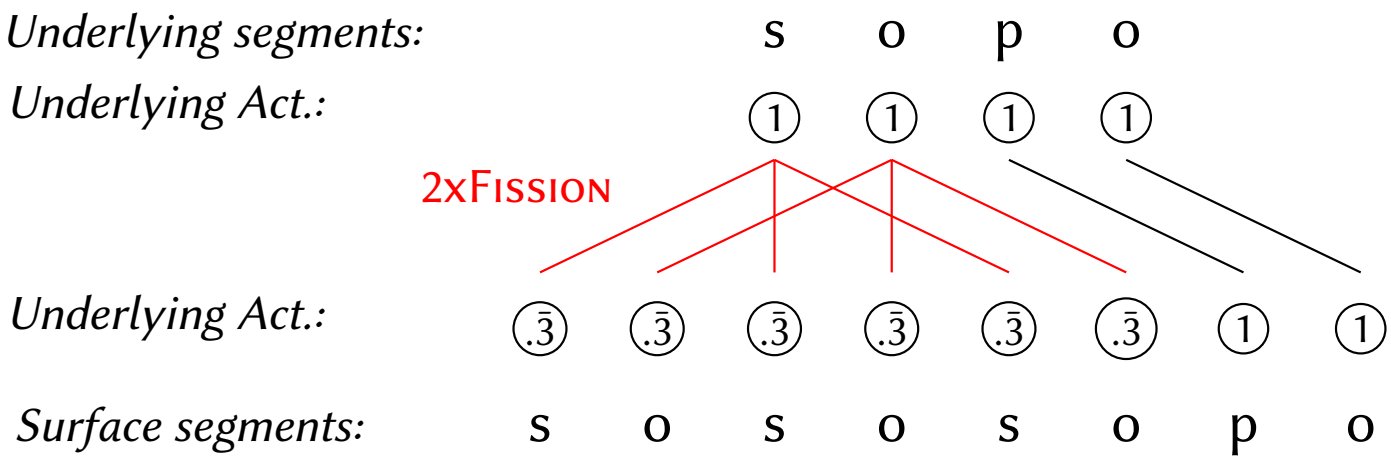


= elements that result from fission necessarily have an activity smaller than 1 that corresponds to input activity

= all output correspondents of S_1 have the same amount of activity that corresponds to input activity ➙ **copying weakens symmetrically**

5. Fission is Distribution of Activity

(32) More copying = More Weakening

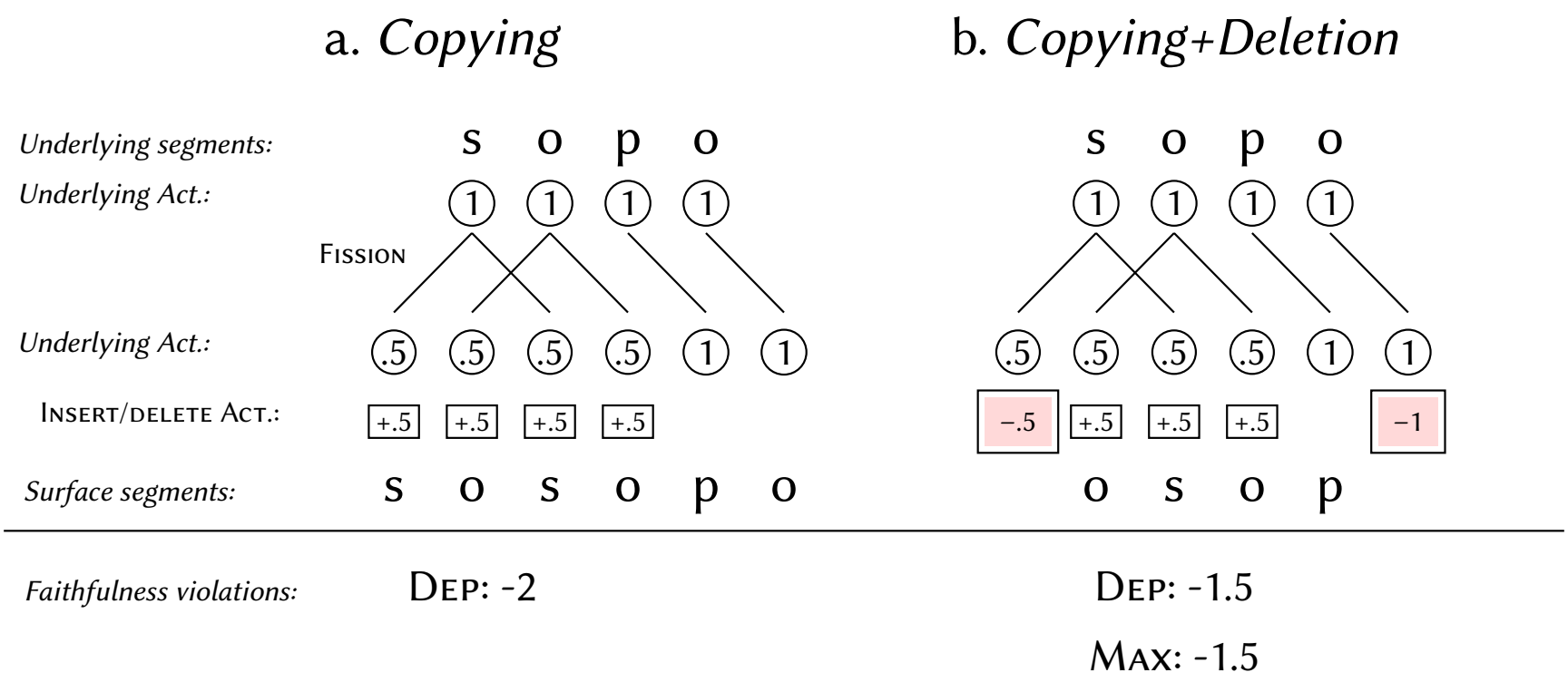


→ **copying weakens gradiently**

5. Fission is Distribution of Activity

- crucial consequence for elements with the same underlying activity: Non-realization of a copied segment is better for MAX; they are **weaker**

