The dual theory of reduplication*

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Abstract

This article argues that the fundamental typological distinction pertaining to reduplication is that between phonological duplication and morphological doubling (the Dual Theory of reduplication). Phonological duplication, which occurs for a phonological purpose such as providing an onset or nucleus for a syllable or filling in the featural content of an otherwise unspecified timing unit in the representation, is formally related to phonological assimilation, modeled here via the mechanism of string-internal correspondence. It obeys phonological locality conditions, targets phonologically defined constituents, and is sensitive to phonological markedness considerations. Morphological doubling, which occurs for a morphological purpose such as marking a change in meaning or creating a new stem type, is the result of the doubling of a morphological category such as root, stem, or affix. Morphological doubling, modeled via the "double insertion" mechanism of Morphological Doubling Theory (Inkelas and Zoll 2005), is not derived by phonological correspondence and therefore is not subject to any of the phonological properties characteristic of phonological duplication; the two copies, related morphosemantically, are phonologically independent.

1. Introduction

This article argues for the Dual Theory, which provides two sources of word-internal reduplication: morphological doubling and phonological duplication. These two methods are formally distinct and produce very different types of reduplication. Taken together, they improve on Base Reduplicant Correspondence Theory (BRCT; McCarthy and Prince 1995) as an overall approach to reduplication, although there are many formal similarities between BRCT and phonological duplication. Throughout this article, the term "reduplication" will be used to refer

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generally to the phenomenon of duplication of any kind; morphological doubling and phonological duplication are its formally disjoint subtypes whose difference is the subject of this study.

Morphological doubling is a morphologically driven, morphologically mandated doubling that is at work in cases like total reduplication in Dyirbal, illustrated in (1). The nominal pluralization construction calls for two instances of the singular stem. Following Inkelas and Zoll (2005), we assume here that morphological reduplication results from the double insertion of a morphological constituent. In the case illustrated below, the morphological constituent in question is the entire word, but in other cases it might be a subconstituent: stem, root, or even affix.

(1) Total reduplication: Dyirbal nominals reduplicate fully to mark plurality (Dixon 1972)
    midi-midi 'lots of little ones'
    gulgiɽi-gulgiɽi 'lots of prettily painted men'

Phonological duplication, called "compensatory reduplication" by Yu (2005a, 2007), is not an input mandate of the morphology. Rather, it is driven by purely phonological output requirements, e.g., the requirement of assimilation, or the need to supply features to an otherwise featurally underspecified epenthetic or templatic timing unit. Phonological duplication satisfies purely phonological constraints, making the output more phonologically harmonic than an output without the duplication would be. The alternative to phonological duplication is typically epenthesis of a default segment to serve the same structural phonological role. Phonological duplication is clearly at work in cases like Spokane, illustrated in (2), in which the /e/ repetitive marker is infixed to bases beginning with weak roots, i.e., roots lacking a full vowel underlyingly (2a), but prefixed to bases which are CV-initial (2b) (Black 1996: 210 ff., Bates and Carlson 1998: 655; also cited in Inkelas and Zoll 2005, Yu 2005a: 21, 2007).[1] In the latter cases, an epenthetic copy consonant appears to provide an onset to the syllable headed by /e/. The consonant in question duplicates the consonant immediately following /e/. In the first example in (2b), repetitive -*e*- surfaces as [a] due to a regular process of Retraction (Black 1996: 211, fn. 39):

(2) Phonological duplication in Spokane (Interior Salish)
  a. Repetitive -*e*- infixes into initial consonant cluster
     /-e-, šl'-n'-t-ən'/ → š-**e**-l'n'tén'
     REP, chop-CTR-TR-1SGTRS 'I cut it up repeatedly' (Black 1996: 210)
     /-e-, lč'-n'-t-ən'/ → l'-**e**-č'n'tén'
     REP, tie-CTR-TR-1SGTRS 'I tied it over and over' (Black 1996: 210)

b. Repetive *-e-* prefixes to CV-initial bases, and is preceded by a copy consonant:

