Glossa
a journal of general linguistics

SPECIAL COLLECTION: GLOWING PAPERS 2019

RESEARCH

Faded copies: Reduplication as distribution of activity

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ubiquity press

Abstract

This paper proposes a new theory of reduplication that is based on redefining phonological copying as distribution of underlying activity within the framework of Gradient Symbolic Representations (Smolensky & Goldrick 2016). This assumption correctly predicts that copied elements are more likely to undergo phonological reduction and that reduction in a non-copying context implies reduction in a copying context but not vice versa. These predictions are summarized in the new empirical generalization of the 'Copying-Weakening-Implication'. It is illustrated with case studies of two language types that show different thresholds for reduction: languages can show reduction only for copied material or only for material that is copied twice. Another important result of the proposal is the fact that copying symmetrically weakens all elements that are involved in the copying and does not single out the 'reduplicant' as the best target for reduction processes. This prediction is an important difference to accounts of reduplication based on BR-faithfulness (McCarthy & Prince 1995).

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KEYWORDS:
reduplication; Gradient Symbolic Representations; Emergence of the Unmarked; reduction

TO CITE THIS ARTICLE:
Zimmermann, Eva. 2021. Faded copies: Reduplication as distribution of activity. *Glossa: a journal of general linguistics* 6(1): 58. 1–38. DOI: *https://doi.org/10.5334/gjgl.1117*

1 Introduction

It is an often-discussed phenomenon that reduplicants can undergo markedness reduction processes that are unattested outside of reduplicants in the same language (McCarthy & Prince 1995; Becker & Flack Potts 2011). In this paper, I argue that this pattern is part of a larger generalization that correlates phonological reduction with copying. For one, it is shown that copying causes both the reduplicant and the copied portion of the base to be more prone to reduction. There is hence a correlation between phonological reduction and copying which is symmetrical and affects the whole copied string, not only the reduplicant. And secondly, the correlation between reduction and copying is gradient. This means that every copy operation makes it more likely that copied material undergoes reduction processes that are unattested outside of copying contexts. Consequently, languages can show different thresholds for reduction: they can allow reduction only for strings that are copied once or only for those that are copied twice (or even more than that). These new empirical generalizations are formulated as the *Copying-Weakening-Implication (=CWI)* stating that every copy operation weakens all material involved in the copying. In the first part of the paper, I show that the CWI is empirically borne out. There are various examples for languages showing a correlation between reduction and reduplication that follows the implicational restriction that more copying implies a greater likelihood for reduction. On the other hand, there are apparently no examples of languages that allow more reduction in context with fewer copying operations. In the second part of the paper, it is shown that the CWI straightforwardly falls out in the new account of copying I propose. It is based on redefining *fission as distribution of underlying activity*. The new reduplication theory emerging from the assumption of fission as distribution of underlying activity is based on two in principle independent assumptions: For one, it assumes a phonological account of reduplication where prosodic affixation triggers the phonological repair of fission to fill otherwise empty prosodic nodes with segmental material (Pulleyblank 2009; Bermúdez-Otero 2012; Bye & Svenonius 2012). And secondly, it is crucially based on the assumption of Gradient Symbolic Representations stating that all phonological elements have a certain activity that can gradiently differ (Rosen 2016; Smolensky & Goldrick 2016; Zimmermann 2018a; b; 2019b).

Depiction (1) summarizes the proposal in a nutshell. Reduplication in this example is triggered by prefixing an empty mora. In the output, this mora is filled by a 'copied' CV-string. In the present model, this copying amounts to the fact that the two output instances of /s/ and /o/ correspond to a single respective input segment (indicated with subscripted indices); we hence have an instance of fission. And crucially, the underlying activity of 1 (indicated with circled numbers) of these two input segments is now distributed amongst two respective output elements that only receive 0.5 activity each. The input segments thus literally split up their presence into multiple output instances. As will be shown below, reduced activity of phonological elements results in a lower threshold to undergo phonological reduction processes in the Gradient Harmonic Grammar model employed here.

(1) Proposal: reduplication is copying is distribution of underlying activity

Input:

μ	+		μ		μ
			|		|
		s_1	o_2	p_3	o_4
		①	①	①	①

Output:

	μ		μ		μ
	|		|		|
s_1	o_2	s_1	o_2	p_3	o_4
(.5)	(.5)	(.5)	(.5)	①	①

The main argument for the new proposal of fission as distribution of underlying activity comes from the unified explanation for all the phenomena captured by the CWI. As is discussed in section 6, alternative theories for reduplication predict some of the patterns where reduplication is correlated with more reduction but no alternative account predicts the whole CWI.

The paper is structured as follows: in section 2, the empirical support for the CWI is presented. Section 2.1 is concerned with the specific predictions about possible and impossible language types arising from the CWI whereas sections 2.2 and 2.3 present languages exemplifying the different predicted language types expected under the CWI. Section 3 presents the theoretical proposal. Before the new definition of fission as distribution of activity is presented in 3.3, some background assumptions for the new model of reduplication are introduced. Section 3.1 presents the phonological account of reduplication based on prosodic affixation and section 3.2 introduces the crucial assumption of Gradient Symbolic Representations. How the resulting model predicts the CWI is shown in section 4 with theoretical accounts for the data introduced in section 2. Some further predictions of the model are explored in section 5. Section 6 briefly discusses that no alternative account of reduplication can predict the whole CWI before I conclude in section 7.

2 Copying as weakening: The empirical picture

2.1 The Copying-Weakening-Implication

This section presents empirical evidence for the claim that copying is correlated with a greater likelihood to undergo phonological reduction. This finding is formulated as the CWI in (2). The term 'copying' in the CWI refers to the phonological operation of duplicating phonological material which is taken to underlie all instances of reduplication, the empirical focus of this paper. 'Weakening' in (2) implies a greater likelihood to undergo phonological processes. In all examples discussed in this paper, these processes are deletion of whole segments or certain feature specifications. Both these processes are summarized as 'reduction' in the following.

(2) *The Copying-Weakening-Implication (= CWI)*
Every copy operation weakens all the elements involved in the copying.
Weakening results in a greater likelihood to undergo phonological processes, especially deletion or contrast neutralization (= 'reduction').
A. No language shows reduction of non-copied material but not of copied material (in single or multiple reduplication contexts).
B. No language shows reduction of copied material in single reduplication contexts but not of copied material in multiple reduplication contexts.

The CWI's statement that every copy operation weakens all the elements involved in the copying results in two restrictions on possible language types (2A + B). They describe an implicational universal that the presence of reduction in a given context implies that this reduction also applies in a context with more copying. This means that the CWI predicts that languages can have thresholds for reduction: reduction can be restricted to material that is at least copied once or even to material that is at least copied twice. The typology of languages predicted from these thresholds and the implicational restrictions (2A + B) are illustrated in (3) where 'Reduction' marks the existence of a phonological reduction process and 'Faithful' its absence. It compares the three contexts of 1) no copying, 2) one copy operation, and 3) two copy operations. Four language types are possible under the CWI (3A) whereas four others are excluded (3B). It is, for example, impossible that a language shows a reduction pattern in comparable phonological contexts in non-copied strings and in strings that are copied twice but fails to show this reduction in comparable phonological contexts for strings that are copied only once (*Lg 6).

(3) *Predicted typology: copying and weakening*

		No Copying	1 x Copying	2 x Copying
A.	Languages predicted by the CWI			
	Lg 1	Reduction	Reduction	Reduction
	Lg 2	Faithful	Reduction	Reduction
	Lg 3	Faithful	Faithful	Reduction
	Lg 4	Faithful	Faithful	Faithful
B.	Languages excluded by the CWI			
	*Lg 5	Reduction	Reduction	Faithful
	*Lg 6	Reduction	Faithful	Reduction
	*Lg 7	Faithful	Reduction	Faithful
	*Lg 8	Reduction	Faithful	Faithful

In section 3, a theoretical account of reduplication is presented that predicts the four attested language patterns (3A) from the interaction of standard faithfulness and markedness constraints and systematically excludes the four patterns (3B).

Glossa: a journal of general linguistics
DOI: 10.5334/gjgl.1117

Note that the languages in (3) only contrast the three contexts without, with one, and with two copy operations. In principle, much more thresholds bound to contexts with three, four, or even more copying operations are predicted by the CWI. However, instances of productive combination of two reduplicative processes are already rather rare in the languages of the world[1] and those combining even more reduplicative morphemes are even harder to find. Potential examples include the addition of more reduplicative morphemes to intensify the meaning (e.g. in Fungwa (Akinbo 2018), Tigre (Rose 2003), or Toqabaquita (Lichtenberk 1945)). None of these patterns show a reduction process that is bound to reduplication.

Another prediction of the CWI arises from its reference to 'all elements involved in the copying'. This implies that reduction is more likely for the copied portion usually described as the 'reduplicant' and also for the copied portion within the 'base'. It is important to emphasize this symmetric weakening of all copied elements since the classical phonological account to reduplication based on BR-correspondence (e.g. McCarthy & Prince 1995) only predicts a special status for the reduplicant that is more prone to reduction, in contrast to the CWI.

This distinction into reduplicant and its base is of course a non-surface-apparent distinction and relies on analytical choices made by the linguist. In Ilokano (4), for example, the surface facts are simply that two instances of the three segments /kal/ or /pus/ surface in the reduplicated form – nothing inherently distinguishes one copy from the other. In all theories of reduplication, this surface form can in principle be predicted from either assuming that the phonological element that triggers copying is prefixed or infixed or that the instruction to copy material applies before all base segments or after the first syllable. This ambiguity is illustrated in the depiction in (5) that also introduces the terminology I use throughout the paper. It already implies the phonological account to reduplication assumed here where affixation of two empty moras triggers copying of a heavy syllable. Crucially, both prefixation (5a) or infixation (5b) of these empty moras will derive the same surface structure. As can be seen in (5), I continue to use the traditional term 'reduplicant' for the copied string that is realized in the 'new' position where the reduplication-triggering morpheme was underlyingly positioned and use the term 'copied base' for the counterpart of the copied string in the 'old' position.

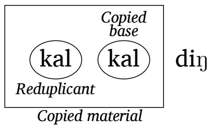
(4) Reduplication in Ilokano (McCarthy 1993: 187)

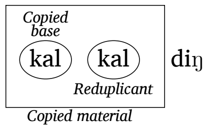
kaldíŋ	'goat'	kalkaldíŋ	'goats'
púsa	'cat'	puspúsa	'cats'

(5) Possible structures

Underlying a. /μ μ - kaldíŋ/ b. /kal < μ μ > díŋ/

Terminology used:





One promising way to disambiguate base and reduplicant can be the presence of fixed segments; an argumentation used in sections 2.2.2 and 2.2.3 where the distinction of the copied string into reduplicant and base is particularly important.

With this background, we now turn to the empirical evidence for the CWI. The next two subsections give examples for the two language types 2 and 3 in (3) which show thresholds for reduction that are bound to reduplication contexts. More concretely, languages of type 2 are those that show reduction only for elements that are copied 2.2 and languages of type 3 are those that show reduction only for elements that are copied twice 2.3.

2.2 Threshold 1: Copying enables reduction

This subsection gives examples for language type 2 where reduction only affects copied material but is blocked for non-copied material. As we will see, there are three sub-patterns for this language type, each is illustrated with one language below. The most obvious instantiation of the CWI is a language where reduction applies to the whole copied string, i.e. both the reduplicant and the copied base. Such a pattern can be found in Tagalog 2.2.1. There are,

1 Zimmermann (2019a) conducted a search for multiple reduplication patterns and ended up with a representative database of 40 different examples for languages with productive multiple reduplication.

however, also languages that show reduction of copied material in only one of the copied instances, i.e. only in the reduplicant or only in the copied base. As will become clear in section 3, this is an epiphenomenon in a model where fission is distribution of underlying activity. In this model, copying makes all copied material more prone to reduction but whether reduction for all or only certain copied elements surfaces is determined by the general phonology of the language. An example where reduction applies only in the reduplicant is Gitksan 2.2.2 and an example where reduction applies only in the copied base is Lushootseed 2.2.3.

2.2.1 Laryngeal deletion in Tagalog

The first example for a type 2 language is Tagalog, an Austronesian language (Blake 1917; Schachter & Otanes 1983; Blust 2007). As most Austronesian languages, the morphology of the language includes many different reduplication processes that express a variety of meanings (cf. Schachter & Otanes (1983: 370) for reduplication and verbal aspect or Schachter & Otanes (1983: 100–103) for reduplication and derived nouns). The data in (6) exemplifies bisyllabic prefixing reduplication. Interestingly enough, the reduplicated form for bases with a laryngeal sound /h/ or /ʔ/ between two like vowels shows an unexpected pattern of a monosyllabic reduplicant and base (6b). Both the reduplicant and the base hence underwent deletion of the laryngeal consonant and of one of the vowels in the copied string (Blust 1976; 2007). Note that /u/ and /o/ which were originally allophones in Tagalog count as like vowels for this process.

(6) Reduplication in Tagalog (Blust 2007: 7)

	base		reduplicated	
a.	ma-basag	'get broken'	ma-basag ~ basag	'get thoroughly broken'
	mag-sugat	'have sores'	magka-sugat ~ sugat	'thoroughly covered with sores'
b.	laʔás	'cracked'	las ~ lás	'ripped'
	láhad	'opening of the hand'	lad ~ lád	'opened'
	súhol	'bribe'	sul ~ sól	'instigation to do evil'
	suʔóŋ	'advance against odds'	suŋ ~ sóŋ	'go against wind'

That this laryngeal reduction does not apply outside of reduplication contexts can already be seen in the non-reduplicated forms in (6b). Some additional morphologically complex forms with a laryngeal between two like vowels are added in (7).