(33)



Predicted Typology: Reduction Thresholds

(34)

Weaker
=Less protected by MAX, IDENT
=More penalized by DEP

	No Reduplication	1 x Reduplication	2 x Reduplication	
Lg 1	Reduction			e.g. Palauan
Lg 2	No Reduction	Reduction		e.g. Lushootseed
Lg 3	No Reduction		Reduction	e.g. Sikaiana
Lg 4	No Reduction			e.g. Papapana

Toy Example

(35)

		DeletePenult!	Max	
NoRed-a.	s a p o ① ① ① ①	-1		
NoRed-b.	s a p o ① ① ① ① −1		-1	
1xRed-a.	s a∼s a p o .5 .5 .5 .5 ① ① +.5 +.5 +.5 +.5	-1		
1xRed-b.	s a∼s a p o .5 .5 .5 .5 ① ① +.5 +.5 +.5 −.5		-0.5	
2xRed-a.	s a∼s a∼s a p o .3̄ .3̄ .3̄ .3̄ .3̄ .3̄ ① ① +.6̄ +.6̄ +.6̄ +.6̄ +.6̄ +.6̄	-1		
2xRed-b.	s a∼s a∼s a p o .3̄ .3̄ .3̄ .3̄ .3̄ .3̄ ① ① +.6̄ +.6̄ +.6̄ +.6̄ +.6̄ −.3̄		-0.3̄	

Lg 1: Always Reduction (e.g. Palauan)

(36) DeletePenult! ≫ Max

		DeletePenult! 1000	Max 100	
NoRed-a.	s a p o ① ① ① ①	-1		-1000
☞ NoRed-b.	s a p o ① ① ① ① −1		-1	-100
1xRed-a.	s a∼s a p o .5 .5 .5 .5 ① ① +.5 +.5 +.5 +.5	-1		-1000
☞ 1xRed-b.	s a∼s a p o .5 .5 .5 .5 ① ① +.5 +.5 +.5 −.5		-0.5	-50
2xRed-a.	s a∼s a∼s a p o .3̄ .3̄ .3̄ .3̄ .3̄ .3̄ ① ① +.6̄ +.6̄ +.6̄ +.6̄ +.6̄ +.6̄	-1		-1000
☞ 2xRed-b.	s a∼s a∼s a p o .3̄ .3̄ .3̄ .3̄ .3̄ .3̄ ① ① +.6̄ +.6̄ +.6̄ +.6̄ +.6̄ −.3̄		-0.3̄	-33.3̄

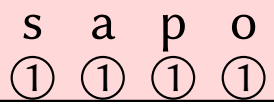
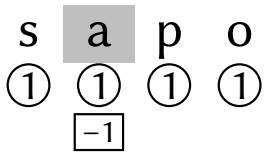
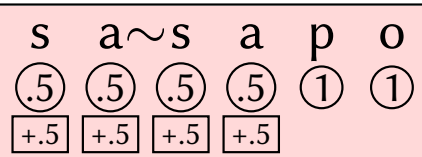
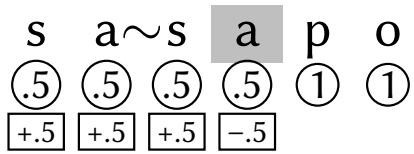
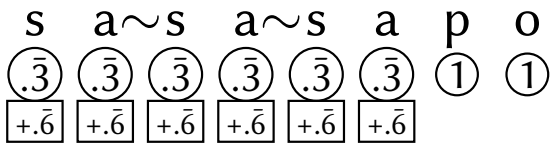
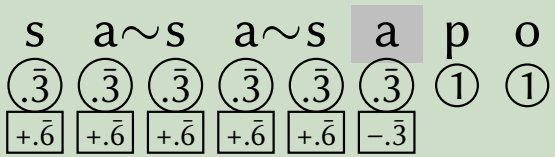
Lg 2: Only Reduction if Reduplication (e.g. Lushootseed)

(37) MAX ≫ DELETEPENULT! and DELETEPENULT! ≫ 0.5xMAX

		DELETEPENULT! 99	MAX 100	
☞ NoRed-a.	s a p o ① ① ① ①	-1		-99
NoRed-b.	s a p o ① ① ① ① −1		-1	-100
1xRed-a.	s a∼s a p o .5 .5 .5 .5 ① ① +.5 +.5 +.5 +.5	-1		-99
☞ 1xRed-b.	s a∼s a p o .5 .5 .5 .5 ① ① +.5 +.5 +.5 −.5		-0.5	-50
2xRed-a.	s a∼s a∼s a p o .3̄ .3̄ .3̄ .3̄ .3̄ .3̄ ① ① +.6̄ +.6̄ +.6̄ +.6̄ +.6̄ +.6̄	-1		-99
☞ 2xRed-b.	s a∼s a∼s a p o .3̄ .3̄ .3̄ .3̄ .3̄ .3̄ ① ① +.6̄ +.6̄ +.6̄ +.6̄ +.6̄ −.3̄		-0.3̄	-33.3̄