/-e-, l'aq'-n'-t-ən'/	→ **l'-a-l'**áqn
REP-bury-CTR-TR-1SGTRS	'I just covered things as I went along' (Black 1996: 212)
/-e-, nič'-n'-t-əx^w/	→ **n'-e-n**íč'n'tx^w
REP, cut-CTR-TR-2SGTRS	'you kept cutting' (Black 1996: 210)

Phonological duplication involves the extension to another segmental position of phonological features which would independently be present in the output. It is formally in a class with phonological assimilation (whether local or, as in harmony, long-distance) and is handled in the same way. Building on recent work in Optimality Theory (OT), we propose that the mechanism in question is string-internal phonological correspondence, developed originally for consonant harmony (Walker 2000a, 2000c; Hansson 2001; Rose and Walker 2004; Hansson 2007; Walker and Mpiranya 2006) but applicable generally to local and long-distance interactions alike.

Phonological correspondence plays no role in morphological doubling; reduplicative morphemes (like the "RED" of Base-Reduplicant Correspondence Theory; McCarthy and Prince 1995) play no role in phonological correspondence. The two types are fully formally distinct, and make very different predictions about locality, markedness, and form of the duplicated material.

The properties distinguishing the two types of reduplication are contrasted in Table 1.

Sections 2 and 3 introduce morphological doubling and phonological duplication in more detail. Section 4 compares the two duplication mechanisms along the dimensions in Table 1. Section 5 discusses the potential for ambiguity in the analysis of CV reduplication, and Sections 6 and 7 discuss how the Dual Theory relates to Generalized Template Theory (GTT) and to Base-Reduplicant Correspondence Theory (BRCT), respectively. Section 8 concludes the article.

2. Morphological doubling

Developed in Inkelas and Zoll (2005), building on earlier proposals by Singh (1982), Saperstein (1997), Sherrard (2001), and others, Morphological Doubling Theory (MDT) is an approach to reduplication in which morphological constructions can call for two instances of the same morphological constituent, where "same" is defined at the level of meaning,

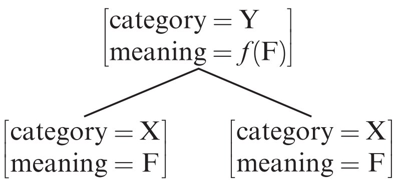
Table 1. *Comparison between phonological doubling and morphological doubling*

	Phonological doubling	Morphological doubling
Most closely related to	epenthesis and assimilation	compounding and affixation
Motivation	required by phonological output wellformedness (e.g., providing obligatory syllable structure without recourse to epenthesis)	required in input by morphological construction
Identity	phonological	morphosemantic
Target	phonological constituent (feature, segment, mora, syllable rime, syllable, foot)	morphological constituent (affix, root, stem, word, phrase)
Size	small; typically single segment or syllable rime	large; typically bimoraic or larger
Linear relationship to rest of output	essentially unrestricted	juxtaposition
Locality effects	duplicates closest constituent of same type	no locality restrictions
Markedness	copy may show phonological unmarkedness effects	no phonological unmarkedness expected in copy

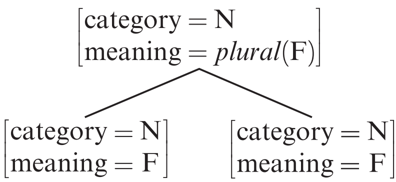
not phonology. Morphological doubling can target a whole word, a stem, a root, or even an affix. It is not phonological in nature, in the sense of increasing the phonological harmony of the output; rather, morphological doubling is an input mandate on the part of the morphology. Consequently, identity in morphological doubling is computed in terms of morphosemantic content but not phonological identity.