(7) No laryngeal reduction outside of reduplication (Blust 2007: 7)
ma-buhók 'hairy'
i-saʔád 'to say'

We can conclude that laryngeal reduction in Tagalog only applies to copied material but never outside of copying contexts. Crucially, it illustrates the completely symmetrical weakening of all copied material predicted from the CWI: reduction applies in both reduplicant and copied base.

Other examples for type 2 languages that show simultaneous reduction in both reduplicant and copied base but never in contexts outside of reduplication include vowel deletion and reduction to /ə/ in Lillooet (van Eijk 1993; 1997; Shaw & Howe 1999) and Heiltsuk (Rath 1974; Shaw & Howe 1999) and potentially vowel shortening in Hausa (Wolff 1993; Newman 2000; Inkelas & Zoll 2005). It is important to point out that simultaneous reduction in both reduplicant and copied base is crucially different from a pattern where reduction applies either in copied base or reduplicant within a language. Reduction in Kwakwala is analysed as such a pattern within the theory of existential faithfulness in Struijke (2000). As is discussed in more detail in 6, the theory of existential faithfulness cannot be extended to simultaneous reduction in reduplicant and copied base.

2.2.2 Consonantal feature neutralization in Gitksan

The most well-known reduction pattern in reduplication contexts is reduction in the reduplicant. An example can be found in Gitksan (Brown 2008), a Tsimshian language. As can be seen in

(8), the plural is marked by prefixing a fixed vowel /i/ and /a/ (next to gutturals) and a copied onset and coda from the initial syllable. The presence of the fixed vowel is a good reason to assume that this is indeed a prefixing reduplicant. The alternative morphological analysis that the reduplicant is infixing (cf. the discussion at the end of section 2.1) would require an additional change of the copied vowel to /a/ or /i/ respectively.

(8) Gitksan plural reduplication (Brown 2008: 147)

base	plural	
dzap	dzip ~ dzap	'make, do'
dulpx^w	dil ~ dulpx^w	'to be short'
ʔisx^w	ʔas ~ ʔisx^w	'stink, smell'

In (9), a reduction process can now be observed for the consonants in the reduplicant. Affricates become fricatives, ejectives and glottalized sonorants deglottalize,[2] and (in some dialects) palato-alveolar /ʃ/ becomes alveolar /s/. All these changes are arguably a reduction in markedness given that the resulting sounds neutralize some contrasts which are marked and less common in the languages of the world (Clements 2009; Hume 2011). Importantly, these reduction processes can only be observed in reduplicants, even though they result in non-identity between reduplicant and copied base.

(9) Plural reduplication and C-reduction (Brown 2008: 148)

base	plural				
m'ats	mis ~ m'ats	'to hit, strike'	ts	→	s
t'u:ts'x^w	dis ~ t'u:ts'x^w	'be black'	X'	→	X
maʃx^w	mis ~ maʃx^w	'white'	ʃ	→	s
iʃxw	as ~ iʃxw	'stink, smell'			

There are many more examples for reduction in the reduplicant cited in the literature (e.g. McCarthy & Prince 1994; 1995; Alderete et al. 1999; Kennedy 2008; Becker & Flack Potts 2011; Haugen & Kennard 2011) which are – under the heading of Emergence of the Unmarked – one of the main empirical arguments for the correspondence-theoretic account of reduplication based on BR-faithfulness (McCarthy & Prince (1995) and subsequent work) where only the reduplicant is expected to undergo reduction that is unattested outside of reduplication contexts.

2.2.3 Vowel reduction in Lushootseed

The counterpart to a language with reduction only in the reduplicant is one with reduction only in the copied base. An example for this pattern is vowel reduction in Lushootseed (Broselow 1983; Bates et al. 1994; Urbanczyk 2001), a Salishan language. The classic description of the diminutive formation is that it involves prefixation of a monosyllabic /CV/-reduplicant, accompanied by deletion (10a) or reduction of the copied base vowel (10b). Given that stress is initial, this reduction applies to a copied base vowel that becomes unstressed in a reduplication context. Whether the base vowel is deleted or only reduced to /ə/ is partially phonologically predictable and depends on the quality of the base vowel (low /a/ has a preference to be deleted) and the sonority of the resulting cluster (Urbanczyk 2001: 111). However, there are some lexical exceptions to these phonological generalization. For the present argumentation, the choice between the two reduction strategies is not particularly important.

In addition, some stems show a fixed vowel /i/ instead of the copied vowel and hence prefix a /Ci/-reduplicant (10c). The choice between the /CV/- and /Ci/-reduplicant is again largely phonologically predictable. Stems that begin with a long vowel, have /ə/ as their first vowel, or begin with a consonant cluster show the fixed vowel /i/ (Urbanczyk 2001: §4). In Urbanczyk (2001), the fixed segment /i/ is consequently taken to be a default segment that is realized instead of a copy-vowel to optimize the phonological structure and, for example, avoid copying of a long vowel.

2 Which is accompanied by predictable voicing: stops are voiced pre-vocalically (Brown 2008: §4.3.1).

Interestingly for the present argumentation, vowel reduction and deletion do not apply if the fixed vowel /i/ surfaces, excluding, for example, */dí ~ dəkʷ/. Vowel reduction thus only affects copied vowels, it is not restricted to, for example, the diminutive context in general.[3]

(10) Diminutive reduplication in Lushootseed (Urbanczyk 2001)

	base		distributive		
a.	júbil	‘die, starve’	jú ~ jəbil	‘small animal dies’	p.207
	s-bádil	‘mountain’	s-bábədil	‘small mountain’	p.192
	ʔágʷal-əb	‘yawn’	ʔá ~ ʔəgʷál-əb	‘yawn’	p.191
b.	ʔúsil	‘dive’	ʔú ~ ʔsil	‘shallow dive’	p.192
	kúpi	‘coffee’	kú ~ kpi	‘a little coffee’	p.196
	sáqʷ’	‘fly’	sá ~ sqʷ’	‘fly just a little bit’	p.201
c.	dú:kʷ	‘knife’	dí ~ du:kʷ	‘small knife’	p.195
	daʔ(a)	‘name, call’	dí ~ daʔa-t-əb	<name, calling>	p.194
	tʃ’saj	‘salmon spear’	tʃ’i ~ tʃ’sáj	‘toy spear’	p.194

It has to be emphasized that this generalization that reduction is bound to copied unstressed vowels is different from the theoretical analysis in Urbanczyk (2001) where all unstressed /a/ vowels are predicted to be reduced. However, this is not a general process as can be seen in the data in (11) where unstressed /a/’s are preserved outside of reduplication contexts. It is not easy to decide whether reduction is bound to copying or applies to unstressed vowels of a certain quality given that there are exceptions to both generalizations (cf. footnote 3). The present approach takes the correlation between reduction and copying to be the one capturing more patterns and assumes that the reduction is expected for unstressed copied vowels in the default case (10a + b) but not for unstressed vowels (of a certain quality) in general (11).

(11) No reduction of unstressed non-copied vowels (Urbanczyk 2001)

t’q’ədíʔ = ac	‘western hemlock’	p.73
plílaʔ	‘wild or bitter cherry’	p.73
ʔu-c’áp’ac	‘insulted someone’	p.86
líl = ax̌ad	‘far away on the other side’	p.87

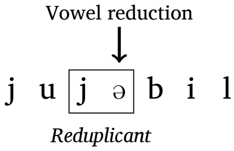
The existence of reduction that only applies in the copied base is a debated issue. There are some claims in the literature that such patterns exist (e.g. Shaw & Howe 1999; Struijke 2000) and that the standard model of BR-faithfulness must be extended to capture them. However, some of the data proving the existence of this pattern is in fact ambiguous and allows a reanalysis in terms of reduction only in the reduplicant. An example is the reduplication pattern in Tohono O’odham that either involves reduction in the copied base if the reduplicant is taken to be prefixing but reduction in the reduplicant if the reduplicant is taken to be infixing (Riggle 2006). This ambiguity is of course expected given that the reduplicant and the copied base are identical in a default case of reduplication (cf. the discussion at the end of 2.1).

For Lushootseed, such a reanalysis as reduction in the reduplicant comes at the price of assuming two suppletive allomorphs for the diminutive reduplication. The illustration in (12) summarizes the surface indicators we have for the position of the reduplicant under the alternative interpretation that reduction applies in the reduplicant. In the patterns (10a), the reduplicant must contain the reduced vowel and one of the instances of the copied consonant, resulting in an infixed CV-reduplicant (12a). For the patterns (10c), on the other hand, the reduplicant must contain the fixed vowel and one of the instances of the copied consonant, resulting in either a prefixed CV-reduplicant or an infixed VC-reduplicant (12b).

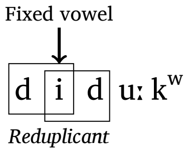
3 There are many exceptions to this generalization. I looked through the 250 instances of diminutive reduplication given in the appendix of Urbanczyk (2001) and of the 87 unambiguous instances where bases beginning with /CV/ show vowel-copying (i.e. excluding bases with an initial /i/), 48 show reduction of the vowel and 39 show no reduction. On the other hand, of the 23 clear cases of fixed /i/ reduplication, only 4 show reduction and 19 no reduction. Though it is far from exceptionless, there is a correlation between copying and weakening. I take this as evidence that reduction is a general phonological process expected for copied vowels which is blocked for certain exceptional stems.

(12) Reduction only in the reduplicant: identifying base and reduplicant

a. Vowel reduction context



b. Fixed vowel context



At first glance, these facts might still be compatible with assuming a single /CV/-reduplicant for the diminutive in a theory where morphemes can dislocate to optimize the phonological structure (Prince & Smolensky 1993/2002). We could, for example, assume that the /CV/-reduplicant is preferably prefixed but is infixed and realized after the first base vowel if prefixation results in a marked structure. The comparison in (13) shows that such an account is untenable: Both the prefixing and the infixing realizations of the reduplicant result in a form that is equally (un)marked in terms of syllable structure.

(13) Alternative morphological structures: reduction only in the reduplicant

	Vowel reduction context		Fixed vowel context	
Infix:	ju < Red > bil	jujəbil	du: < Red > kʷ	*du:dikʷ
Prefix:	< Red > jubil	*jəjubil	< Red > du:kʷ	didu:kʷ

If reduction applies in the reduplicant in Lushootseed, the account hence needs to rely on phonologically conditioned suppletive allomorphy (Paster 2006) between a reduplicative prefix and a reduplicative infix. An account with only a single underlying representation of a prefixing /CV/-reduplicant whose different surface realizations as /CV/ or /Ci/ are predicted by the general phonological optimization is surely to be preferred for reasons of economy and lexical storage. And under this analysis, it is the copied base vowel that is reduced to /ə/ or deleted altogether.

Other examples for type 2 languages that show reduction only in the copied base include vowel deletion in Cupeño (Hill 2005) and Klamath (Barker 1964; Kisseberth 1972; Blevins 1993). The pattern is discussed at length within the theory of existential faithfulness (Struijke 2000) which also predicts reduction in the copied base.

2.3 Threshold 2: More copying enables more reduction

This subsection now turns to languages of type 3 (cf. (3)), namely those that restrict reduction to elements that are copied more than once.

Before we turn to concrete examples, some background on 'multiple copying' contexts is in order. Since the paper focusses on reduplication, this situation involves multiple reduplication of the same base material. Such a situation arises if two (or more) reduplicative morphemes are present (and usually adjacent) in a word. An example for multiple reduplication from Bikol is given in (14). The imperfective is marked by monosyllabic prefixing reduplication and the plural by bisyllabic prefixing reduplication as can be seen in (14a). Verbs marked for both imperfective and plural now simply concatenate these reduplicants (14b). From the perspective of phonological copying, the string /ha/ in (14b) is copied twice since three /ha/ sequences surface in the multiply reduplicated form.

(14) Multiple reduplication in Bikol (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'

2.3.1 Vowel deletion in Sikaiana

A first example for reduction that is bound to multiple reduplication contexts comes from Sikaiana, an Austronesian language (Donner 2012). As can be seen in (15), the repetitive is marked by prefixing a bisyllabic reduplicant and the plural by prefixing a monosyllabic reduplicant. The latter pattern shows optional variation between a /CV/-reduplicant and a shortened /C/-reduplicant.

(15) Reduplication in Sikaiana (Donner 2012: 23 + 24)

a.	base		repetitive	
	sopo	'jump'	sopo ~ sopo	
	sepu	'dive'	sepu ~ sepu	
	motu	'snap'	motu ~ motu	
b.	base		plural	
	sopo	'jump'	s ~ sopo	so ~ sopo
	sepu	'dive'	s ~ sepu	se ~ sepu
	moe	'sleep'	m ~ moe	mo ~ moe

The optional deletion of a vowel between two like consonants that results in a C_1VC_1/C_1C_1 alternation can also be observed outside of reduplication contexts (16).

(16) C_1VC_1/C_1C_1 alternation in Sikaiana (Donner 2012)

hahai	hhai	'to strip off bark'	p.60
papale	ppale	'to blame or accuse someone'	p.228
sasau	ssau	'to carry, to lift'	p.256
totolo	ttolo	'to crawl'	p.308

Verbs can now be marked for both the repetitive and a plural object, combining the two reduplication patterns in (15). In such multiple reduplication contexts, however, the optionality between C_1VC_1 and C_1C_1 vanishes and the exponent for the plural is obligatorily the shorter C-copy (17).