Lg 3: Only Reduction if Multiple Reduplication (e.g. Sikaiana)

(38) 0.5xMax ≫ DeletePenult! and DeletePenult! ≫ 0.$\bar{3}$xMax

	DeletePenult! 99	Max 200	
☞ NoRed-a. 	-1		-99
NoRed-b. 		-1	-200
☞ 1xRed-a. 	-1		-99
1xRed-b. 		-0.5	-100
2xRed-a. 	-1		-99
☞ 2xRed-b. 		-0.$\bar{3}$	-66.$\bar{6}$

Lg 4: No Reduction (e.g. Papapana)

(39) $0.\bar{3}$xMax ≫ DeletePenult!

	DeletePenult! 100	Max 1000	
☞ NoRed-a.	s a p o ① ① ① ①	-1		-100
NoRed-b.	s a p o ① ① ① ① −1		-1	-1000
☞ 1xRed-a.	s a∼s a p o .5 .5 .5 .5 ① ① +.5 +.5 +.5 +.5	-1		-100
1xRed-b.	s a∼s a p o .5 .5 .5 .5 ① ① +.5 +.5 +.5 −.5		-0.5	-500
☞ 2xRed-a.	s a∼s a∼s a p o .3̄ .3̄ .3̄ .3̄ .3̄ .3̄ ① ① +.6̄ +.6̄ +.6̄ +.6̄ +.6̄ +.6̄	-1		-100
2xRed-b.	s a∼s a∼s a p o .3̄ .3̄ .3̄ .3̄ .3̄ .3̄ ① ① +.6̄ +.6̄ +.6̄ +.6̄ +.6̄ −.3̄		-0.3̄	-333.3̄

2.3. Example 1: Lushootseed

Lushootseed Reduction (simplified)

Pattern

- vowels are reduced to /ə/ (=loss of all place features) if they are copied

- Reduction is triggered by (40-a) penalizing place features in unstressed positions
- outside of copying, (40-b) preserves vowels from reduction

(40)
a. *UnstrV: Assign -1 violation for every unstressed full V (=place features).

b. Id-V : For ever input vowel with activity I, assign -I violations if the corresponding output vowel has a different place feature specification.

Lushootseed: Reduction Only for Copied Vowels

(41) a. Id-V ≫ *UnstrV

b. *UnstrV ≫ -0.5xId-V

(42) Reduction in the copied base

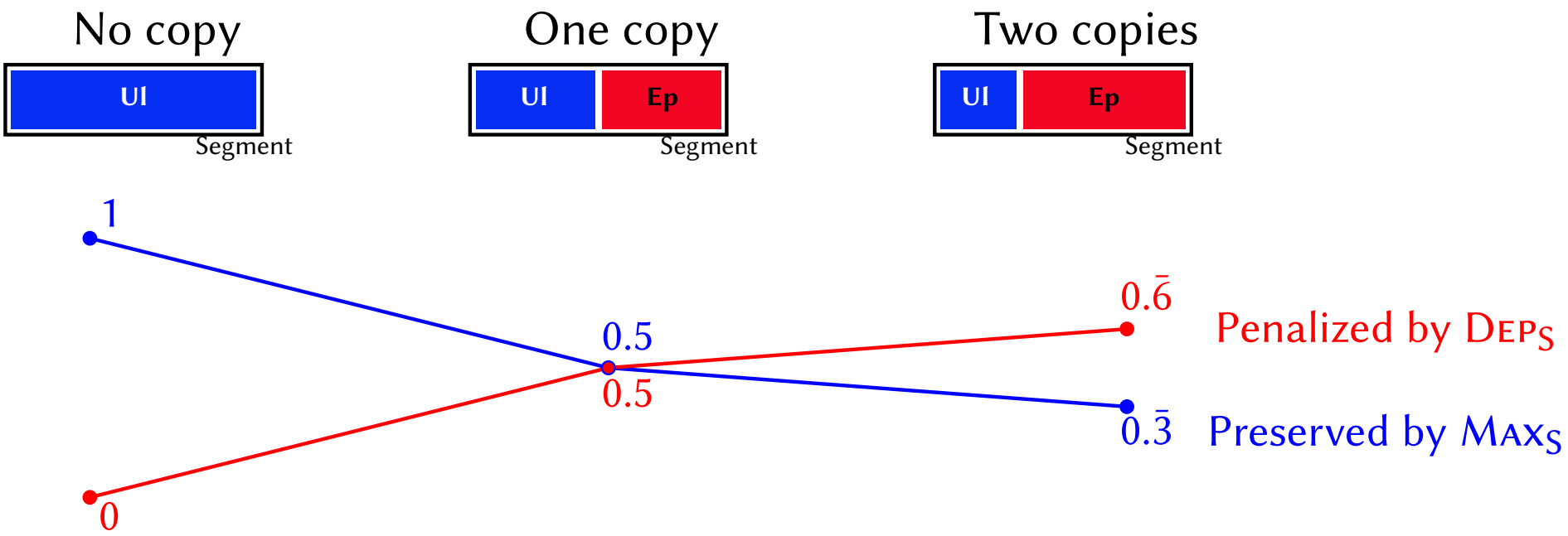
	Id-V	*UnstrV	Dep	
	40	30	10	
a.		-2	-2	-80
b.	-1	-1	-2	-90
☞ c.	-0.5	-1	-2	-70