Example (3a) shows a general morphological doubling schema. Example (3b) shows the specific schematic construction that accomplishes pluralizing total nominal reduplication in Dyirbal from (1), and (3c) represents the actual Dyirbal form in (1a):

(3) a.



b.



c. [category = N
meaning = 'lots of little ones'
midi-midi]

[category = N
meaning = 'little one'
midi] [category = N
meaning = 'little one'
midi]

Just as a construction might call for one vs. two instances of the same morphosemantic stem, it can also call for three, as in cases of triplication which, while not common, are robust in some languages, typically marking verbal aspect of some kind (see e.g., Blust 2001; Singh and Wee 2002; Wee 2005).

(4) Emai: verbs triplicate to form adverbs (Schaefer 2001, cited in Wee 2005)

		verb gloss
a.	pu-pu-pu	'to flap'
b.	kpi-kpi-kpi	'to flutter'
c.	kpa-kpa-kpa	'to tremble'
d.	kpe-kpe-kpe	'to shiver'

In making morphosemantic identity the defining feature, morphological doubling in MDT formally resembles synonym compounding, illustrated in (5) by data from Khmer (Ourn and Haiman 2000: 485):

(5) Synonym compounding inKhmer
a. peel-weeliə 'time' < peel 'time (< Sanskrit) + weeliə 'time' (< Pali)
b. cɑmnəj-ʔahaa(r) 'food' < 'food' + 'food'

Cases like these, while not as well-known as other types of reduplication, clearly show the role of morphosemantic identity and the lack of a role of phonological identity in morphological doubling constructions.

2.1. *Functions of morphological doubling*

The morphological functions of morphological doubling vary greatly, ranging from the familiar case of doubling associated with an iconic meaning (as in Dyirbal pluralization (1)) to doubling associated with a more idiomatic meaning (as, perhaps, in Emai (4)) to doubling that is not itself semantically contentful but is a concomitant of other semantically contentful constructions, such as affixation. In a discussion of the latter possibility, which he calls "automatic reduplication", Rubino (2001, 2005a, 2005b) cites cases from Ilocano and Nez Perce, in which particular affixes require their bases to be reduplicated even though the unaffixed reduplicated base either does not occur independently or does not occur with a meaning that is part of the affixed reduplicated construction (e.g., Ilocano *ángot* 'smelly'; *naka-ang-ángot* 'stinking very much'; see Rubino 2001 and (7), below). Rubino characterizes this sort of reduplication as being an obligatory in the context of the affix but not carrying any meaning of its own that would motivate its occurrence. Such patterns have been documented in a number of Austronesian languages, including Tagalog (Schachter and Otanes 1972), and in Nancowry (Radhakrishnan 1981), as well as in Nuuchahnulth [Nootka] (Sapir 1921, Stonham 1994), in which a variety of affixes with no necessary semantic commonality select for formally reduplicated bases. Inkelas and Zoll (2005) analyze semantically empty stem reduplication as a stem-forming construction (see e.g., Aronoff 1994) which exists on a par with other stem-forming constructions, such as ablaut or truncation or theme vowel suffixation, forming stem types which other morphological constructions call for.[2]

To sum up, while there is no necessary uniformity in the types of semantic function associated with the outcome of morphological doubling, there is uniformity in inputs: the two (or three) inputs to a morphological doubling construction must be morphosemantically identical.

2.2. *Phonological concomitants of morphological doubling*

In MDT, there is no phonological correspondence between the two copies of the relevant morphological constituent. Double morphological insertion, not the phonological grammar, is the mechanism producing duplication. Phonology is, nonetheless, crucially involved in many morphological doubling constructions. As is well known, morphological reduplication is often accompanied by the phonological modification of one or both copies. MDT draws heavily on the observations of Steriade (1988) and McCarthy and Prince (1999) to the effect that the kinds of phonological effects observed in reduplicants are parallel to those observed outside of reduplication.