(17) Multiple reduplication in Sikaiana (Donner 2012: 23 + 24)

base		repetitive plural	
sopo	'jump'	sopo ~ s ~ sopo	*sopo ~ so ~ sopo
sepu	'dive'	sepu ~ s ~ sepu	*sepu ~ so ~ sepu

This is taken to follow directly from the assumption that every copy operation weakens all copied elements: an optional deletion process that avoids a marked sequence C_1VC_1 becomes obligatory as soon as the elements creating this sequence are copied twice and weakened 'too much'.

An alternative generalization about the data in (17) is that deletion to avoid C_1VC_1 sequences becomes obligatory within words. The marked C_1VC_1 sequence would then only be (optionally) allowed in word-initial position.[4] However, Sikaiana allows C_1VC_1 sequences within words outside of reduplication contexts. An example are the contexts (18) where C_1VC_1/C_1C_1-initial stems are preceded by the prefix /haka-/ CAUSATIVE.[5]

(18) Word-medial C_1VC_1/C_1C_1 alternations (Donner 2012)

a.	mmata	mamata	'examine'	
	hakammata	hakamamata	'to display, to show'	p.6 + 70

4 I'm grateful to an anonymous reviewer for pointing out this possible alternative interpretation of the data.

5 Contexts with the stative prefix /ma-/ apparently support the alternative generalization that C_1VC_1 sequences are obligatorily reduced to C_1C_1 word-medially since the plural forms of verbs with /ma-/ always reduplicate only the stem-initial consonant; there is apparently no optional realization with a copied CV-sequence (ia). However, /ma-/ has a second unexpected property since C_1VC_1/C_1C_1 stems are obligatorily realized as only C_1 after /ma-/ (ib). I therefore take /ma-/ to be a special prefix with an exceptional subtractive property that makes optional realization of C_1VC_1 -sequences impossible.

(i) Subtractive prefix /ma-/ (Donner 2012)

a.	makolu	'bent' (SG)	makkolu	'bent' (PL)	p.23
	mahana	'separated' (SG)	mahhana	'separated' (PL)	p.23
b.	ssae	'tear'	masae	'to be torn, ripped'	191
	hhana	'separate'	mahana	'to be pulled out'	177
	ttala	'untie'	matala	'to be undone'	194

DOI: 10.5334/gjgl.1117

b.	mmau	mamau	'firm'	
	hakammau	hakamamau	'to make firm'	p.16 + 71 + 198
c.	ppili	pipili	'to stick'	
	hakappili	hakapipili	'to make one thing adhere to another'	p.76 + 237
d.	ttaki	tataki	'to lead someone'	
	hakattaki	hakatataki	'to go strolling'	p.80 + 278

I hence take Sikaiana to be an example of a type 3 language that shows obligatory reduction in multiple reduplication contexts that is only optional in single reduplication contexts or outside of reduplication.

2.3.2 Segment deletion in Southern Wakashan

Another example for gradient weakening after multiple copying is the avoidance of multiple reduplicants in Southern Wakashan (e.g. Stonham 1994; 2004).

The data in the following is taken from Ditidaht and the two Nuu-Chah-Nulth varieties Kyuquot and Tseshaht but the pattern is basically identical in most Southern Wakashan languages.[6] Some meanings like the plural or the iterative are expressed by prefixing reduplication. In addition, many suffixes have the idiosyncratic property of triggering an additional prefixing reduplication pattern, illustrated in (19)–(21) where reduplication-triggering suffixes are marked with underlining. The prefixing monosyllabic reduplicants in these languages show a variety of slightly different shapes or accompanying phonological effects which are indicated with subscripted letters.[7] Note that Stonham (1994) only gives contrasts between unreduplicated and reduplicated forms that are subsegmented into morphemes and it is not entirely clear whether those are all surface forms.

(19) Reduplication in Ditidaht (Stonham 1994: 41 + 44)

a. sa:nti:-ataχ$_{[RL]}$
sunday-ready.to…
sa:sa:nti:ataχ
'saturday'

b. wik-ʔac'uɬ$_{[R+L]}$
not-at.the.foot
wiwi:kʔac'uɬ
'bare feet'

(20) Reduplication in Kyuquot (Rose 1981: 312 + 340)

a. tɬuk-'as$_{[RL]}$
broad-at.wrist
tɬu:tɬuk'ʷas
'he has wide wrists'

b. ʔu-ħw'aɬ$_{[L]}$-apa$_{[RL+L]}$
it-use-too
ʔu:ʔu:ħw'aɬap
'he used it too much'

(21) Reduplication in Tseshaht (Davidson 2002: 50 + 210)

a. ʔana-as$_{[R]}$
only-on.cheeks
ʔaʔanas
'only that on the cheeks'

6 Southern Wakashan, spoken in British Columbia and centered at Vancouver Island, is usually subdivided into Ditidaht, Makah and Nuu-Chah-Nulth (formerly Nootka). The latter has around 13 different varieties (Mithun 1999). Stonham (2004) and Stonham (2007) in fact use Kyuoquot data from Rose (1981) to illustrate some reduplication facts for Tseshaht.

7 R = CV, RL = CV:, + L = lengthening of the first base vowel.

b. Red ~ kuḥ
PL ~ hole
kuḥkuḥ
'holes'

If now two reduplication-triggering morphemes are present in a word, only a single prefixed reduplicant surfaces as can be seen in (22) and (23). The examples all involve suffix-triggered reduplication since those are the examples where it is most apparent that indeed two reduplication-triggering morphemes are present given that the suffixal portions of morphemes that trigger reduplication are present. This pattern hence involves complete reduction of one reduplicant in case another one is present – since the segment deletion is bound to two copy operations, it is a language of type 3.

(22) Avoidance of multiple reduplicants in Ditidaht (Stonham 1994: 49)
a. tɬ'uqʷ-a:ʔdɬ$_{[R]}$-a:p$_{[RL]}$
tɬ'u:tɬ'uqʷa:ʔdɬa:p (*tɬ'u:tɬ'utɬ'uqʷa:ʔdɬa:p)
'X's legs are really big'

b. sa:tq-'aqsiɬ$_{[R+L]}$-a:p$_{[RL]}$
sa:sa:tq'aqsiɬa:p (*sa:sasa:tq'aqsiɬa:p)
'X's eyes were really itchy'

c. ba:ɬ-aski-jabɬ$_{[R]}$-a:p$_{[RL]}$
ba:ba:ɬaskijabɬa:p (*ba:baba:ɬaskijabɬa:p)
'X is really cold on the shoulders'

(23) Avoidance of multiple reduplicants in Kyuquot (Rose 1981: 341 + 342)
a. tɬ'uk-a:n'uɬ$_{[R+L]}$-apa$_{[RL+L]}$
broad-at.leg-really
tɬ'u:tɬ'u:kʷan'ɬap
'his legs are really big'

b. m'aɬ-'as$_{[RL]}$-apa$_{[RL+L]}$
cold-at.wrist-really
m'a:m'a:ɬʔasap
'he has really cold wrists'

c. m'aɬ-jimtɬ$_{[R]}$-apa$_{[RL+L]}$
cold-at.shoulder-really
m'a:m'a:ɬjimtɬap
'he's really cold in the shoulders'

A possible alternative explanation for these facts that is independent of (multiple) reduplication would be a surface ban against $C_1V_1C_1V_1$-sequences with two adjacent identical syllables. Such restrictions against adjacent identical segment sequences within a word have been argued to explain a variety of phenomena, including haplology (Menn & McWhinney 1984; Plag 1998; Yip 1998). An account based on such a surface ban is untenable in Southern Wakashan since one can indeed find adjacent identical $C_1V_1C_1V_1$-sequences on the surface. The first context is one that is actually derived from the concatenation of multiple reduplication-triggering suffixes. The ban on adjacent reduplicants we saw in (22) and (23) in fact only holds between multiple inflectional or multiple derivational morphemes. If a derivational and an inflectional reduplication-triggering morpheme are combined, multiple adjacent reduplicants surface. This is illustrated in (24) for Ditidaht, in (25) for Kyuquot, and in (26) for Tseshaht.

(24) Multiple reduplicants in Ditidaht (Stonham 1994: 57)
Red ~ kaw'ad-ataχ$_{[R]}$
DISTR ~ killer.whale-hunt
kakakaw'adataχ
'hunting killer whales here and there'

(25) Multiple reduplicants in Kyuquot (Rose 1981: 340)
Red ~ Red ~ mitx^{ω}-$_{L}$-(j)a
DISTR ~ IT ~ turn-GRAD-REP
mimi:txmitx
'they were turning repeatedly here and there'

(26) Multiple reduplicants in Tseshaht (Davidson 2002: 39 + 42)

a. Red ~ mutq-n'uk$_{R+L}$
PL-amputate-at.hand
mumumutqn'uk
'each with fingers shot off'

b. Red ~ ʔu-atah$_{R}$
DISTR ~ so.and.so-hunting
ʔuʔuʔutaḥ
'hunting it here and there'

As is argued convincingly in Stonham (2007) and Stonham (2008), this is a strong argument for a stratal model of phonology where the addition of inflectional and derivational morphemes is followed by its own phonological evaluation. This assumption is independently motivated for these languages since there are in fact a number of other phonological and morphological processes that warrant such a distinction into different levels of phonology (Stonham 2007; 2008).[8]

In addition, at least some monomorphemic words with $C_1V_1C_1V_1$-sequences exist in Southern Wakashan. An example from Ditidaht is the stem for 'cow' (27a) that can even undergo reduplication if a reduplication-triggering suffix is added (27b).

(27) Ditidaht: Pseudoreduplicated stem (Stonham 1994: 59)

a. mu:smus
'cow'

b. mu:smus-ataχ$_{[RL]}$
cow-hunt…
mu:mu:smusataχ
'hunting cows'

The deletion of one reduplicant in multiple reduplication contexts in Southern Wakashan can thus not be due to a general ban on adjacent identical surface sequences and is taken to be reduction that applies to segments that are copied twice (within the same stratum).

2.4 Summary: Reduction and copying thresholds

Table (28) repeats the four language types that are in accordance with the CWI. Different examples for languages that exemplify the two threshold types 2 and 3 were discussed in the last two subsections. Language types 1 and 4 are trivially attested and show no interesting reduction threshold with respect to reduplication. An example for a language of type 1 where the presence of reduction is completely independent from any copying is Palauan where all unstressed vowels are predictably reduced to /ə/ (Finer 1990). This reduction applies to vowels that are not copied, to those that are copied once, and to those that ore copied twice. And an example for a type 4 language where no reduction applies in any context would be Papapana (Smith 2015; 2016). Single and multiple reduplication contexts predictably copy a prosodically defined portion of the base and no reduction process applies to any copied or non-copied elements.

(28) *Predicted typology: Copying and weakening*

	No Copying	1 x Copying	2 x Copying	Example
Lg 1	Reduction	Reduction	Reduction	Palauan
Lg 2	Faithful	Reduction	Reduction	Tagalog 2.2.1
				Gitksan 2.2.2
				Lushootseed 2.2.3
Lg 3	Faithful	Faithful	Reduction	Sikaiana 2.3.1
				Southern Wakashan 2.3.2
Lg 4	Faithful	Faithful	Faithful	Papapana

8 As will be discussed in detail later, the theoretical account I propose in section 3 is also a stratal model and can easily incorporate the insight that segment deletion is only possible if two copy operations apply within a single stratum.

3 Proposal: Fission as distribution of activity

The novel proposal in this paper that predicts the CWI is that fission is the distribution of underlying activity. Before this claim and its predictions can be discussed, some background assumptions are necessary that are presented in sections 3.1 and 3.2. Section 3.1 introduces the phonological model of reduplication based on prosodic affixation that underlies all the following discussion. Another crucial background assumption are Gradient Symbolic Representations, introduced in section 3.2. In addition, the model relies on containment (section 3.1) and is implemented in Harmonic Grammar (section 3.2). These four assumptions are all independently motivated and in principle orthogonal to each other but are all essential for the formal modeling of the core proposal that fission is distribution of activity which predicts the CWI for reduplication (section 3.3).

3.1 A phonological account of reduplication

The reduplication theory advocated here is purely phonological and assumes that reduplication is the consequence of a phonological copy operation that applies to fill otherwise segmentally empty prosodic nodes. This sets this approach apart from theories assuming reduplication-specific elements like the phonologically empty RED morpheme, reduplication-specific correspondence relations (McCarthy & Prince 1995), reduplication-specific phonological operations (Raimy 2000), or reduplication morpheme-specific cophonologies (e.g Inkelas & Zoll 2005; Inkelas 2008).

Reduplication-triggering affixes in this model contain 'prosodic affixes' or empty prosodic nodes that lack segmental content. Apart from this representational peculiarity, there is nothing special about them: phonology alone is left to deal with those empty prosodic nodes and no special morphology or phonology applies in reduplication contexts. The influential theoretical proposals in Marantz (1982) and McCarthy & Prince (1986) can be understood as first arguments for such a phonological account of reduplication based on segmentally empty affixes. It was re-introduced into optimality-theoretic phonology in the work of Saba Kirchner (2010) (cf. also Pulleyblank (2009); Bermúdez-Otero (2012); Bye & Svenonius (2012); McCarthy et al. (2012)) that emphasizes, for example, the existence of phonologically predictable allomorphy between reduplication and other non-concatenative strategies as a strong argument for a prosodic affixation account to reduplication (Saba Kirchner 2010; 2013a; b; Zimmermann 2013). Prosodic affixation can thus not only result in reduplication, but it can also result in other non-concatenative exponents that realize a morpheme, most notably vowel lengthening or gemination. The constraints that ensure realization and prosodic integration of a prosodic affix are hence by no means specific to reduplication (e.g. Samek-Lodovici 1992; Davis & Ueda 2002; van Oostendorp 2005; Wolf 2007; Bye & Svenonius 2012; Zimmermann 2017).