2.4. Example 2: Sikaiana

Copied Elements: Too Weak to Surface

- realizing copied elements is **costly** (=adding of activity) and deleting them does violate MAX$_S$ only partially

(43) Being copied: Decreasing the chances of surfacing



- predicts avoidance of copied elements just because they are copied

Sikaiana Syncope

Pattern

- syncope for the monosyllabic copy-exponent is
  - optional for single reduplication (so∼sopo / s∼sopo) and
  - obligatory for multiple reduplication (sopo∼s∼sopo)

- copying triggered by σ>V and μ>V
- copy-exponent deletion since **copied V's are preferably avoided**
  - copied elements filling affixed σ*: never deleted (=high weight of $\boxed{\sigma{>}V}_P$)
  - copied elements filling affixed μ: can be deleted (=lower weight of $\boxed{\mu{>}V}_P$)

*Or those already prosodified/dominated by a σ in the input.

Sikaiana: No Syncope for Single Reduplication (bisyllabic)

(44) $\boxed{\sigma{>}V}_P$ + 0.5xMax ≫ 0.5xDep

		$\boxed{\sigma{>}V}_P$	Dep	Max	$\boxed{\mu{>}V}_P$	
	σ σ σ σ s o p o (1) (1) (1) (1)	100	36	20	8	
☞ a.	σ σ σ σ s o p o∼s o p o (.5) (.5) (.5) (.5) (.5) (.5) (.5) (.5) [+.5] [+.5] [+.5] [+.5] [+.5] [+.5] [+.5] [+.5]		-4			-144
b.	σ σ σ σ s o p o∼s o p o (.5) (.5) (.5) (.5) (.5) (.5) (.5) (.5) [+.5] [+.5] [+.5] [-.5] [+.5] [+.5] [+.5] [+.5]	-1	-3.5	-0.5		-236

Sikaiana: Optional Syncope for Single Reduplication (monosyllabic)

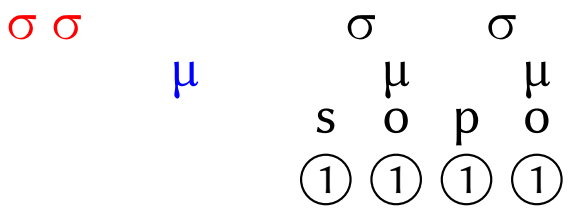
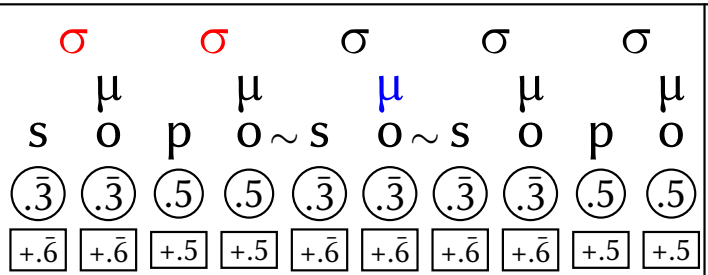
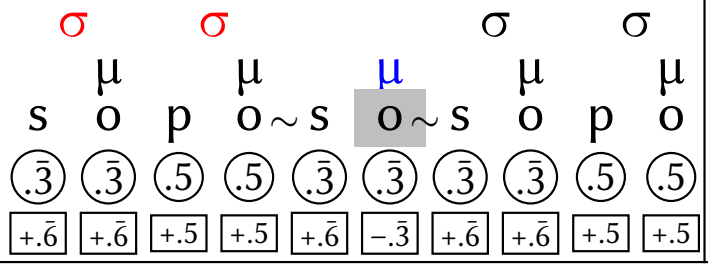
(45) $\boxed{\mu{>}V}_P$ + 0.5xMax ∼ 0.5xDep

	μ s o p o (1 1 1 1)	$\boxed{\sigma{>}V}_P$	Dep	Max	$\boxed{\mu{>}V}_P$	
		100	36	20	8	
☞ a.	μ μ μ s o∼s o p o (.5 .5 .5 .5 1 1) [+.5 +.5 +.5 +.5]		-2			-72
☞ b.	μ μ μ s o∼s o p o (.5 .5 .5 .5 1 1) [+.5 −.5 +.5 +.5]		-1.5	-0.5	-1	-72

*Simplification of the optionality that can be modeled in, e.g. MaxEnt (Johnson, 2002; Goldwater and Johnson, 2003; Wilson, 2006).

Sikaiana: Syncope in Multiple Reduplication Contexts

(46) $0.\bar{6}\times$Dep + $\text{OCP}_C \gg 0.\bar{3}\times$Max

		$\boxed{\sigma>V}_P$	Dep	Max	$\boxed{\mu>V}_P$	
		100	36	20	8	
a.			-5.$\bar{9}$			-215.$\bar{9}$
☞ b.			-5.$\bar{3}$	-0.$\bar{3}$	-1	-206.$\bar{6}$

Avoidance of Multiply Copied Segments: Sikaiana

- in Sikaiana multiply-copied segments are so weak that they are only tolerated under affix-syllables*, not affix-moras
- that **only vowels are deleted**, not consonants: only $\textsc{Dep}_V$ is important and $\textsc{Max}_V$ less important enough; the weighting for $\textsc{Dep}_C$ and $\textsc{Max}_C$ is different

Footnote: This is an instance of 'anti-anti-gemination'
(Odden, 1988; Bakovic, 2005; Rose, 2000)

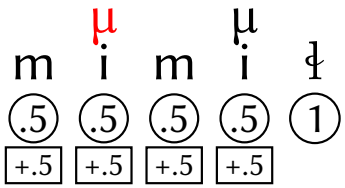
- attested in other Austronesian languages (e.g. Nukuoro, Carroll and Soulik, 1973)
- could alternatively triggered by an OCP that is violated by C_1VC_1 but not by C_1C_1 (=a geminate), cf. Rose (2000)

*And within the stem that is already prosodified prior to affix concatenation.