Phonological effects that are specific to a particular morphological doubling construction are implemented in MDT via the association of a cophonology with the construction as a whole, and potentially with each of of its daughters as well. Cophonologies are phonological subgrammars consisting of fully general phonological constraints, potentially ranked differently in different cophonologies (Orgun 1996; Inkelas et al. 1997; Yu 2000; Anttila 2002; Inkelas and Zoll 2005, 2007). A common phonological modification of this type is truncation, the source of partial reduplication in MDT. Partial reduplication arises when one of the daughters in a morphological doubling construction is associated with a truncation cophonology. In Ilokano, for example, the intensifying adjectival prefix *naka-* selects for a reduplicated base whose first member is truncated to a maximal syllable, or perhaps minimal foot (CVC):

(6) Ilokano adjective intensifying prefix selects for a doubled stem (Rubino 2001)

a.	na-ángot	'smelly'	naka-ang-ángot	'stinking very much'
b.	na-sakít	'sore'	naka-sak-sakít	'very sore'
c.	katáwa	'laughter'	naka-kat-katáwa	'funny'

It is an important prediction of MDT that the ways in which a partial reduplicant can be formed via truncation are the same ways in which a nonreduplicated constituent can be truncated. The empirical underpinnings of this claim are well known (see e.g., McCarthy and Prince 1986, Steriade 1988, Nelson 2003), and in MDT the correlation follows from the fact that cophonologies perform truncation in the same way regardless of whether it is associated with reduplication. The "Generalized Phonology Prediction" of Inkelas and Zoll (2005) states that reduplicative and nonreduplicative constructions alike draw from the same range of cophonologies. As Table 2 illustrates, the truncation possibilities for stems are the same regardless of whether the morphological construction is reduplicative or not.

Table 2. *Prosodic shapes of partial reduplicants and truncata*

	Prosodic shape of material added via partial reduplication	Prosodic shapes of pure truncation (nonreduplicative)
Bimoraic (maximal) syllable	Mokilese (e.g., *pɔd-pɔdok* 'plant'; Harrison 1973; Blevins 1996)	English nicknames (e.g., *Daniel* → *Dan*)
Bimoraic foot	Manam (e.g., *salaga-laga*)	Japanese loanword and compound clipping (e.g., 'personal computer' → *paso koN*; Itô 1990)
Disyllabic foot	Fox (e.g., *ki:hpoče:-wa* → *ki:hpo-ki:hpoče:wa* 'he eats his fill'; Dahlstrom 1997: 217)	Central Alaskan Yupik hypocoristics (e.g., *qəɬuqi:n* → *qəɬuq* (name); Weeda 1992: 163)

One prosodic shape, the CV syllable, is omitted from Table 2. It occurs frequently in reduplication, but infrequently in pure truncation, possibly because of the lack of recoverability inherent in such a degree of truncation, or possibly because truncation so commonly respects minimal word size constraints, which CV truncata would violate.[3] As discussed in Section 5, many if not all instances of CV duplication are analyzable using phonological duplication rather than morphological doubling + truncation, and so it is not clear whether CV morphological doubling is actually necessary. Other than this, however, the parallels between truncation and partial reduplication are very clear.

The list of phonological modifications that take place within one or both copies in morphological doubling is too great to repeat here, though see Inkelas and Zoll (2005) for a survey. The point that is important to make here is, again, the Generalized Phonology Prediction: the types of modifications found on one or both copies in unambiguous cases of morphological doubling are the same types of modifications that can in principle apply to stems in nonreduplicative morphological constructions. It is common, for example, for one of the two copies in morphological reduplication to undergo dissimilation. This phenomenon, often termed "echo-reduplication", is discussed by Yip (1992, 1997, 1998, 1999). An illustration from Hindi is cited in (7), from Nevins (2005). In Hindi, the "(noun) and the like" construction consists of total reduplication with the caveat that the second copy is modified so as to begin with *v* (7a). The *v* replaces an initial consonant, if any, in that stem. The dissimilatory motivation underlying *v*-replacement is revealed by what happens with stems that would begin with *v* anyway: in just these cases, an alternative initial consonant (*š*) is provided (7b):

(7)	a.	mez-vez	'tables and the like'
		aam-vaam	'mangoes and the like'
		tras-vras	'grief and the like'
	b.	vakil-šakil	'lawyers and the like'