The 'copying' process that fills the otherwise empty prosodic nodes in reduplicative contexts is standardly taken to be fission: underlying elements are split up into multiple output instances under violation of INTEGRITY (=INT_s) (29a) (Raimy & Idsardi 1997; Spaelti 1997; Struijke 2000; Gafos 2003; Nelson 2003). The basic logic of this account is illustrated in tableau (30) where a prefix consisting only of an empty mora is affixed to a base. Deletion of this mora is impossible due to undominated MAX-μ demanding preservation of every underlying mora (not given in (30)). If the mora is realized, however, it needs to dominate some segments due to (29b) ensuring proper integration of all prosodic nodes. Two obvious possibilities to fill this mora with segmental content are to link it to the following vowel of its base resulting in vowel lengthening (30b), to insert an epenthetic vowel (30c), or to split up the underlying initial vowel into two output instances (30d). It is easily determinable from the indices that mark the IO-correspondence relations that fission applied in this candidate. Both underlying /s_1/ and /i_2/ have two output correspondents with the same index. Given that DEP (29c) and *V: penalizing long vowels are ranked above INT_s in this language, segment fission becomes optimal. This repair is often termed 'copying' in the following but it should be clear that it is simple double realization of input elements. Crucially, the candidates (29a) and (29b) represent strategies that become optimal in other languages to realize an empty mora – strategies which can even alternate in a phonologically predictable way with reduplication (cf. the discussion above).

It has to be noted that the constraint in (29b) only refers to 'morphologically coloured' prosodic nodes. The theory of morphological colours assumes that all phonological elements that are part of the underlying representation of a morpheme have a designated colour that represents morphemic affiliation (van Oostendorp 2003; 2006; 2007; 2008; Revithiadou 2007). It hence relies on the often implicit assumption that the phonology can detect whether a phonological element is epenthetic (=has no colour) or not (=has a colour) and whether two phonological elements belong to the same morpheme or not. Only underlying moras induce a violation of (29b) if they are not dominating a vowel. That epenthetic nodes are exempt from those prosodic integration constraints is a natural assumption given that the insertion of epenthetic nodes is only motivated if they are necessary for prosodic integration to begin with.

(29) a. INT_S: Assign * for every pair of output segments that correspond to the same input segment.
b. μ>: Assign * for every morphologically coloured μ not dominating a vowel.
c. DEP: Assign * for every output-segment without an input correspondent.

(30) Copying as fission: the basic mechanism

μ + μ s_1 i_2 l'_3	μ>V	DEP	*V:	INT_S
a. μ μ s_1 i_2 l'_3	*!			
b. μ μ s_1 $i{:}_2$ l'_3			*!	
c. μ μ ʔ ə s_1 i_2 l'_3		*!*		
☞ d. μ μ s_1 i_2 s_1 i_2 l'_3				**

In the following analyses, the basic interaction between these constraints is taken for granted and it is not explicitly shown anymore how and why copying emerges as the optimal strategy to fill the prosodic affixes.

Another background assumption adopted here is the containment assumption that literal deletion of input elements is impossible and that elements can only be marked as phonetically uninterpreted (Prince & Smolensky 1993/2002).[9] In such systems where unrealized elements are still part of the structure, constraints are taken to exist in two versions (Trommer 2011; Trommer & Zimmermann 2014): one referring only to realized material and the other to all phonological material. This distinction is illustrated in (31) with the constraint (29b) demanding that every mora wants to dominate a segment. The phonetic version of this constraint only 'sees' realized elements whereas the generalized version sees all the structure, including unrealized material. It has been argued that the latter type of constraints allows a natural account for various challenging morphological lengthening facts (Trommer 2011; Trommer & Zimmermann 2014; Zimmermann 2017). It will become crucial in the accounts in section 4 that an unrealized element can be enough to fill a prosodic node for the generalized constraints since it allows to predict the apparent conundrum that copying applies to fill a prosodic node but parts of this copy are deleted in reduction contexts.

(31) a. $\boxed{\mu\text{>V}}_P$: Assign * for every morphologically coloured μ that does not dominate a phonetically interpreted vowel.
b. μ>V: Assign * for every morphologically coloured μ that does not dominate a vowel.

9 The model employed here is, however, not a containment model in the strict sense since it still employs fission. In a strict containment model without correspondence relations, fission and its counterpart coalescence are usually excluded (e.g. Zaleska 2018). This falls out from the assumption that the input is always reconstructable from the output without any reference to the input itself – something which requires additional representational devices for fission and coalescence.

3.2 Gradient Symbolic Representations

This paper assumes a specific version of gradient activity for linguistic elements, namely the theory of 'Gradient Symbolic Representations' (=GSR; Rosen 2016; Smolensky & Goldrick 2016; Trommer 2018; Zimmermann 2018a; b; 2019b; Kushnir 2019). The assumption that linguistic elements are not categorical but have activity differences is a rather old one. It was, for example, proposed in Rizzi (1986) and Koster (1986) that functional categories in syntax are either weak or strong and Garde (1965) already observed that some lexical accent system are based on scalar grades of accent strength. The present paper adds to the bulk of recent research that investigates the predictions of numerical gradient activity in an OT-system and argues that it can explain exceptionality. More concretely, elements with different activities can be exceptional (non)undergoers or (non)triggers for phonological processes since they violate constraints to different degrees. GSR thus has the potential for being a general representational account of exceptional phonological behaviour: one morpheme can behave exceptionally with respect to the general phonology of a language since its underlying representation contains a phonological element of a different activity. The proposal in this paper extends the GSR assumption in proposing that the phonology contains operations that predictably adjust the activity of phonological elements. As will become clear in 3.3, the new definition of fission as distribution of underlying activity predictably reduces the activity of copied elements.

Gradient activity of elements can also predict gradient or variable behaviour and hence optionality in grammar (e.g. Rosen 2016), something that will become important in the case study of Sikaiana in section 4.2.1.

This paper thus focusses on the specific predictions that arise from the interaction of gradient activity with the grammatical processes and constraints of a concrete language. Its focus is thus different from other work on non-categorical elements in neural networks (an example that focusses on reduplication is Corina (1994) where it is argued that a neural network can induce prosodic categories).

The crucial mechanism for different phonological behaviour depending on underlying activity are gradient constraint violations: deletion of a weakly active element is, for example, not penalized by Max as much as deletion of a more active element and is consequently 'cheaper' for the phonology. This intuition is illustrated in a first toy example in (32). The input contains three segments with the full default activity of 1 and one segment that only has the weak activity of 0.5. These activities are part of the underlying representations for these morphemes and are hence (arbitrary) lexical properties. The tableau illustrates how these activity differences can result in different phonological behaviour: deletion of a fully active segment (32b) results in a full violation of Max whereas deletion of the weakly active segment (32c) results in a partial violation of Max.[10] In the following, underlying activity is notated as a circled number below every segment.[11]

(32) Toy example: gradient activity = gradient violations

b a t – p ① ① ① ⓘ.5	*CC	Max	Dep
a. batp	-1		-0.5
☞ b. bat		-0.5	
c. bap		-1	-0.5

In the original GSR proposals (Rosen 2016; Smolensky & Goldrick 2016), a GEN restriction excludes all output elements that have an activity other than 1 – a weakly active element like /p/ in (32) must therefore be strengthened by adding 0.5 activity in candidates (32a) and (32c) under violation of Dep. Later work in GSR has argued that the ban on activity other than 1 should be a violable constraint and that languages can tolerate weak or over-strong activity for output elements (Zimmermann 2018b; 2019b). In all the following analyses, realized output elements have to have the full activity of 1 but whether this is ensured by a constraint that

10 The definition of gradient Max and Dep are given in (36) below.

11 Activity is only given for segments since those are the relevant phonological elements in the following accounts. In principle, however, all phonological elements (features, tones, moras,...) have an activity on their own.

happens to be inviolable in those languages or by a GEN restriction is in principle irrelevant. In section 5, it is discussed that there might be evidence from reduplication reduction facts for weak output activity but these arguments are left for future research.

Recall from section 3.1 that the present model is also based on the containment assumption that literal deletion of elements is impossible. GSR allows a natural implementation of this principle in stating that non-realization of an element is setting its activity to zero. This formally implements the implication of GSR that output activity can have phonetic effects (cf. section 5 for a discussion).

All addition or deletion of activity in the phonology is notated in boxes below the underlying activity. Non-realization of an element with activity zero is always marked with a gray background to ease readability. Prosodic nodes also remain unrealized if they only dominate unrealized elements.

Tableau (33) illustrates all these assumptions with another toy example. It contains a floating mora and a vowel that underlyingly only contains an activity of 0.5 and that lacks an underlying association to a mora. Non-realization of this vowel in candidates (33a + c) hence induces a gradient 0.5 violation of MAX. Realization of this vowel in (33b), on the other hand, implies strengthening of this weak segment to a fully active segment under a gradient 0.5 violation of DEP. The floating mora does not dominate any segment in (33a) and induces a violation of both μ > V and $\boxed{\mu > V}_P$ (31). Both these violations are avoided in (33b) where the mora dominates a realized and fully active vowel. Candidate (33c), however, only avoids one of these violations since the mora dominates a vowel which is itself deprived of all its activity and thus remains non-realized. This candidate induces a violation of $\boxed{\mu > V}_P$ but it crucially avoids a violation of the general μ > V: the mora dominates some vowel, even if this vowel is non-realized. The contrast between candidates (33a) and (33c) is a contrast that is only possible under the containment assumption.

The tableau also illustrates another assumption made in all GSR accounts, namely that the harmony evaluation is based on Harmonic Grammar (= HG) where constraints are weighted, not ranked (Legendre et al. 1990; Potts et al. 2010).[12] In HG, the violations each candidate incurs are taken times the respective weight of the constraints and summed up into a so-called harmony score. The candidate with the highest harmony score (given that constraint violations are negative) is the optimal one. The weight for each constraint is given below them and the harmony score for every candidate in the last column.

(33) Filling prosodic nodes with realized or unrealized material

μ + s o p o (μ–o) ① ⓹.5 ① ①	μ > V 20	DEP 20	$\boxed{\mu > V}_P$ 6	MAX 4	
a. μ s [o] p o (μ–o) ① .5 ① ① [–.5]	-1		-1	-0.5	-28
b. s o p o (μ–o, μ–o) ① .5 ① ① [+.5]		-0.5			-10
☞ c. s [o] p o ([μ]–o, μ–o) ① .5 ① ① [–.5]			-1	-0.5	-8

A final background assumption for the following accounts is a stratal organization of grammar (Kiparsky 2011; Bermúdez-Otero in preparation) where stems are optimized prior to affix concatenation (Trommer 2011). The important consequence for the following analyses is

12 It has to be noted, though, that the assumption of gradient activation and of HG are in principle orthogonal.

Glossa: a journal of general linguistics
DOI: 10.5334/gjgl.1117

that the prosodic affixes are added to stems that are already fully prosodified. In addition, all phonological structure at the end of each stratum receives a unified new morphological colour (Trommer 2011). This implements the concept of Bracket Erasure since morpheme differences are neutralized at the end of each stratum. Similarly, the distinction into underlying and epenthetic elements is lost after each stratum. This has important consequences for the present model since it predicts that prosodic nodes that were assigned in an earlier stratum are due to the same constraints $\mu > V$/$\boxed{\mu > V}_P$ as affixed prosodic nodes that are added in the new stratum (cf. especially the discussion of Sikaiana in section 4.2.1).

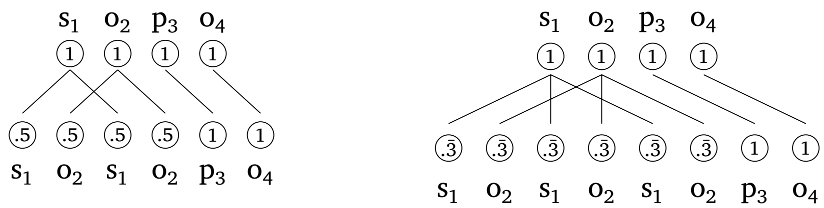
3.3 Fission as distribution of activity

The new proposal in this paper is that the fission operation creating copies in the phonology is the distribution of underlying activity. This new definition of the GEN operation fission is given in (34).

(34) Fission as distribution of activity
For an input element S_1 with activity A, create x output instances of S_1 with underlying activity A/x.

Fission in this novel sense is illustrated in (35) where two underlying segments /so/ are split into two (35a) and three (35b) output instances of themselves, visible by the corresponding input-output indices. The first intuitive consequence from fission as distribution of activity is that elements that result from fission receive a comparatively small amount of underlying activity. More concretely, all the output instances of /so/ in (35) are weaker than /po/ though all four segments had the same input activity. A second important result is the fact that all elements resulting from fission of the same element have the same amount of (reduced) activity. There is thus no /so/ sequence in (35) that is different from any other /so/ copy, they all have the same activity. Weakening resulting from copying is hence crucially symmetrical. A third important consequence is that more copying weakens elements even more. One copy operation (35a) thus leaves more activity for each segment than two copy operations (35b).

