Faded Copies:
Reduplication as Distribution of Activity

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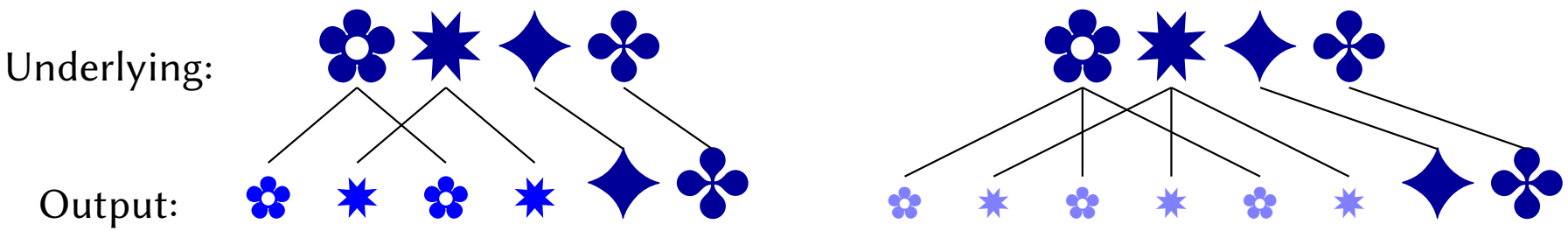
Main Claim

Assumptions

1. All linguistic symbols have **activity** that can **gradiently** differ (Smolensky and Goldrick, 2016; Rosen, 2016).
2. Reduplication is **fission** to fill empty prosodic nodes (e.g. Marantz, 1982).
3. Fission is **distribution of underlying activity**.

Consequences

1. Reduplication is weakening of all elements involved in the copying.
2. Every copy operation gradiently weakens elements.



Footnote: Terminology for Phonological Account of Reduplication

(1)

'Traditional': Reduplicant Base

so ~ sopo

Here:
(phonological account)

so - so - po → Copying is symmetrical

Copied Not copied

□ ~ so po → Empty prosody triggers copying

Copy-Exponent Copied base

Copying as Weakening: Empirical Picture

Reduction and Reduplication

1. **Copying = Weakening**
   a. TETU in the copy-exponent
      (McCarthy and Prince, 1995; Becker and Flack Potts, 2011)
      e.g. Gitksan, Shuswap, Sanskrit…
   b. TETU in the the copied base
      (Shaw and Howe, 1999; Struijke, 2000)
      e.g. Tohono O'odham, Heiltsuk, Mainland Sliammon,…
   c. TETU in both copy-exponent and the the copied base
      (Struijke, 2000)
      e.g. Kwakwala, Hausa, Lushootseed,…

2. **Multiple Copying = Further Weakening**
   (Zimmermann, 2018*e*,*d*)
   TETU only under multiple reduplication
   e.g. Sikaiana, Southern Wakashan,…

Reduction in the Copy Exponent: Gitksan

- fixed segmentism reduplication with /i/ and /a/ (adjacent to a gutturals)
- deglottalization (+predictable voicing), deaffricativization, and depalatalization in the copy-exponent

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

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

Reduction in the Copied Base: Tohono O'odham

(3) Plural reduplication (Shaw and Howe, 1999; Fitzgerald, 2012)

a. *Syncope in the copied base: Single V*

jípos-ìd	jí ~ j poʃìd	'to brand object'	S2
tóki	tó ~ t ki	'cotton'	S2
dápk	dá ~ d pk	'to press down with fingers repeatedly'	F451

b. *Syncope in the copied base: Diphtongs*

híopčig	hí ~ h opčig	'to be full of body lice in one place'	F716
ʔíoldakùḍ	ʔí ~ ʔ oldakùḍ	'bean pot used for frying beans'	F716
dóa	dó ~ d a	'to be healthy'	

c. *Syncope blocked for phonotactic reasons (e.g. sonority reversal in coda)*

hím	hí ~ hi m	'walking' *hí~hm	S3
wáŋgo	wá ~ pa ŋgo	'bank' *wá~pŋgo	S3
pílsa	pí ~ pi lsa	'blanket' *pí~plsa	S3

Syncope in Copy-Exponent and Copied Base: Kwak'wala (simplified)