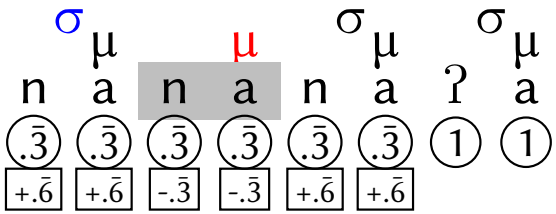
Avoidance of Multiply Copied Segments: Ahousaht Nuuchahnulth

- we see the expected deletion of **all multiply copied elements** (under certain affix nodes): $\textsc{Dep}_C$/$\textsc{Dep}_V$ and $\textsc{Max}_C$/$\textsc{Max}_V$ have same weight

(47) a. No Deletion under affixed μ: Single copying



b. Deletion under affixed μ: Multiple copying

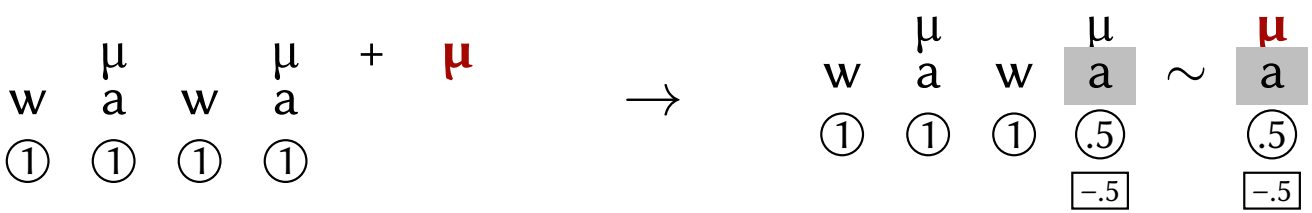


3. Discussion and Conclusion

Further Prediction 1

- **Complete reduction** in copy-exponent and copied base (e.g. Siakaiana'/Ahousaht')?
  - systematically attested as **subtraction** of prosodically defined portions to express morphological category
    (e.g. Dressler, 2000; Arndt-Lappe and Alber, 2012; Zimmermann, 2017*c*)
  - e.g. Aymara accusative /wawa + Acc/ –> [waw]
    (Briggs, 1976; Hardman, 2001; Coler, 2010)

(48) Aymara subtraction as 'reduplication'



Further Predictions 2-4

- If output elements can have weak activity and thus violate markedness gradiently (cf. Zimmermann (2018*a*,*c*,*b*); vs. Smolensky and Goldrick (2016); Rosen (2016)), copy-exponents and copied bases are predicted to **tolerate more marked structure**
  - e.g. marked structures in copy-exponent in Oowekyala (Howe, 2000)
  - e.g. copy-exponents as exceptional non-undergoers in Mojeño Trinitario (Rose, 2014; Marquardt, 2018)
- Weakening not only implies reduction but also being an easier target for **other phonological processes** (e.g. assimilation)
- The same typology is expected for **phonotactic copying** (Kawahara, 2007; Kitto and de Lacy, 1999)

Further Prediction 5

- **Phonetic differences** between elements with different (underlying) activity?
  - gradient phonetic effects are well-attested: e.g. subphonemic gradience in word-final devoicing, nasal place assimilation, flapping (e.g. Braver, 2013), vowel harmony is gradient; gets weaker the farther it spreads (McCollum, 2018),...
  - optional deletion in Sikaiana single reduplication might in fact be a phonetic effect rather than optional phonological deletion (and optional variation between /$C_1V_1 \sim C_1V_1$.../ and /$C_1 \sim C_1V_1$.../ is well-attested in Austronesian, e.g. Hoava (Davis, 2003; Blevins, 2005) or Doku (Unger, 2018))

Conclusion

- extending a phonological account of reduplication based on segmental fission with the assumption that **fission is distribution of underlying activity** correctly predicts
  - that reduplication involves **symmetrical weakening** of all elements involved in the copying and reduction can affect copy-exponents and/or copied bases
  - the **gradient weakening of every copy operation** that can result in more reduction under multiple copying
    (main advantage over an alternative based on Existential Faithfulness (Struijke, 2000))

References

Alderete, John, Jill Beckman, Laura Benua, Amalia Gnanadesikan and John McCarthy (1999), 'Reduplication with fixed segmentism', *Linguistic Inquiry* **30**, 327–364.

Amato, Irene (2018), 'A gradient view of Raddoppiamento Fonosintattico', ms., University of Leipzig.

Arndt-Lappe, Sabine and Birgit Alber (2012), Templatic and subtractive truncation, *in* J.Trommer, ed., 'The morphology and phonology of exponence: The state of the art', Oxford University Press, Oxford.