(35) Copying as distribution of underlying activity
a. Fission into two segments b. Fission into three segments



If fission redistributes underlying activity, the evaluation of faithfulness constraints need to be able to distinguish between underlying and epenthetic activity of a segment, even if the former is not necessarily the same as the input activity of the segment in question. More concretely, the first output segment /s/ in (35a) only received 0.5 underlying activity after fission though the input segment it corresponds to has an underlying activity of 1. One way to model this distinction is to extend the assumption of morphological colours to activity. The elements that underwent fission in (35a) thus only have 0.5 underlying or morphologically coloured activity. The faithfulness constraints Dep and Max penalizing the deletion or addition of activity are now calculated with respect to this (possibly redistributed) underlying or morphologically coloured activity (36). This formalization thus takes the fission intuition to its literal extreme: fissioned or copied elements are indeed the same element distributed among multiple surface instances.

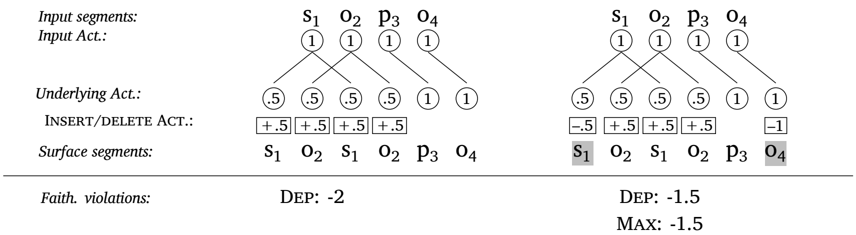
(36) a. Max: For every pair of corresponding input output elements with underlying activity I and an output activity O where I > O:
Assign -(I-O) violations.

b. 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.

How distribution of elements results in weakening and thus different faithfulness violations is illustrated in (37) where two input segments with activity 1 are split into two respective output instances that get only 0.5 underlying activity each. Realization of every fissioned element consequently induces 0.5 DEP violations. On the other hand, deletion of an element that underwent fission only induces 0.5 violations of MAX since only 0.5 underlying activity remains unrealized. Deletion of a fissioned segment is hence cheaper for MAX than deletion of a fully active element that did not undergo fission. In (37b), this can be seen in the contrast between deleting copied /o/ that is penalized by 0.5 MAX violations and deleting non-copied /s/ that is penalized by 1 MAX violations. Though weakening of copied elements is illustrated with deletion and the gradient violations of MAX here, weakening also affects the violations of IDENT constraints. A weakened element is therefore also more prone to a change of its feature values (cf. section 4.1).

(37) Fission and gradient DEP/MAX violations

a. Copying b. Copying + Deletion



That all copied elements are more prone to reduction (cf. section 2.2) thus follows in this model since they have less underlying activity and induce less faithfulness violations if they undergo any change or remain unrealized. And it automatically falls out that more copying increases the chance of reduction (cf. section 2.3) since more copying implies less underlying activity for each segment. In this model, the four attested language types 1–4 (cf. (3), repeated in (38)) simply differ in the thresholds for reduction set by the weightings of faithfulness constraints.

(38) *Predicted typology: Copying and weakening*

		No Copying	1 x Copying	2 x Copying
A.	Languages predicted by the CWI			
	Lg 1	Reduction	Reduction	Reduction
	Lg 2	Faithful	Reduction	Reduction
	Lg 3	Faithful	Faithful	Reduction
	Lg 4	Faithful	Faithful	Faithful
B.	Languages excluded by the CWI			
	*Lg 5	Reduction	Reduction	Faithful
	*Lg 6	Reduction	Faithful	Reduction
	*Lg 7	Faithful	Reduction	Faithful
	*Lg 8	Reduction	Faithful	Faithful

These different thresholds are illustrated in the toy tableaux (39) and the weighting relations (40). The tableaux compare contexts where there is no copying (39–1), one copy operation (39–2), and two copy operations (39–3). Only two candidates are considered: one candidate without deletion (a.) and one where the penult vowel is deleted (b.) to satisfy some markedness constraint (abbreviated for convenience as DELETEPENULT!). The a.-candidates are preferred by MAX and the b.-candidates by DELETEPENULT! The crucial difference between the contexts are the decreased violations of MAX: it is fully violated in (39–1b), only by 0.5 in (39–2b) and only by $0.\bar{3}$ in (39–3b). These gradient violations predict exactly the thresholds for deletion in the four language types (38). The weighting relations for language types 1–4 are given in (40). It has to be noted that those weighting relations include ganging effects that are only possible in HG and are impossible under a strict ranking of constraints. More concretely, the weighting relations (40b + c) result in a ranking paradox in OT with ranked constraints. Some exemplifying constraint weights for each language are given in (40) to illustrate that they are indeed possible in HG.

DOI: 10.5334/gjgl.1117

(39) Reduction thresholds: gradient MAX violations

		DELETEPENULT!	MAX
1.	No copying		
a.	s a p o (1) (1) (1) (1)	-1	
b.	s [a] p o (1) (1) (1) (1) [–1] under a		-1
2.	One copy operation		
a.	s a ~ s a p o (.5) (.5) (.5) (.5) (1) (1) [+.5][+.5] [+.5][+.5]	-1	
b.	s a ~ s [a] p o (.5) (.5) (.5) (.5) (1) (1) [+.5][+.5] [+.5][–.5]		-0.5
3.	Two copy operations		
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	
b.	s a ~ s a ~ s [a] p o $(.\bar{3})$ $(.\bar{3})$ $(.\bar{3})$ $(.\bar{3})$ $(.\bar{3})$ $(.\bar{3})$ (1) (1) $[+.\bar{6}][+.\bar{6}]$ $[+.\bar{6}][+.\bar{6}]$ $[+.\bar{6}][-.\bar{3}]$		$-0.\bar{3}$

(40) Reduction thresholds: weighting relations for language types 1–4

a. Lg. 1: Always reduction (e.g. Palauan)
DELETEPENULT! > MAX
Example weights: DELETEPENULT! = 100; MAX = 5

b. Lg 2: Reduction only if single or multiple reduplication (e.g. Lushootseed)
MAX > DELETEPENULT! and
DELETEPENULT! > 0.5 × MAX
Example weights: MAX = 100, DELETEPENULT! = 99

c. Lg 3: Reduction only if multiple reduplication (e.g. Sikaiana)
0.5 × MAX > DELETEPENULT! and
DELETEPENULT! > $0.\bar{3}$ × MAX
Example weights: MAX = 100, DELETEPENULT! = 49

d. Lg 4: No reduction (e.g. Papapana)
$0.\bar{3}$ × MAX > DELETEPENULT!
Example weights: MAX = 100, DELETEPENULT! = 5

The violation profiles in (39) exclude the four other imaginable language types 5–8 in (38) that violate the CWI. This is shown in (41) where the contradictory weighting relations are given that would be necessary to predict such languages. Section 2 established the existence of the four language types in :ast and I'm not aware of any language that resembles the excluded four language types in (41).

(41) Impossible reduction thresholds: weighting relations for language types 5–8

a. *Lg. 5: Reduction without and with single reduplication
DELETEPENULT! > 0.5 × MAX and
$0.\bar{3}$ × MAX > DELETEPENULT!

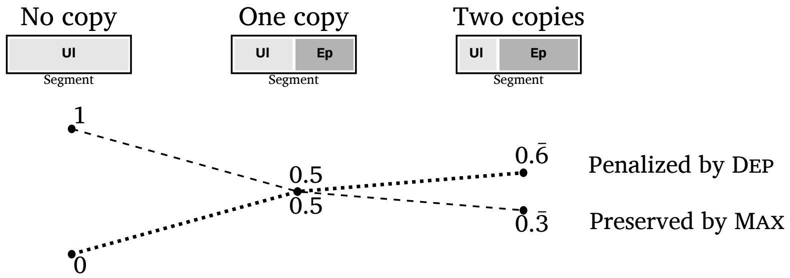
b. *Lg 6: Reduction without and with multiple reduplication
DELETEPENULT! > MAX and
0.5 × MAX > DELETEPENULT! and
DELETEPENULT! > $0.\bar{3}$ × MAX

c. *Lg 7: Reduction only if single reduplication
MAX > DELETEPENULT! and
DELETEPENULT! > 0.5 × MAX and
$0.\bar{3}$ × MAX > DELETEPENULT!

d. *Lg 8: Reduction only without reduplication
DELETEPENULT! > MAX and
$0.\bar{3}$ × MAX > DELETEPENULT!

Before we can turn to concrete analyses for the patterns we saw in 2, it is important to point out one final prediction of this system. Apart from being less protected by faithfulness and hence being more prone to reduction, copied segments are also more costly to realize since this induces violations of DEP. Recall from section 3.2 that it is taken for granted for now that output elements have to have the fully activity of 1 – either due to a language-specific high-weighted constraint or due to a GEN restriction. The picture in (42) emerges where the full activity of 1 for one output segment is depicted as a box, filled with either underlying and/or epenthetic activity. The increase of DEP violations induced by realizing copied segments and the decrease of MAX violations induced by non-realizing copied segments predicts that copied elements might remain unrealized simply because they are copied and thus weakened. Such an instance is discussed in the Southern Wakashan case study in 4.2.

(42) Being copied: decreasing the chances of surfacing



4 Case studies

In the following subsections, it is shown how the theoretical model proposed in section 3 accounts for the CWI and the data discussed in section 2. As in the empirical discussion, the predictions of the CWI are discussed in turn: in 4.1, it is shown how languages of type 2 emerge that show reduction only for a string that is copied once, and in 4.2, it is shown how languages of type 3 emerge that show reduction only for a string that is copied twice.

4.1 Threshold 1: Copying enables reduction

4.1.1 Laryngeal deletion in Tagalog

Under the present proposal of symmetric weakening (cf. (37)), we in fact expect simultaneous reduction for all copied elements as the default pattern. A theoretical account of the Tagalog pattern (cf. (6)) illustrates this default expectation.

Recall that glottals between like vowels are reduced in both reduplicant and copied base but never outside of reduplication contexts in Tagalog. The trigger for this process is taken to be the general markedness constraint (43) penalizing glottal segments. This markedness constraint has a lower weight than MAX (and other faithfulness constraints like IDENT) and all laryngeals with the default activity of 1 are faithfully preserved.

(43) *GLOTTAL: Assign -1 violation for every glottal consonant (/ʔ/ or /h/).

If a glottal is copied, however, it is weakened enough to fall under the threshold of elements that are protected by MAX: half a violation of MAX is outweighed by a violation of *GLOTTAL and laryngeal reduction applies. This is shown in tableau (44). Reduplication in Tagalog is taken to be triggered by two affixed empty syllables. A bisyllabic string hence needs to be copied in order to satisfy σ>V. Candidate (44a) shows unreduced reduplication and induces two violations of *GLOTTAL. One of those violations is avoided in (44b) that deletes the glottal in the reduplicant. The optimal candidate, however, is (44c) with simultaneous reduction of glottal consonants in both reduplicant and base.

Recall the assumption from section 3.2 that prosodic nodes that dominate only unrealized elements with an activity of zero remain unrealized themselves. Though the second affixed syllable hence triggered copying since it must be filled with copied material, it remains unrealized itself since it only dominates elements with an activity of zero in candidates (44b) and (44c). The two moras that were inserted to properly integrate the copied material under this syllable also remain unrealized. The same holds for the underlying second syllable and its moras in candidate (44c). Note that the crossing of association lines that is generally assumed to be impossible (Goldsmith 1976) is taken to be possible if one of the lines only links unrealized prosodic nodes. Consequently, the copied /s/ in (44b) and (44c) can be syllabified under a preceding syllable which is realized.

This tableau only illustrates the crucial part of the account and omits, for example, constraints whose weights ensure that the additional vowel deletion applies or those that explain why laryngeal reduction is only allowed between like vowels.[13]

The weighting relations (45) for Tagalog illustrate the default pattern we might expect for a reduplication context: a marked structure that is tolerated outside of reduplication contexts is repaired in both reduplicant and copied base since those segments are too weak to be protected by the respective faithfulness constraint.

(44) Tagalog: reduction in reduplicant and copied base

		MaxC 50	*Glottal 40	
	σ σ + l a ʔ a s (1 1 1 1 1)			
	a. l a ʔ a s l a ʔ a s		-2	-80
	b. l a ʔ a s l a ʔ a s	-0.5	-1	-65
☞	c. l a ʔ a s l a ʔ a s	-1		-50

(45) Weighting relations
a. MaxC > *Glottal — *No deletion of non-copied /ʔ/'s*
b. *Glottal > 0.5 × MaxC — *Deletion of all copied /ʔ/'s*

4.1.2 Vowel reduction in Lushootseed

If a language only shows reduction in either reduplicant or copied base, there thus has to be an independent reason why simultaneous reduction is either blocked by independent constraints or not required for all copied elements. Reduction in the copied base in Lushootseed (cf. (10)) is an example of the latter pattern. It is analysed here as avoidance of unstressed full vowels. Since stress is regularly on the first non-/ə/ vowel in the language[14] and reduplication is prefixing, the reduplicant usually ends up to be stressed and the copied base as unstressed. Reduction of unstressed full vowels to /ə/ is a common pattern in Salishan languages and one of at least three possible sources for /ə/ in most of these languages (cf., for example, Kinkade 1993; Shaw et al. 1999; Blake 2000).

13 Vowel deletion is taken to follow from the standard markedness constraint against adjacent vowels. The restriction that laryngeal deletion only applies between like vowels falls out since the repair of coalescence that avoids adjacent identical vowels is only possible between like vowels. If the adjacent identical vowels that result from laryngeal reduction cannot be avoided, laryngeal reduction is blocked altogether.