(4) /m'uːt/ 'refuse, useless' suffixation (Struijke, 2000; Saba Kirchner, 2010)

a. *C-deletion/V-reduction in the copied base (S72)*

səl	səl ~ sə muːt	'drill'
kən	kən ~ kə muːt	'scoop up'
k'aːp	k'aː ~ k'ə pm'uːt	'(mouse) gnaw'
qəns	qən ~ qə sm'uːt	'adze with long-handled adze'

b. *C-deletion/V-reduction in the copy exponent (S77)*

məndz	mə ~ mən dzəmuːt	'leavings after cutting kindling woods'
qʷ'aːl'	qʷ'ə ~ qʷ'aː l'əmuːt	'embers'
saːqʷ'	sə ~ saː qʷ'əmuːt	'peelings'

- H=Vː or sonorant coda; reduction thus ensures unmarked iambic feet (LH, LL, H) and avoids stress clashes
- repairs are bound to copying: e.g. (ʦ'óː)(l'ə̀m)(y'àː) (S70)

Truncation in Multiple Reduplication Contexts: Sikaiana

(5) 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∼sopo	‘jump’
sepu	sepu∼ s ∼ se pu	*sepu∼so∼sepu	‘dive’

Copying as Weakening: Theoretical Modeling

Copying as Weakening: Assumptions

1. Phonological account of reduplication: Segmental fission
2. Gradient Symbolic Representation
3. HG
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 the general phonological repair of segmental **fission** violating (6) (Spaelti, 1997; Struijke, 2000; Gafos, 2003; Nelson, 2003)

(6) INT$_S$: Assign -1 violation to every pair of output segments that correspond to the same input segment.

(7)

	μ>S	DEP$_S$	*V:	INT$_S$
μ μ | s$_1$ i$_2$ l'$_3$				
a. μ μ | s$_1$ i$_2$ l'$_3$	*!			
☞ b. μ μ | | s$_1$ i$_2$ s$_1$ i$_2$ 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 (GEN or constraint – cf. later)
- 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

(8) Gradient activity = gradient faithfulness violations

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

Intermezzo: Max and Dep and GSR

(9) 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.

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

- constraints are **weighted**, not ranked: Constraint ganging and threshold effects

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

(10)

		μ>S	IntS	
	μ μ μ s o p o 1 1 1 1	100	10	
(☞) a.	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 0 1 1 1 1		-2	-20

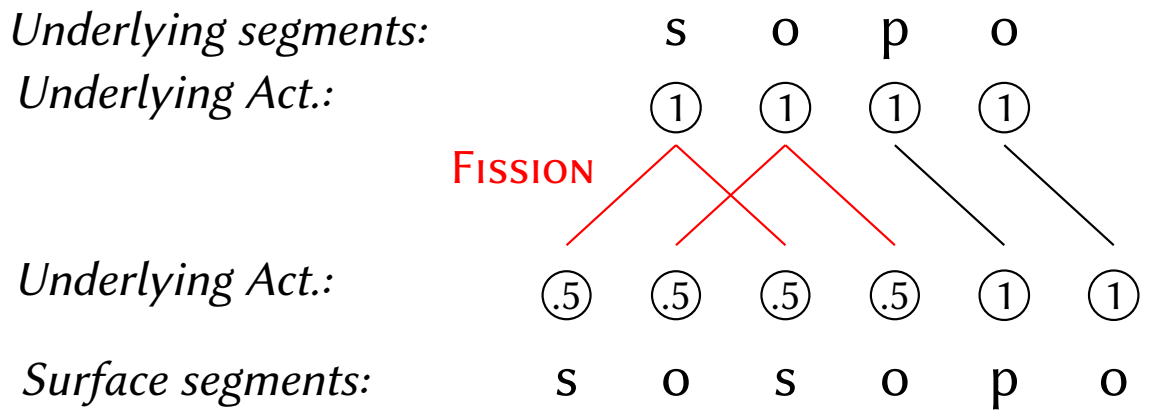
5. Fission is Distribution of Activity

(11) GEN operation: Fission
Input element S_1 with activity A corresponds to x output elements S_1 with underlying activity A/x.