Bakovic, Eric (2005), 'Antigemination, assimilation and the determination of identity', *Phonology* **22**, 279–315.

Bates, Dawn, Thom Hess and Vi Hilbert (1994), *Lushootseed dictionary*, University of Washington Press.

Becker, Michael and Kathryn Flack Potts (2011), The emergence of the unmarked, *in* M.van Oostendorp, C. J.Ewen, E.Hume and K.Rice, eds, 'The Blackwell Companion to Phonology', Wiley Blackwell, chapter 58.

Blevins, Juliette (2005), 'The role of phonological predictability in sound change: Privileged reduction in Oceanic reduplicated substrings', *Oceanic Linguistics* **44**, 517–526.

Blust, Robert (2007), 'Disyllabic attractors and anti-antigemination in Austronesian sound change', *Phonology* **24**, 1–36.

Boas, Franz (1947), Kwakiutl grammar with a glossary of the suffixes, *in* H. B.Yampolski, ed., 'Transactions of the American Philosophical Society. New Series, Vol. 37, part 3', pp. 201–377.

Braver, Aaron (2013), Degrees of incompleteness in neutralization: Paradigm uniformity in a phonetics with weighted constraints, PhD thesis, Rutgers The State University of New Jersey-New Brunswick.

Briggs, Lucy Therina (1976), Dialectal variation in the Aymaran language of Bolivia and Peru, PhD thesis, University of Florida.

Broselow, Ellen (1983), 'Salish double reduplications: Subjacency in morphology', *Natural Language and Linguistic Theory* **1**, 317–346.

Brown, Jason (2008), Theoretical aspects of Gitksan phonology, PhD thesis, University of British Columbia.

Carroll, Vern and Tobias Soulik (1973), *Nukuoro lexicon*, University of Hawaii Press, Honolulu.

Coler, Matt (2010), A grammatical description of Muylaq' Aymara, PhD thesis, Vrije Universiteit Amsterdam.

Davis, Karen (2003), *A grammar of the Hoava language, Western Solomons*, Pacific Linguistics, Canberra.

Donner, Wiliam W. (2012), 'Sikaiana dictionary', Ms., online available at the sikaianaarchives.

Dressler, Wolfgang (2000), Subtraction, *in* G.Booij, C.Lehmann and J.Mugdan, eds, 'Morphologie. Ein internationales Handbuch', de Gruyter, Berlin, New York, pp. 581–587.

Faust, Noam and Paul Smolensky (2017), 'Activity as an alternative to autosegmental association', talk given at mfm 25, 27th May, 2017.

Gafos, Adamantios I. (2003), 'Greenberg's asymmetry in Arabic: a consequence of stems in paradigms', *Language* **79**, 317–355.

Goldwater, Sharon and Mark Johnson (2003), Learning ot constraint rankings using a maximum entropy model, *in* J.Spenader, A.Eriksson and O.Dahl, eds, 'Proceedings of the Workshop on Variation within Optimality Theory', Stockholm University, Stockholm, pp. 111–120.

Hardman, Martha J. (2001), *Aymara*, LINCOM.

Hayes, Bruce (2009), 'Manual for maxent grammar tool', online available at http://linguistics.ucla.edu/people/hayes/MaxentGrammarTool/ManualForMaxentGrammarTo

Howe, Darin (2000), Oowekyala segmental phonology, PhD thesis, University of British Columbia.

Inkelas, Sharon and Cheryl Zoll (2005), *Reduplication: Doubling in Morphology*, Cambridge University Press, Cambridge.

Johnson, Mark (2002), Optimality-theoretic lexical functional grammar, *in* S.Stevenson and P.Merlo, eds, 'The Lexical Basis of Sentence Processing: Formal, Computational and Experimental Issues', John Benjamins, Amsterdam, pp. 59–73.

Kalmar, Michele (2003), Patterns of reduplication in Kwakwala, Master's thesis, University of British Columbia.

Kawahara, Shigeto (2007), 'Copying and spreading in phonological theory: Evidence from echo epenthesis', *UMOP: Papers in Optimality Theory* **32**, 111–143.

Kim, Eun Sook (2003*a*), 'Patterns of reduplication in Nuu-chah-nulth', *Proceedings of NELS 33* pp. 127–146.
Kim, Eun-Sook (2003*b*), Theoretical issues in Nuu-chah-nulth phonology and morphology (British Columbia), PhD thesis, University of British Columbia.
Kim, Eun-Sook (2008), 'Multiple patterns of reduplication in Nuuchahnulth: A templatic approach', *Language Research* **44**, 63–94.
Kitto, Catherine and Paul de Lacy (1999), 'Correspondence and epenthetic quality', *Proceedings of AFLA* **4**, 181–200.
Kushnir, Yuriy (2017), 'Accent strength in Lithuanian', talk, given at the workshop on Strength in Grammar, Leipzig, November 12, 2017.
Lee, Hyunjung (2019), 'Born to be gradient: Predicting exceptions of compound tensing in Korean', talk at OCP 16, January 17, 2019.
Legendre, Geraldine, Yoshiro Miyata and Paul Smolensky (1990), 'Harmonic grammar – a formal multi-level connectionist theory of linguistic well-formedness: Theoretical foundations', *Proceedings of the 12th annual conference of the cognitive science society* pp. 388–395.
Marantz, Alec (1982), 'Re reduplication', *Linguistic Inquiry* **13**, 483–545.
Marquardt, Christine (2018), 'Opacity in Mojeño Trinitario reduplication: A Harmonic Serialism account', talk, presented at GLOW 42, Budapest, April 11, 2018.
Mattes, Veronika (2007), Types of reduplication: a case study of Bikol, PhD thesis, University Graz.