14 And on the initial /ə/ if there is no full vowel. In addition, there are sonority effects in that /a/ has a preference to be stressed and some morphological facts since non-reduplicative prefixes are never stressed and some lexical suffixes attract stress (Urbanczyk 2001: §3.3).

The trigger for vowel reduction is the constraint (46a), penalizing unstressed vowels with a place feature.[15] The constraint is part of a larger family of constraints proposed to account for sonority-driven stress systems (cf., for example, Kenstowicz (1996); Morén (1999); de Lacy (2002), or de Lacy (2006) for discussion of such systems and (de Lacy 2009) and Shih (2016) for the critical discussion that such systems might in fact not exist). The faithfulness constraint preserving place feature specifications for vowels and effectively penalizing vowel reduction is Ident(VPlace) (= IdVPl) (46b). The GSR formulation of standard Ident constraints is – as Max and Dep – sensitive to the activity of segments. Ident thus preserves the feature specification of a segment with higher activity more than the one of a segment with weaker activity.

(46) a. *UnstrV: Assign -1 violation for every unstressed full vowel (= a vowel with place features).

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

The tableau (47) shows how the Lushootseed vowel reduction is derived. The prefixing reduplication in the diminutive is taken to result from an affixed empty mora. The first important weighting relation is that a non-copied vowel is never reduced, even if it is unstressed. This can be seen in comparing candidates (47a), (47c), and (47d) with candidate (47b). The former realize the final unstressed vowel as a full vowel and induce a violation of *UnstrV. Reduction of this vowel in (47b) avoids this violation but induces a violation of IdVPl. The harmony score resulting from this constraint violation is worse than the one resulting from a violation of *UnstrV. Unstressed non-copied vowels are hence not reduced in Lushootseed. Reduction of an unstressed vowel that is copied as in candidate (47c), however, only induces 0.5 violations of IdVPl. This gradient violation is now outweighed by the full violation of *UnstrV and candidate (47c) emerges as optimal. Importantly, the first copied vowel is equally weakened and its reduction also only penalized by 0.5 violations of IdVPl as can be seen in candidate (47d). However, this vowel is stressed and does not induce a violation of *UnstrV; its reduction does hence not improve on any constraint. For completeness, the tableau also gives the Dep violations that are identical for all candidates. Four copied and thus weakened segments are strengthened to fully active output segments in each candidate.

(47) Lushootseed: reduction in the copied base

μ + j ú(μ) b i(μ) l ① ① ① ① ①	IdVPl 40	*UnstrV 30	Dep 10	
a. j ú(μ) j u(μ) b i(μ) l (.5) (.5) (.5) (.5) ① ① ① +.5 +.5 +.5 +.5		-2	-2	-80
b. j ú(μ) j u(μ) b ə(μ) l (.5) (.5) (.5) (.5) ① ① ① +.5 +.5 +.5 +.5	-1	-1	-2	-90
☞ c. j ú(μ) j ə(μ) b i(μ) l (.5) (.5) (.5) (.5) ① ① ① +.5 +.5 +.5 +.5	-0.5	-1	-2	-70
d. j ə́(μ) j u(μ) b i(μ) l (.5) (.5) (.5) (.5) ① ① ① +.5 +.5 +.5 +.5	-0.5	-2	-2	-100

15 This is a simplification. It is argued in Urbanczyk (2001) that the dispreference for unstressed vowels also depends on the sonority of the vowel in question; Urbanczyk (2001) hence adopts a more specific version of the constraint in her account of Lushootseed (§3.3.4.2).

DOI: 10.5334/gjgl.1117

(48) Weighting relations
a. IdVPl > *UNSTRV *No reduction of fully active vowels*
b. *UNSTRV > 0.5 × IdVPl *Reduction of copied vowels*

In Lushootseed, reduction hence only applies to the copied base since the relevant markedness constraint is simply not violated in the reduplicant. Another straightforward reason for reduction only in the copied base can be a positional faithfulness constraint protecting a prefixed word-initial reduplicant. An example for this is reduction in the copied base in Klamath or Cupeño (cf. section 2.2.3). The same argumentation holds for instances of reduction only in the reduplicant: independent constraints ensure that it is not the whole copied string which is reduced. In Gitksan (cf. 2.2.2, for example, a high-weighted faithfulness constraint preserving material that is already integrated under prosodic structure protects the base to which a reduplicative morpheme is added and confines reduction to the reduplicant.

To summarize, these case studies showed how all copied elements are symmetrically weakened and reduction can be expected for all copied elements. If reduction can only be observed in reduplicant or copied base, this falls out from orthogonal properties of the phonology of a language. The former case was illustrated with Tagalog in 4.1.1 and the latter with Lushootseed in 4.1.2.

4.2 Threshold 2: More copying enables more reduction

In this subsection, we now turn to type 3 languages that only show reduction in multiple reduplication contexts but never in single reduplication contexts or contexts without any reduplication.

4.2.1 Vowel deletion in Sikaiana

The first example for a type 3 language is Sikaiana (cf. 2.3.1) where an optional vowel deletion process (*sosopo/ssopo*, cf. (15)) becomes obligatory if the vowel is copied twice (*sopossopo/*soposopo*, cf. (17)).

The optionality of vowel deletion outside of reduplication and in single reduplication contexts is formally implemented in a model where harmony scores represent probabilities (Maxent; Johnson 2002; Goldwater & Johnson 2003; Wilson 2006). The C_1VC_1/C_1C_1 alternation is taken to result from vowel deletion triggered by the markedness constraint (49). Importantly, this alternation can not only be found in many other Austronesian languages of this area (e.g. Doku/Lengo (Unger 2018), Dobel (Hughes 2000), or Takuu, Totoli, and Mussau (Blust 2007)), it is also attested in a variety of completely unrelated languages (often termed 'anti-anti-gemination'; Odden 1988; Bakovic 2005). It could alternatively triggered by an OCP constraint that is violated by C_1VC_1 but not by C_1C_1 (Rose 2000).

(49) *C_1VC_1: Assign -1 violation for every vowel that is directly preceded and followed by identical consonants C_1.

The first weighting relation that predicts the general optionality of C_1VC_1/C_1C_1 (cf. (16)) is given in (50): a violation of MAX$_v$ is taken to result in an equally good/bad harmony score as a violation of *C_1VC_1. This weighting relation implies that stem vowels lack moras in their underlying representation. If a vowel would be dominated by a mora underlyingly, an additional violation of $\boxed{\mu > V}_P$ followed if this vowel is deleted and only realization of the marked C_1VC_1 sequence became optimal. Given that moras on short vowels are completely predictable, it is uncontroversial from a Lexicon Optimization perspective that they are absent in underlying representations.

(50) Weighting relation
MAX$_v$ = *C_1VC_1 *Optional V-deletion in C_1VC_1*

The two reduplicative morphemes are taken to consist of empty syllable and mora nodes. More concretely, the repetitive consists of two empty syllables resulting in bisyllabic reduplication and the plural of one empty mora resulting in monosyllabic reduplication.[16] These empty prosodic nodes must be filled with segmental material due to $\sigma > V$ (cf. (31)–b) and $\mu > V$ respectively. As was shown in 3.1, the containment assumption in this paper predicts the additional constraints $\boxed{\sigma > V}_{P}$ and $\boxed{\mu > V}_{P}$ demanding that the vowels filling a prosodic node must be phonetically realized (cf. (31)–a). In the present account, the former constraint type will enforce copying and the second will penalize any vowel deletion within the new copy.

Both $\sigma > V$ and $\mu > V$ enforcing copying to begin with are taken to have a very high weight and are not shown in the following tableaux.[17] The first relevant context is a single reduplication pattern where an empty mora affix is added to a base. The creation of a monosyllabic reduplicant to fill this mora necessarily induces a violation of $*C_1VC_1$ as in candidate (51a). Vowel deletion in candidate (51b) avoids this violation but induces a 0.5 violation of MAX and a violation of $\boxed{\mu > V}_{P}$. The weighting relation (52a) ensures that these two strategies result in nearly the same harmony score and optionality between these two candidates emerges. Deletion of a consonant in candidate (51c) is an alternative strategy to avoid a violation of $*C_1VC_1$ but MAX is taken to have a quite high weight in Sikaiana.

Note that all epenthetic elements are marked with a circle around them in the following tableaux. This distinction is especially important if we recall that $\sigma > V$/$\boxed{\sigma > V}_{P}$ and $\mu > V$/$\boxed{\mu > V}_{P}$ (31) only require that non-epenthetic prosodic nodes dominate segmental material.[18]

(51) Sikaiana: optional syncope for single monosyllabic reduplicant

μ + σ[s μ[o]] σ[p μ[o]]; s① o① p① o①	DEP_V 27	MAX_C 22	$\boxed{\mu > V}_{P}$ 16	MAX_V 4	$*C_1VC_1$ 4	DEP_C 0	
☞ a. (σ)[s μ[o]] σ[s μ[o]] σ[p μ[o]]; s(.5) o(.5) s(.5) o(.5) p① o①; +.5 +.5 +.5 +.5	-1				-1	-1	-31
☞ b. σ[s μ[o] s μ[o]] σ[p μ[o]]; s(.5) o(.5) s(.5) o(.5) p① o①; +.5 –.5 +.5 +.5	-0.5		-1	-0.5		-1	-31.5
c. (σ)[μ[o]] σ[s μ[o]] σ[p μ[o]]; s(.5) o(.5) s(.5) o(.5) p① o①; –.5 +.5 +.5 +.5	-1	-0.5				-0.5	-38

16 The analysis would in fact not change if the plural were taken to consist of a single syllable or the repetitive of two moras.

17 That the preceding consonant is always copied in addition to the vowel (that would be sufficient to satisfy $\sigma > V$ or $\mu > V$), cannot be due to ONSET in Sikaiana since the language allows onsetless syllables. It is taken to follow from a CONTIGUITY constraint that prefers the copying of contiguous morpheme strings (Zimmermann 2018c):

(i) 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.

18 The weights in the following tableaux are (as in all tableaux in the paper) just an illustration of the most relevant weighting relations. The Sikaiana pattern was tested with the Maxent grammar tool (Hayes 2009). The weightings and probabilities calculated by the algorithm are:

(i)

Weights		*Probabilities*		
DEP_V:	27.461524958616096	(51)	☞	a. 0.4962243576140779
$\sigma > V$	24.73295167435539		☞	b. 0.5034005241387637
MAX_C:	22.070555587457584			c. 3.751182469637786E-4
$\boxed{\mu > V}_{P}$:	15.638918604592885	(53)		a. 0.006283785255822912
$*C_1VC_1$:	3.8477356578971174		☞	b. 0.9930190402873161
MAX_V:	3.850443134132723			c. 2.0238668297313414E-4
DEP_C:	0.0			

(52) Weighting relations

a. $*C_1VC_1 + 0.5\times\textsc{Dep}_v = \boxed{\mu>V}_P + 0.5\times\textsc{Max}_v$ *V-deletion or C_1VC_1*

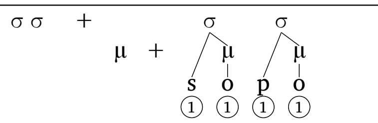
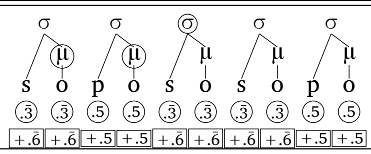
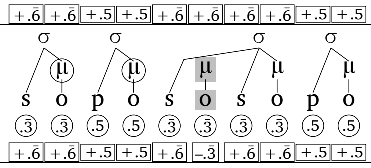
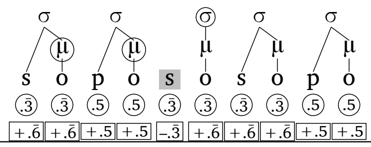
b. $0.5\times\textsc{Max}_c > *C_1VC_1 + 0.5\times\textsc{Dep}_c$ *No C-deletion*

c. $0.5\times\textsc{Dep}_v + 0.5\times\textsc{Max}_c > \boxed{\mu>V}_P + 0.5\times\textsc{Max}_v + 0.5\times\textsc{Dep}_c$ *No C-deletion*

A single reduplication context with only the repetitive plural morpheme does not add anything interesting for a $C_1V_1C_2V_2$-base. Since a bisyllabic string is copied, no additional violation of $*C_1VC_1$ is induced and no reason for segment deletion arises: faithful bisyllabic copying emerges as optimal. For a base of the pseudoreduplicated shape $C_1V_1C_1V_1$, however, the present model predicts optional reduction in both reduplicant and copied base. I was not able to find data to confirm this prediction.

The crucial context is now one where both prosodic affixes are combined and we hence expect a monosyllabic and a bisyllabic reduplicant. Crucially, the string /so/ is copied twice to satisfy both μ > V and σ > V. Consequently, the DEP constraints are violated more if all copied segments are realized whereas the MAX constraints are violated less if /s/ or /o/ are deleted. Candidate (53a) fills all prosodic nodes with segmental material without any deletion and hence avoids any violations of $\boxed{\mu>V}_P$ and $\textsc{Max}_v$. On the other hand, it induces the violation of $*C_1VC_1$ that was optionally avoided in a single reduplication context (51). The vowel deletion candidate (53b) only induces $0.\bar{3}$ violations of $\textsc{Max}_v$ since the unrealized vowel was copied twice. This difference in faithfulness violations now crosses a threshold were optionality becomes impossible: only the deletion candidate (53b) is optimal. Candidate (53c) shows that consonant deletion is again impossible although it also solves the $*C_1VC_1$ problem. Since $\textsc{Max}_c$ has such a high weight, even $0.\bar{3}$ violations of this constraint are enough to exclude such a candidate.