= 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

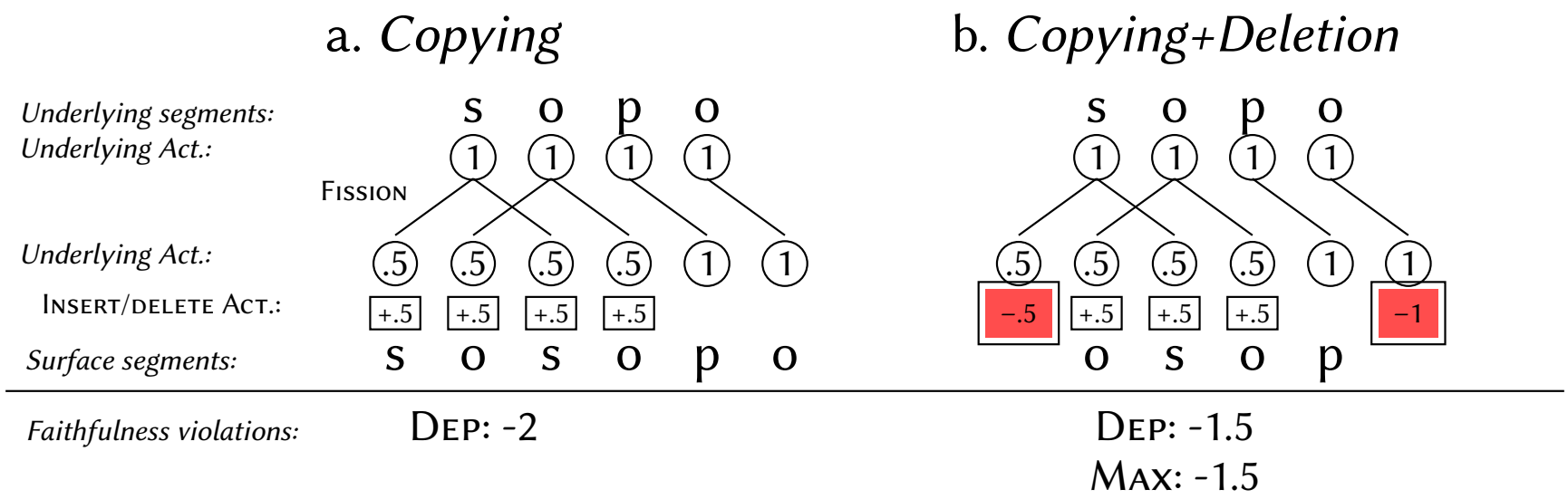
(12)



5. Fission is Distribution of Activity

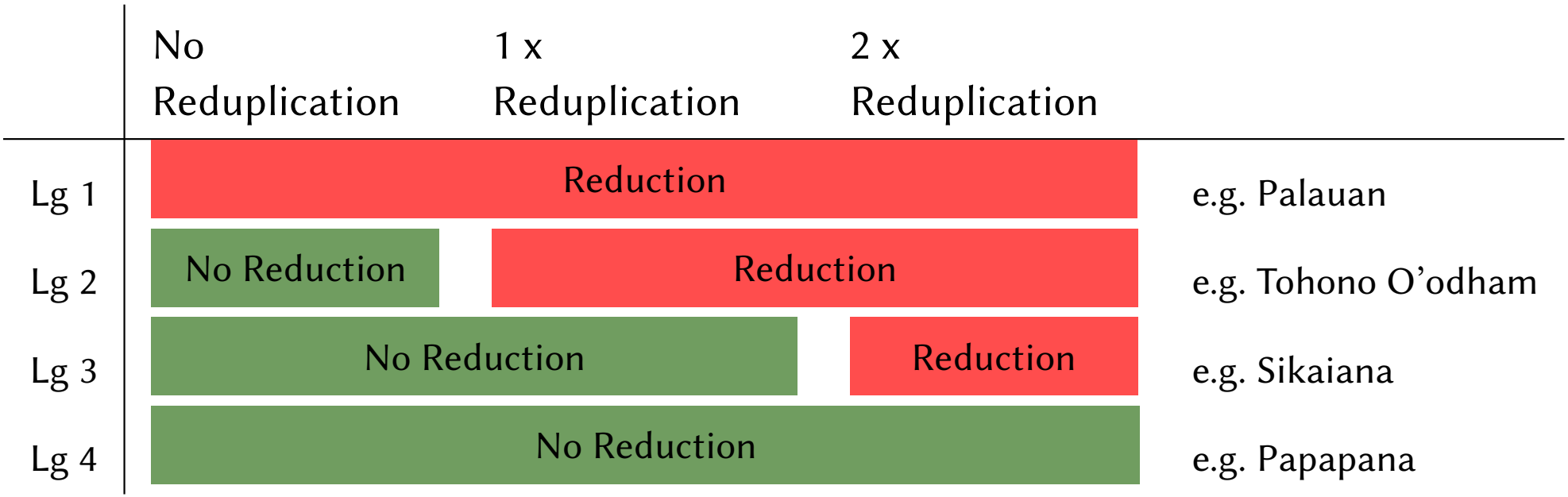
- crucial consequence for elements with the same underlying activity: Non-realization of a copied segment is better for MAX; they are **weaker**