McCarthy, John and Alan Prince (1995), Faithfulness and reduplicative identity, *in* J.Beckman, L.Dickey and S.Urbanczyk, eds, 'UMOP', GLSA, Amherst, MA, pp. 249–384.

McCarthy, John J. (1993), Template form in prosodic morphology, *in* e. a.Smith, Stvan L., ed., 'Papers from the Third Annual Formal Linguistics Society of Midamerica Conference', IULC Publications, Bloomington, pp. 187–218.

McCollum, Adam (2018), 'Gradient morphophonology: Evidence from Uyghur vowel harmony', talk at AMP 2018, San Diego, October 06, 2018.

Nelson, Nicole Alice (2003), Asymmetric Achoring, PhD thesis, Rutgers University.

Nformi, Jude and Sören Worbs (2017), 'Gradient tones obviate floating features in Oku tone sandhi', talk at the Workshop on Strength in Grammar, Leipzig, November 10, 2017.

Odden, David (1988), 'Anti antigemination and the OCP', *Linguistic Inquiry* **19**, 451–475.

Potts, Christopher, Joe Pater, Karen Jesney, Rajesh Bhatt and Michael Becker (2010), 'Harmonic grammar with linear programming: From linear systems to linguistic typology', *Phonology* pp. 77–117.

Prince, Alan and Paul Smolensky (1993/2004), *Optimality Theory: Constraint Interaction in Generative Grammar*, Blackwell, [first circulated as Prince & Smolensky (1993) Technical reports of the Rutgers University Center of Cognitive Science].

Pulleyblank, Douglas (2009), Patterns of reduplication in Yoruba, *in* K.Hanson and S.Inkelas, eds, 'The nature of the word: Studies in honor of Paul Kiparsky', MIT Press, pp. 311–357.

Rose, Francoise (2014), When vowel deletion blurs reduplication in Mojeño Trinitario, *in* G. G.Gómez and H.van der Voort, eds, 'Indigenuous languages of South America', Brill, Leiden, pp. 375–399.

Rose, Sharon (2000), 'Rethinking geminates, long-distance geminates, and the ocp', *Linguistic Inquiry* **31**, 85–122.

Rose, Suzanne Maria (1981), Kyuquot grammar, PhD thesis, University of Victoria.

Rosen, Eric (2016), Predicting the unpredictable: Capturing the apparent semi-regularity of rendaku voicing in Japanese through Harmonic Grammar, *in* E.Clem, V.Dawson, A.Shen, A. H.Skilton, G.Bacon, A.Cheng and E. H.Maier, eds, 'Proceedings of BLS 42', Berkeley Linguistic Society, Berkeley, pp. 235–249.

Rosen, Eric (2018), 'Evidence for gradient input features from Sino-Japanese compound accent', poster, presented at AMP 2018, San Diego, October 06, 2018.

Saba Kirchner, Jesse (2010), Minimal Reduplication, PhD thesis, UC Santa Cruz.

Saba Kirchner, Jesse (2013*a*), 'Minimal reduplication and reduplicative exponence', *Morphology* **23**, 227–243.

Saba Kirchner, Jesse (2013*b*), Reduplicative exponence and minimal reduplication, *in* J.Trommer, ed., 'New theoretical tools in the modeling of morphological exponence', Special issue of Morphology, pp. 227–243.

Shaw, Patricia A. and Darin Howe (1999), 'Prosodic faithfulness: vowel syncope and reduction as output-output correspondence', Paper presented at the Annual Meeting of the Canadian Linguistics Association, Université du Québec, Sherbrooke, QC, June 4–6, 199.

Smolensky, Paul and Matthew Goldrick (2016), 'Gradient symbolic representations in grammar: The case of French liaison', Ms, Johns Hopkins University and Northwestern University, ROA 1286.

Spaelti, Phillip (1997), Dimensions of variation in multi-pattern reduplication, PhD thesis, UC Santa Cruz.
Stonham, John (1994), *Combinatorial morphology*, John Benjamin, Amsterdam.
Stonham, John (2004), *Linguistic Theory and Complex Words*, Palgrave Macmillan, New York.
Struijke, Caro (2000), Existential Faithfulness. A Study of Reduplicative TETU, Feature Movement, and Dissimilation, PhD thesis, University of Maryland at College Park.
Trommer, Jochen (2011), 'Phonological aspects of Western Nilotic mutation morphology', Habilitation, Leipzig University.
Trommer, Jochen (2018), 'The layered phonology of Levantine Arabic syncope', poster, presented at AMP 2018, San Diego, October 07, 2018.
Trommer, Jochen and Eva Zimmermann (2014), 'Generalised mora affixation and quantity-manipulating morphology', *Phonology* **31**, 463–510.
Unger, Paul (2018), *Reduced Reduplication in Doku: Geminate Consonants and Stressed Vowel Syncope in Southeast Solomonic*, SIL International.
Urbanczyk, Suzanne (1999), Double reduplications in parallel, *in* R.Kager, H.van der Hulst and W.Zonneveld, eds, 'The Prosody Morphology Interface', Cambridge University Press, Cambridge, pp. 390–428.
Urbanczyk, Suzanne (2001), *Patterns of reduplication in Lushootseed*, Garland, New York.
Wilson, Colin (2006), 'Learning phonology with substantive bias: An experimental and computational study of velar palatalization', *Cognitive Science* **30**, 945–982.
Zimmermann, Eva (2013), 'Non-concatenative allomorphy is generalized prosodic affixation: The case of Upriver Halkomelem', *Lingua* **134**, 1–26.