(53) Sikaiana: obligatory syncope in multiple reduplication contexts

	$\textsc{Dep}_V$	$\textsc{Max}_C$	$\boxed{\mu>V}_P$	$\textsc{Max}_V$	$*C_1VC_1$	$\textsc{Dep}_C$	
	27	22	16	4	4	0	
a. 	$-2.\bar{9}$				-1	$2.\bar{9}$	$-84.\bar{9}$
☞ b. 	$-2.\bar{3}$		-1	$-0.\bar{3}$		$2.\bar{9}$	$-80.\bar{3}$
c. 	$-2.\bar{9}$	$-0.\bar{3}$				$2.\bar{3}$	$-88.\bar{3}$

(54) Weighting relations

a. $*C_1VC_1 + 0.\bar{6}\times\textsc{Dep}_v > 0.\bar{3}\times\textsc{Max}_v + \boxed{\mu>V}_P$ *Only V-deletion*

b. $0.\bar{3}\times\textsc{Max}_c + 0.\bar{3}\times\textsc{Dep}_v > 0.\bar{3}\times\textsc{Max}_v + \boxed{\mu>V}_P$ *No C-deletion*

A final candidate that one has to consider for the context (53) is one that simply integrates the affixed empty mora under one of the affixed empty syllables (= 'prosodic integration' in the terminology of Zimmermann (to appear)). This structure avoids two $\textsc{Int}_s$ violations since the string /sopo/ needs to be copied only once to fill all prosodic structure. It is taken to fall out from a high-weighted faithfulness constraint against adding new association lines between morphologically coloured prosodic nodes (Zimmermann to appear) that this structure is sub-optimal in Sikaiana. Though morphologically coloured nodes can be integrated under epenthetic prosodic nodes for free, it comes at a cost to integrate them under other morphologically coloured nodes.

The optionality of vowel deletion in Sikaiana hence vanishes as soon as vowels are copied 'too often'. Distribution of a vowel into three output instances leaves only $0.\bar{3}$ input activity for each which makes them too easy to delete and too costly to realize. However, only mora affixes are 'satisfied' with phonetically unrealized vowels and deletion only ever applies within the monosyllabic reduplicant.

4.2.2 Segment deletion in Southern Wakashan

The account for deletion in multiple reduplication contexts in Southern Wakashan (cf. (22) and (23)) is interestingly different. Whereas we have an independent markedness reason to shorten a reduplicant in Sikaiana, there is no good phonotactic reason in Southern Wakashan why one reduplicant should completely be deleted if another one is adjacent. Southern Wakashan is rather an example for a pattern where copied elements are avoided simply because there are copied too often and realization of weakened elements is too costly. Recall from the discussion of (42) that the present model predicts such a situation since more DEP violations are induced by realizing and fewer MAX violations by deleting a copied and thus weakened segment.

The first obvious question for this account is why only one of the reduplicants is deleted in a multiple reduplication context. If double copying weakens all the copied elements so much that they are rather deleted than strengthened to fully active output elements, we would expect that no reduplicant and no copied base elements surface in a multiple reduplication context. For the Ditidaht pattern, it is argued that the surfacing of one of the reduplicants follows since only morphologically coloured syllables tolerate it to be filled by deleted vowels, morphologically coloured moras have to be filled by realized vowels.[19] Theoretically, this is implemented by the different weights of $\boxed{\mu > V}_P$ and $\boxed{\sigma > V}_P$ that predict that only a violation of the latter is tolerated in Ditidaht. Tableau (55) shows this for a multiple reduplication context where both an empty syllable and two empty moras are added. Note that this tableau is a simplification and only gives the relevant reduplication-triggering portions of the added affix. Filling both these underlyingly empty prosodic nodes with segmental material[20] as in candidate (55a) induces quite a number of DEP violations since 6 segments with only $0.\bar{3}$ activity need to be strengthened to fully active output elements. The optimal candidate (56b) is one that deletes the consonant and vowel that were copied to fill the empty syllable affix. This induces $0.\bar{6}$ MAX violations in addition to a $\boxed{\sigma > V}_P$ violation which still results in a better harmony score than the $0.\bar{3}$ violations of DEP that this candidate avoids in comparison to (56a). Deletion of the material under the affixed mora nodes in candidate (56c), on the other hand, induces violations of $\boxed{\mu > V}_P$ since two morphologically coloured moras only dominate a phonetically invisible vowel. Since the weight of $\boxed{\mu > V}_P$ is higher than the weight of $\boxed{\sigma > V}_P$, this candidate is sub-optimal. For the same reason, the deletion in both reduplicants (56d) and simultaneous deletion in reduplicant and copied base (56e) is excluded. The latter candidate also induces a $\boxed{\mu > V}_P$ violation since the mora of the copied base was already present in the input. The general $\mu > V$ and $\sigma > V$ that trigger reduplication to begin with (and which are satisfied with dominating deleted segments) are not given to ease readability of the tableau. Recall again that prosodic nodes that dominate only unrealized elements with an activity of zero remain unrealized themselves and allow line crossing (cf. candidate (55e)).

19 This reasoning makes the prediction that combining two reduplicative morphemes that both require a short /CV/-reduplicant (= a syllable node) results in no reduplicant at all and that combining two reduplicative morphemes that both require a long /CV:/-reduplicant (= two mora nodes) results in two reduplicants. The data for Ditidaht is consistent with this prediction since all examples of deletion of a reduplicant in multiple reduplication contexts involve the combination of a /CV/- and a /CV:/-reduplicative morpheme. On the other hand, this could very easily be a coincidence. The empirical picture in other varieties of Southern Wakashan is unfortunately even less clear. Stonham (1994) gives a generalization that is different from the one predicted here, namely that 'the effects on the final form are those required by all the suffixes with the exception that only a single copy occurs' (p.49; cf. also Stonham (2003; 2004; 2007). However, the examples given in Stonham (1994) for deletion of a reduplicant in multiple reduplication contexts in Ditidaht are all compatible with both hypotheses. Davidson (2002) states a similar generalization for Tseshaht but no examples of multiple reduplication are given. However, one of the examples given in Stonham (2003; 2004) and Stonham (2007) for Tseshaht are indeed problematic for the prediction I make for Ditidaht since two /CV:/-reduplicating morphemes are combined and a single reduplicant surfaces. Finally, of the 7 examples for avoiding adjacent reduplicants given in Rose (1981) for Kyuquot, 3 are compatible with the hypothesis adopted here, 2 are only possible under Stonham's alternative hypothesis, and 3 are problematic under both hypotheses. Future research has to determine whether the (non-)deletion in multiple reduplication contexts indeed depends on whether reduplicative morphemes of different prosodic sizes are combined or not.

20 As in the Sikaiana account, MCONT ensures that the onset is copied together with the vowel, cf. footnote 17.

(55) Ditidaht: deletion in multiple reduplication contexts

	μ μ + σ + σ(μ) tɬ u qʷ ①①①	MAX 22	DEP 15	μ>V_P 5	σ>V_P 1	
a.	tɬ u: tɬ u tɬ u qʷ (.3 .3 .3 .3 .3 .3 1; +.6 +.6 +.6 +.6 +.6 +.6)		-3.9̄			-59.9̄
☞ b.	tɬ u: tɬ u tɬ u qʷ (.3 .3 .3 .3 .3 .3 1; +.6 +.6 –.3 –.3 +.6 +.6)	-0.6̄	-2.6̄		-1	-55.6̄
c.	tɬ u: tɬ u tɬ u qʷ (.3 .3 .3 .3 .3 .3 1; –.3 –.3 +.6 +.6 +.6 +.6)	-0.6̄	-2.6̄	-2		-64.6̄
d.	tɬ u: tɬ u tɬ u qʷ (.3 .3 .3 .3 .3 .3 1; –.3 –.3 –.3 –.3 +.6 +.6)	-1.3̄	-1.3̄	-2	-1	-60.9̄
e.	tɬ u: tɬ u tɬ u qʷ (.3 .3 .3 .3 .3 .3 1; +.6 +.6 –.3 –.3 –.3 –.3)	-1.3̄	-1.3̄	-1	-2	-56.9̄

(56) Weighting relations

a. $1.\bar{3} \times$ DEP $>$ $0.\bar{6} \times$ MAX + $\boxed{\sigma > V}_P$ *Deletion within a σ-affix*

b. $2 \times \mu > V$ $>$ $\boxed{\sigma > V}_P$ *No deletion for a μ-affix*

c. $0.\bar{6} \times$ MAX + $2 \times \mu > V$ $>$ $1.\bar{3} \times$ DEP *No deletion within a μ-affix*

d. $0.\bar{6} \times$ MAX + $\boxed{\mu > V}_P$ + $\boxed{\sigma > V}_P$ $>$ $1.\bar{3} \times$ DEP *No deletion within the copied base*

The weighting relation in (56a) shows that deletion of segments that are copied to fill an affixed syllable node are possible in Southern Wakashan if these segments are split into three output instances. For a complete account, the weighting relation in (57) is also crucial that predicts that no deletion is possible in single reduplication contexts when segments are only split into two output instances. In such a context, the segments still receive 0.5 underlying activity and the violations of MAX and $\boxed{\sigma > V}_P$ are not out-weighed by the $0.5 \times$ DEP violations.

(57) Weighting relations

$0.5 \times$ MAX + $\boxed{\sigma > V}_P$ $>$ $0.5 \times$ DEP *No deletion if single reduplication*

To summarize, these final two case studies showed concrete accounts of languages of type 3 that only show reduction in multiple reduplication contexts. The two case studies were interestingly different since the reduction has an independent markedness reason ($= {*}C_1VC_1$) in Sikaiana whereas the copied segments are reduced simply because they are copied in Southern Wakashan. It was shown that both patterns straightforwardly fall out under the assumption of fission as distribution of underlying activity and standard markedness and faithfulness constraints within a HG account.

5 Further predictions

In this section, some further predictions arising from the assumption of fission as distribution of activity and some directions for future research are discussed.

A first prediction resulting from the symmetrical weakening of all copied elements is the *complete deletion of all copied elements*. Such a language is illustrated in (58). An affixed mora results in copying to satisfy μwills but all copied elements are now so weak that they are deleted. This follows if the 0.5 violations of Dep that arise for every copied segment that makes it to the surface result in a worse harmony score than the violations of $\boxed{\mu > V}_P$ and the 0.5 violations of Max induced by deletion of the copied segments. Under such a weighting, candidate (58c) that deletes both the reduplicant and the copied base becomes optimal.

(58) Prediction: copying and full reduction in reduplicant and copied base

	μ μ + μ w a w a ① ① ① ①	μ>V 100	Dep 100	Max 50	$\boxed{\mu > V}_P$ 20	
a.	μ μ μ w a w a a ① ① ① .5 .5 +.5 +.5		-1			-100
b.	μ μ μ w a w a a ① ① ① .5 .5 +.5 –.5		-0.5	-0.5	-1	-95
☞ c.	μ μ μ w a w a a ① ① ① .5 .5 –.5 –.5			-1	-2	-90

(59) Weighting relation
Dep > Max + 2 × $\boxed{\mu > V}_P$ *Deletion for all copied elements*

This pattern looks like a serious misprediction where reduplication results in non-realization of reduplicant and copied base. However, patterns like this are very well attested under the name of subtraction. Subtraction is in fact defined as a non-concatenative exponent strategy that deletes a prosodically defined portion of a base (e.g. Dressler 2000; Arndt-Lappe & Alber 2012; Zimmermann 2017) – exactly the pattern predicted in (58). The example (58) in fact already derives an existing subtraction example, namely the accusative formation in Aymara that is expressed by deleting a final vowel (Briggs 1976; Hardman 2001; Coler 2010).

Under the assumption of fission as distribution of activity, a purely concatenative account for subtraction based on the affixation of empty prosodic nodes thus falls out for free.[21] Since subtraction falls out from the affixation of prosodic nodes, the account also naturally predicts the fact that morphological truncation involves the non-realization of a prosodically defined portion. On the other hand, this account predicts that the coexistence of a subtracting and a reduplicative morpheme that have the same prosodic node in their representation is impossible within a single language. It is an interesting topic for future research to explore the typology of subtraction and reduplication to see whether this prediction is borne out.

In the accounts presented here, all output elements had the full activity of 1. It was discussed in section 3.2 that there are proposals arguing that this is not a consequence from a GEN restriction against weak output elements but from a violable constraint (Zimmermann 2018b; 2019b). If this is indeed the case, then we expect languages where this constraint is low-weighted and all *copied material is weak in the output*. In a GSR model with gradient constraint violations, this means that those weak copied elements tolerate more marked structures since they don't induce full markedness violations.[22] There are a few potential examples of such exceptional

21 Cf. Trommer & Zimmermann (2014) and Zimmermann (2017) for a different proposal that affixation of prosodic nodes can result in subtractive morphology.

22 The assumption of gradient output activity immediately raises the question whether those output activity differences should result in phonetic differences. The position taken here is that it could easily be the case that the phonetics interprets the gradient activity differences but the absence of any phonetic effect is also not an argument against phonological output activity. The phonetic interpretation of a specific language undoubtedly ignores certain differences in the phonological structure and gradient activity is one of the structure differences that can be irrelevant. On the other hand, gradient phonetic effects are well-attested (e.g. subphonemic gradience in word-final devoicing, nasal place assimilation, or flapping (e.g. Braver 2013) or gradient vowel harmony (McCollum 2018) and can easily be due to activity differences.

markedness in copied structures. Reduplicants show marked structures in Oowekyala (Howe 2000) and reduplicants are exceptional non-undergoers of vowel deletion in Mojeno Trinitario (Rose 2014; Marquardt 2018).