(13)



Predicted Typology: Reduction Thresholds

(14)



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

(15) 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. Tohono O'odham)

(16) 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)

(17) 0.5xMax ≫ DeletePenult! and DeletePenult! ≫ 0.$\bar{3}$xMax

		DeletePenult! 99	Max 200	
☞ NoRed-a.	s a p o ① ① ① ①	-1		-99
NoRed-b.	s a p o ① ① ① ① −1		-1	-200
☞ 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	-100
2xRed-a.	s a∼s a∼s a p o .$\bar{3}$.$\bar{3}$.$\bar{3}$.$\bar{3}$.$\bar{3}$.$\bar{3}$ ① ① +.$\bar{6}$ +.$\bar{6}$ +.$\bar{6}$ +.$\bar{6}$ +.$\bar{6}$ +.$\bar{6}$	-1		-99
☞ 2xRed-b.	s a∼s a∼s a p o .$\bar{3}$.$\bar{3}$.$\bar{3}$.$\bar{3}$.$\bar{3}$.$\bar{3}$ ① ① +.$\bar{6}$ +.$\bar{6}$ +.$\bar{6}$ +.$\bar{6}$ +.$\bar{6}$ −.$\bar{3}$		-0.$\bar{3}$	-66.$\bar{6}$

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

(18) $0.\bar{3}$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 .$\bar{3}$.$\bar{3}$.$\bar{3}$.$\bar{3}$.$\bar{3}$.$\bar{3}$ ① ① +.$\bar{6}$ +.$\bar{6}$ +.$\bar{6}$ +.$\bar{6}$ +.$\bar{6}$ +.$\bar{6}$	-1		-100
2xRed-b.	s a∼s a∼s a p o .$\bar{3}$.$\bar{3}$.$\bar{3}$.$\bar{3}$.$\bar{3}$.$\bar{3}$ ① ① +.$\bar{6}$ +.$\bar{6}$ +.$\bar{6}$ +.$\bar{6}$ +.$\bar{6}$ −.$\bar{3}$		-0.$\bar{3}$	-333.$\bar{3}$

Sikaiana Syncope

Pattern

- syncope for the monosyllabic copy-exponent is optional for single reduplication and obligatory for multiple reduplication

(19) a. $\textsc{Int}_{\textsc{OCP}}$: Assign -1 violation to every pair of output segments that correspond to the same input segment and are adjacent on their tier.

b. $\textsc{Max}_{\textsc{STR}}$: For ever input element with activity I and its stressed output correspondent with activity O where I>O:
Assign -(I-O) violations.