Zimmermann, Eva (2017*a*), 'Being exceptional is being weak: tonal exceptions in San Miguel el Grande Mixtec', poster, presented at AMP 2017, New York, September 16, 2017.
Zimmermann, Eva (2017*b*), 'Gradient symbols and gradient markedness: a case study from Mixtec tones', talk, given at the 25th mfm, 27th May, 2017.
Zimmermann, Eva (2017*c*), *Morphological Length and Prosodically Defective Morphemes*, Oxford University Press, Oxford.
Zimmermann, Eva (2018*a*), 'Exceptional non-triggers are weak: The case of Molinos Mixtec', talk at OCP 15, January 13, 2018.
Zimmermann, Eva (2018*b*), 'The gradience of ghosts: An account of unstable segments', talk at mfm 26, Manchester, May 26, 2018.
Zimmermann, Eva (2018*c*), 'Gradient symbolic representations and the typology of ghost segments: An argument from gradient markedness', talk, given at AMP 2018, San Diego, October 06, 2018.
Zimmermann, Eva (to appear), 'Gradient symbolic representations in the output: A case study from Moses Columbian Salishan stress', *Proceedings of NELS 48* .

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Sikaiana, tested with the Maxent Grammar Tool (Hayes, 2009)

Weights

MAX$_C$: 39.510925583659265
MAX$_V$: 17.130320954981542
DEP$_C$: 0.0
DEP$_V$: 17.143113638603637
μ>V P: 0.0
σ>V P: 3.62370715560716 63
CONT: 5.91793226522023

Probabilities

σ+ sopo
so∼sopo: 0.9998680938615468 ☜
sop<o>∼sopo: 7.225023388204955E-5
so<po>∼sopo: 1.9017384152256463E-13
<sopo>∼sopo: 4.995851293881543E-21
μ+ sopo
so∼sopo: 0.49773317757419294 ☜
s<o>∼sopo: 0.5009270527781152 ☜
<so>∼sopo: 4.900172127756463E-7
o∼sopo: 0.0013392796304789309
σ+ μ+ sopo
sopo∼so∼sopo: 0.0020702788740010795
sopo∼s<o>∼sopo: 0.995297845849349 ☜
sopo∼<so>∼sopo: 0.0026318752766498273

Contiguous Morpheme Copying

(49) MCont

For every pair of output elements O_1 and O_2 corresponding to input elements I_1 and I_2 that belong to the same morpheme and I_1 directly precedes I_2:
Assign * for every O_1 that is not directly followed by O_2 and for every O_2 that is not directly preceded by O_1.

- a non-existential version demanding **contiguous linear order for all instances of an element** and hence subsumes (50-a+b)

(50) Contiguity (McCarthy and Prince, 1995, 123)
I-Contig ('No skipping')
The portion of S_1 standing in correspondence forms a contiguous string.
O-Contig ('No intrusion')
The portion of S_2 standing in correspondence forms a contiguous string.

Contiguous Morpheme Copying

		[σ>V]$_P$	MCont	Dep	Max	Int	
	σ σ σ σ s o p o ① ① ① ①	100	50	36	20	5	
☞ a.	σ σ σ σ s o p o∼s o p o .5 .5 .5 .5 .5 .5 .5 .5 +.5 +.5 +.5 +.5 +.5 +.5 +.5 +.5			-4		-4	-164
b.	σ σ σ σ o o∼s o p o .5 .5 ① .5 ① .5 +.5 +.5 +.5 +.5		-3	-2		-2	-232
c.	σ σ σ σ o p o∼s o p o .5 .5 .5 ① .5 .5 .5 +.5 +.5 +.5 +.5 +.5 +.5		-1	-3		-3	-173

Laryngeal Reduction in Copy-Exponent and Copied Base: Tagalog

- 'Contractions of this type never occur in non-reduplicated bases such as /daʔán/ 'road' or /buIhok/ 'hair', nor (as already noted) do they occur in reduplicated disyllables that do not contain a laryngeal consonant between like vowels' (Blust, 2007, 7)

(51) Reduplication in Tagalog (Blust, 2007, 7)

búhos	'pouring'	b-al-usbós	'grain spilled from package'
laʔáb	'spreading flame'	l-ag-abláb	'noisy conflagration'
laʔás	'cracked'	laslás	'ripped'
láhad	'opening of the hand'	ladlád	'opened'
sáhaŋ	'potency'	saŋsáŋ ∼ sansáŋ	'strong agreeable odor'
súhol	'bribe'	sulsól	'instigation to do evil'
suʔóŋ	'advance against odds'	suŋsóŋ	'go against wind'
tahán	'cessation'	tantán	'cessation'

V shortening in Copy-Exponent and Copied Base: Hausa

(52) Adjectival reduplication (Inkelas and Zoll, 2005, 87)

gishiriː	'salt'	gishiri-gishiri	'salty'
búhuː	'sack'	búhu-búhu	'sacklike'
gáːriː	'flour'	gáːri-gáːri	'powdry'