Thirdly, it is important to recall that the CWI (2) is defined over copying in general and expected to hold not only for reduplication but also for phonological copying that applies to, for example, avoid *phonotactic problems or word minimality violations* (Kitto & de Lacy 1999; Kawahara 2007). In most cases of phonotactically triggered copy-epenthesis, further reduction processes are unexpected since the additional element created by copying is supposed to provide a full segment that, for example, helps to satisfy a word minimality requirement. On the other hand, the present proposal might allow a generalized version of the claim put forward in Staroverov (2014) that there is no consonant epenthesis but only fission. The present model allows to claim the extreme position that there is no epenthesis of phonological elements at all and that all apparent cases are in fact instances of fission. That epenthetic elements tend to be unmarked and reduced would then be predicted since they are weak. Future research has to show whether this generalized view is tenable.

A fourth prediction of the model is its potential *interaction with exceptionality*. Recall from section 3.2 that the most recent GSR proposals model phonological exceptionality. They assume that morphemes behave differently or exceptional in the phonology since their underlying representations contain phonological elements of different activities. The proposal in this paper proposes the new option of phonologically predictable activity adjustment under fission. There are two potential interactions with exceptionality. For one, copied elements can mirror the behaviour of lexical exceptional elements if the reduced activity that remains after copying is identical to the weak activity that another element had underlyingly. And secondly, it is predicted that exceptional elements that are already weak underlyingly show a different behaviour from other elements if they are copied: if their weak underlying activity is distributed among multiple output instances, even fewer activity remains for those.

Finally, in the case studies discussed above, weakening always resulted in reduction: either to avoid an independently marked structure (as in Tagalog, Lushootseed, and Sikaiana) or to avoid copied material altogether (as in Southern Wakashan). This followed since copied elements are not preserved by faithfulness constraint as much as non-copied elements. This predicts that copied elements could also be *more prone to phonological processes like assimilation or dissimilation*.[23] So far, I'm not aware of any case requiring an analysis along these lines.

6 The CWI and alternative accounts of reduplication

In this section, I will briefly discuss some alternative accounts to reduplication and show how they fare with respect to predicting the CWI (2), repeated in (60). The two parts of the CWI that will prove to be difficult to predict in alternative accounts are 1) the symmetrical weakening of all the elements involved in the copying, and 2) the gradient weakening effect that every copy operation makes reduction more likely. Since there are numerous reduplication theories and most exist in different versions, it is impossible to discuss all relevant alternatives in detail. I will hence focus on theories or constraint types that predict some part of the CWI and point out how they fail to predict the whole CWI.

(60) *The Copying-Weakening-Implication (=CWI)*
Every copy operation weakens all the elements involved in the copying.
Weakening results in a greater likelihood to undergo phonological processes, especially deletion or contrast neutralization (='reduction').
  A. No language shows reduction of non-copied material but not of copied material (in single or multiple reduplication contexts).
  B. No language shows reduction of copied material in single reduplication contexts but not of copied material in multiple reduplication contexts.

A prominent alternative to the prosodic affixation account presented here is the correspondence-theoretic account of reduplication based on *BR-faithfulness* (McCarthy & Prince (1995) and

23 Thanks to Rachel Walker, pc, for pointing this out to me.

subsequent work) where reduplication is triggered by the affixation of an abstract RED-morpheme that does not contain any phonological material. As was already discussed above at various points, the standard implementation of this model predicts a special status for the reduplicant: it is only preserved by BR-faithfulness constraints and is exempt from IO-faithfulness. Only the reduplicant is thus expected to be more likely to undergo reduction. On the other hand, patterns with simultaneous reduction in both reduplicant and copied base (cf. 2.2.1) and those with only reduction in the copied base (cf. 2.2.3) remain unaccounted for.

A modification of this model is proposed in Struijke (2000) where an argument for *existential faithfulness* is made. Existential faithfulness demands that an input element is preserved somewhere in the output but does not require identity between input and output. In reduplication contexts, input structure can hence either be preserved in the reduplicant or the base. In addition to reduction in the reduplicant, existential faithfulness also predicts reduction in the copied base or an alternation between reduction in reduplicant or copied base. However, it still fails to account for simultaneous reduction in reduplicant and copied base.

An alternative proposal within BR-faithfulness is the adoption of *OO-faithfulness* constraints (Benua 1995; 1997; Kenstowicz 1995; McCarthy 2000) demanding prosodic faithfulness between unreduplicated and reduplicated forms (Shaw & Howe 1999). In this account, simultaneous reduction in reduplicant and copied is predicted since reduplicated forms are ideally not prosodically 'longer' than their unreduplicated counterparts. This account can explain all the type 2 languages I discussed here but it also seems undesirably powerful. More concretely, reduction is not bound to copied elements: if OO-faithfulness for prosodic structure outranks IO-faithfulness, we predict reduction in the non-copied portion of the base. This sets the predictions of this model apart from the prediction of the present proposal where only the copied strings are more prone to reduction. All the examples of simultaneous reduction in copied base and reduplicant are in line with the more restrictive prediction arising from the assumption of fission as distribution of activity.

Apart from these problems to predict the symmetric weakening of all copied elements, the standard BR-faithfulness model and its extensions have no explanation for the gradient weakening of every copying that results in a higher likelihood for reduction if multiple copy operations apply. In the standard model, every RED-morpheme establishes its own BR-faithfulness relation and there is no way that BR-faithfulness gets 'weaker' if multiple such relations are present. To predict the reduction pattern in Southern Wakashan, one has to assume a specific constraint banning multiple reduplicants or copies (e.g. *DupDup in Stonham (2004)). This does not only rely on a specific constraint penalizing only this configuration, it also can only predict complete avoidance of multiple reduplicants (as in Southern Wakashan). Partial reduction (as in Sikaiana) remains unaccounted for given that only the complete absence of a second reduplicant satisfies such a constraint. Yet another account of the Southern Wakashan pattern in BR-correspondence theory assumes an Integrity constraint penalizing multiple correspondences between base and reduplicant under the assumption that only a single set of BR-correspondence indices exist (Buckley 1997; Rose 1997). Again, this account has no explanation for the non-complete reduction of one reduplicant in multiple reduplication contexts.

Inkelas (2018) presents an account of avoidance of multiple reduplicants in Ditidaht (cf. (22)) in the *Optimal Construction Morphology* approach (Caballero & Inkelas 2013; Inkelas 2016), a target-driven account of word-formation. In this model, all reduplication-triggering morphemes are associated with a cophonology where a high-ranked constraint demands a reduplicant of a certain shape. It is a cyclic model where affixation of each morpheme is evaluated separately. If now a morpheme's cophonology demands reduplication in a first cycle, a reduplication-requiring cophonology in a later cycle will already be satisfied and there is no reason to add another reduplicant.[24] This implies that the constraint demanding reduplication can identify stems and reduplicants, even in a later cycle. If the constraint simply checked for a repetition of segmental strings, it would make the misprediction that pesudoreduplicated stems are not further reduplicated (cf. (27) in 2.3). This assumption, however, is a violation of the Bracket

24 In addition, a constraint penalizing homophony between input and output is assumed that demands additional reduplication, irrespective of whether reduplication already applied to the form in an earlier cycle. This constraint is assumed to be high-ranked in languages where multiple reduplicants surface (and would also be relevant for the multiple reduplicants across strata in Southern Wakashan (cf. (24)–(26) in 2.3).

Erasure principle (e.g. Chomsky & Halle 1968; Siegel 1974; Pesetsky 1979) since morphological structure must remain accessible throughout the cyclic derivation. Similarly to the assumption of a *DupDup constraint, this model can predict the deletion of one reduplicant in multiple reduplication contexts but it cannot predict the shortening of a reduplicant in a multiple reduplication context as in Sikaiana.

Accounts that *penalize adjacent identical surface strings* (e.g. Menn & McWhinney 1984; Plag 1998; Yip 1998), often employed for instances of haplology (cf. for overviews Stemberger 1981; Nevins 2012), have the same problem: they only predict the complete avoidance of multiple reduplicants. In addition, such accounts make the misprediction that pseudoreduplicated stems should always block further reduplication in a language with avoidance of multiple reduplicants. It was discussed in section 2.3 that this is not true for Southern Wakashan (cf. (27)). The stratal difference in Southern Wakashan that two reduplicants surface if inflectional and derivational reduplicative morphemes are combined remains unaccounted for as well.

Another constraint-based alternative to reduction in multiple reduplication contexts is proposed in Zimmermann (to appear). As the present account, it is a phonological account of reduplication based on *prosodic affixation*. It is argued that reduction in multiple reduplication contexts falls out from coalescence and prosodic integration of affixed prosodic nodes. This account, however, has no explanation to offer for the symmetric reduction in single reduplication contexts and hence languages of type 2.

This brief discussion of some alternative accounts to reduplication showed that some parts of the CWI can be predicted under alternative assumptions but no theoretical approach correctly predicts the complete empirical picture of reduction effects in reduplication contexts summarized in the CWI. In contrast, the assumption that fission is distribution of underlying activity offers a unified account for all these reduction phenomena.

7 Conclusion

In this paper, I proposed the new definition of fission as distribution of underlying activity which resulted in a new account of reduplication. This theoretical proposal makes a falsifieable empirical prediction about possible language types that correlate reduction and reduplication. More concretely, the CWI (3) states that languages can show reduction for copied material in single or multiple reduplication contexts that is absent in contexts with no or fewer reduplication processes. Crucially, no language is expected to show reduction only in contexts with no reduplication or single reduplication if it is absent in contexts with more reduplication processes.

The paper discussed several languages that illustrate the different thresholds predicted by the CWI: In Tagalog, Gitksan, and Lushootseed (section 2.2), reduction is confined to the copied string in reduplication contexts and in Sikaiana and Southern Wakashan (section 2.3), it is restricted to copied strings in multiple reduplication contexts. Under the theory of fission as distribution of underlying activity, these languages are straightforwardly predicted since every copy operation results in less activity for the copied elements and thus lowers the threshold set by faithfulness constraints protecting these elements. Another important prediction of this redefinition of fission is the fact that copying symmetrically weakens all copied elements. Simultaneous reduction in both reduplicant and copied base as in Tagalog is hence the expected default if a language allows reduction only for copied material. That there can be independent reasons why a language restricts reduction to either reduplicant or copied base was exemplified with the analysis for reduction in the copied base in Lushootseed.

Crucially, most of the empirical evidence discussed in this paper can be accounted for under alternative theories of reduplication. Reduction only in the reduplicant is one of the main arguments for BR-correspondence theory and the existence of reduction only in the copied base is one of the arguments for the theory of existential faithfulness (Struijke 2000). Finally, reduction in multiple reduplication contexts in Southern Wakashan was analysed as the avoidance of multiple reduplicants in different theoretical accounts (e.g. Stonham 2004; Inkelas 2018; Zimmermann to appear). One empirical contribution of the paper is the argumentation that all these seemingly unrelated phenomena can fall out from a single theoretical assumption, namely the redefinition of fission as distribution of underlying activity. A second empirical contribution is to emphasize the challenge posed by simultaneous reduction in both reduplicant and copied base (e.g. Tagalog) and by non-complete deletion of one reduplicant in multiple reduplication contexts (e.g. Sikaiana). As was argued in section 6, both these patterns are unexpected under all existing reduplication theories.

The theory of fission as distribution of underlying activity is a completely novel proposal. As the many directions for future research pointed out in section 5 made clear, the theory makes far more interesting predictions than the present paper was able to discuss. For one, there are various empirical areas like non-reduplication copying contexts that can either provide further support or potentially falsify the theory. On the other hand, the proposal is embedded into the larger context of research assuming GSR whose potential for phonological exceptionality and variability is still explored. The present paper thus hopefully ignites new discussions about both the ongoing research within GSR theory and the empirically most adequate reduplication theory.

Abbreviations

CWI Copying-Weakening-Implication

GSR Gradient Symbolic Representations

HG Harmonic Grammar

AF *ang*-form (cf. Mattes (2007))

AV actor voice

BEG begun (cf. Mattes (2007))

DEM demonstrative

DIST distal

DISTR distributive

GRAD graduative

IPFV imperfective

IT iterative

PB predicate base

PL plural

PROX proximal

REP repetitive

SG singular

UG undergoer voice

Acknowledgements

I thank the audiences and organizers of OCP 16, ConSOLE 27, GLOW 42, and the special session on 'Reduplication-Phonology Interactions' at the LSA 2019 for their helpful questions, comments, and suggestions. I am especially grateful to Sharon Inkelas, Jochen Trommer, Douglas Pulleyblank, Rachel Walker, and Sam Zukoff for discussions and feedback on the ideas of this paper. The manuscript also benefitted a lot from the detailed and constructive comments of three anonymous Glossa reviewers.

Funding information

This research was supported by the DFG Emmy Noether grant 'Grammatical Strength in Prosodic Morphology: Typology and Theory' (ZI 1717/2-1).

Competing interests

The author has no competing interests to declare.

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Zimmermann, Eva. to appear. Too much is too much… in the phonology! *The Linguistic Review*.

TO CITE THIS ARTICLE:
Zimmermann, Eva. 2021. Faded copies: Reduplication as distribution of activity. *Glossa: a journal of general linguistics* 6(1): 58. 1–38. DOI: ***https://doi.org/10.5334/gjgl.1117***

Submitted: 30 September 2019
Accepted: 01 November 2020
Published: 30 April 2021

Glossa: a journal of general linguistics is a peer-reviewed open access journal published by Ubiquity Press.