Sikaiana: No Syncope for Single Reduplication (bisyllabic)

(20) 0.5xMax ≫ 0.5xDep

	MaxStr	Max	Dep	IntOCP	
σ σ s o p o ① ① ① ①	1000	100	46	27	
☞ 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		-184
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		-0.5	-3.5		-211

Sikaiana: Optional Syncope for Single Reduplication (monosyllabic)

(21) $0.5\text{x}\textsc{Dep} + \textsc{Int}_{\textsc{OCP}} = 0.5\text{x}\textsc{Max}$

	$\textsc{Max}_{\textsc{Str}}$	Max	Dep	$\textsc{Int}_{\textsc{OCP}}$	
μ s o p o 1 1 1 1	1000	100	46	27	
☞ a. μ μ μ s o∼s o p o .5 .5 .5 .5 1 1 +.5 +.5 +.5 +.5			-2	-1	-119
☞ b. μ μ μ s o∼s o p o .5 .5 .5 .5 1 1 +.5 −.5 +.5 +.5		-0.5	-1.5		-119
c. μ μ μ s o∼s o p o .5 .5 .5 .5 1 1 +.5 +.5 +.5 -.5	-0.5	-0.5	-1.5		-619

*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

(22) $0.\bar{6}\times\textsc{Dep} + \textsc{Int}_{\textsc{OCP}} \gg 0.\bar{3}\times\textsc{Max}$

		$\textsc{Max}_{\textsc{Str}}$	Max	Dep	$\textsc{Int}_{\textsc{OCP}}$	
	σ σ σ σ μ μ μ s o p o ① ① ① ①	1000	100	46	27	
a.	σ σ σ σ σ μ μ **μ** μ μ s o p o∼s o∼s o p o .3̄ .3̄ .5 .5 .3̄ .3̄ .3̄ .3̄ .5 .5 +.6̄ +.6̄ +.5 +.5 +.6̄ +.6̄ +.6̄ +.6̄ +.5 +.5			-5.9̄	-1	-302,9̄
☞ b.	σ σ σ σ σ μ μ **μ** μ μ s o p o∼s o∼s o p o .3̄ .3̄ .5 .5 .3̄ .3̄ .3̄ .3̄ .5 .5 +.6̄ +.6̄ +.5 +.5 +.6̄ −.3̄ +.6̄ +.6̄ +.5 +.5		-0.3̄	-5.3̄		-278,6̄
c.	σ σ σ σ σ μ μ **μ** μ μ s o p o∼s o∼s o p o .3̄ .3̄ .5 .5 .3̄ .3̄ .3̄ .3̄ .5 .5 +.6̄ +.6̄ +.5 +.5 +.6̄ +.6̄ +.6̄ −.3̄ +.5 +.5	-0.3̄	-0.3̄	-5.3̄		-611,9̄

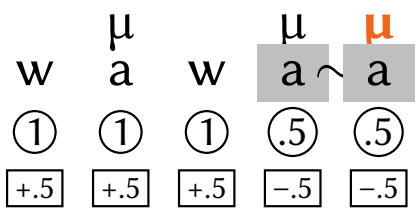
Discussion

Further Predictions

- The same typology expected for **phonotactic copying**
  (Kawahara, 2007; Kitto and de Lacy, 1999)

- 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)

- **Complete reduction** in copy-exponent and copied base?
  - systematically attested as **subtraction**
  - e.g. Aymara accusative /wawa + Acc/ –> [waw]



Conclusion

- extending a phonological account of reduplication based on segmental fission with the assumption that **fission is distribution of underlying activity** correctly predicts
  - the typology of reduction in copy-exponents and/or copied bases
  - the **gradient effect** of more copying=more weakening in the typology of multiple reduplication (main advantage over an alternative based on Existential Faithfulness (Struijke, 2000))

References

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.

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

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

Fitzgerald, Colleen (2012), 'Prosodic inconsistency in Tohono O'Odham', *International Journal of American Linguistics* **435-463**(78).

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.

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

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.

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

Kitto, Catherine and Paul de Lacy (1999), 'Correspondence and epenthetic quality', *Proceedings of AFLA* **4**, 181–200.

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.

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.

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

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.

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.

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.

Struijke, Caro (2000), Existential Faithfulness. A Study of Reduplicative TETU, Feature Movement, and Dissimilation, PhD thesis, University of Maryland at College Park.

Wilson, Colin (2006), 'Learning phonology with substantive bias: An experimental and computational study of velar palatalization', *Cognitive Science* **30**, 945–982.

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 (2018*d*), 'Too much is too much... in the phonology!', ms. UBC Vancouver.

Zimmermann, Eva (2018*e*), 'The typology of multiple reduplication – an argument for a prosodic affixation account', invited talk at the Linguistics Colloquium, University of Victoria, April 12, 2018.

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