This pattern of onset replacement and dissimilation is a widespread areal phenomenon throughout Asia, and there is a vast literature on it. The important point here, though, is that the stem-to-stem dissimilation phenomenon is not reduplication-specific. There is also a large literature on anti-homophony effects created when affixation to a stem would produce a phonological output identical to the output of the same stem when unaffixed; see e.g., Crosswhite 1999, Kurisu 2001, Gessner and Hansson 2004, Kenstowicz 2005, and Ichimura 2006 for recent discussion. Paster (2006, chapter 2) cites the case of Yucunany Mixtepec Mixtec (Otomanguean, Mexico; Paster and Beam de Azcona 2004), in which the third person singular familiar (subject and possessor) is *-ì* except when the verb already ends in *-i*, in which case the suppletive allomorph *-à* is used instead. (Double vowels are an orthographic convention used for representing the many tonal contrasts in the language, and do not indicate contrastive vowel length).

(8)	a.	sàmá	'clothing'	sàm-íì	'his clothing'
		ma tzá'nu	'grandmother'	ma tzá'n-ì	'her grandmother'
		nda'á	'hand'	nda'-íì	'her hand'
		kù'ù	'woman's sister'	kù'-ì	'her sister'
	b.	kachìí	'cotton'	kachì-áà	'his cotton'
		sì'i	'leg'	sì'-aà	'his leg'
		tzí'ì (yù)	'(I am) dying'	tzí'-à	'she is dying'

Whatever anti-homophony constraint explains the choice of the *-à* allomorph in (8) can equally well explain the *š-* vs. *v*-allomorphy within the second stem of the morphologically doubled constructions in (7). The stem-forming affixational constructions responsible for converting *sàmá* to *sàm-íì.* etc. in Yucunany Mixtepec Mixtec, and *mez* to *vez*, etc. in Hindi, select a suppletive allomorph for the stem-forming affix just in case the output and input would otherwise be homophonous.

Interestingly, while MDT and the Generalized Phonology Prediction can describe a wide range of possible modifications to stems that take place within and outside of morphological doubling constructions, one effect that morphological doubling theory does *not* predict for morphological doubling is the purposeful reduction of contrast in one copy, or the so-called TETU phenomenon that has been observed in many instances of reduplication. This may seem surprising, since TETU has become such a hallmark of reduplication. As argued in Section 4.3, however, the bulk of the convincing cases of TETU are actually found in what, in the Dual Theory, counts as phonological duplication, exactly as the Dual Theory predicts.

3. Phonological duplication

Phonological duplication can be defined generally as any increase in the number of positions in which a given feature, segment, or even string appears in the output, relative to the input. Prior to OT, phonological assimilation was normally handled by autosegmental spreading. Correspondence Theory, developed within OT, has seen the development of a new analysis of phonological duplication, namely string-internal correspondence.[4] This is the approach applied by Walker (2000a,b,c, 2003), Walker and Mpiranya (2006), Rose and Walker (2004), and Hansson (2001, 2007) to consonant harmony, by Krämer (2003) and Kim (2007) to vowel copy, and by Zuraw (2002), Yu (2003, 2005a), Haynes (2007a), and Yu (2007) to a variety of reduplicative phenomena which in the Dual Theory would all be classified as phonological duplication.[5]

3.1. *String-internal correspondence*

Originally developed by Walker (2000a, 2000b, 2000c, 2003), string-internal correspondence is a relationship mandated by a family of correspondence ("Corr") constraints. The constraint definitions in (9) are based on Walker's work but are generalized beyond consonants (Walker's focus) to any segments. Hansson (2001) and Rose and Walker (2004) argue that correspondence constraints need to be inherently directional in order to determine directionality in harmony systems. The first two correspondence constraint schemas in (9) are directional, or asymmetric; the third is more general, and will be used in this article since directionality will not be at particular issue in the discussion.

(9) Corr-$S_{1\rightarrow}S_2$: For any S_1, S_2 that are segments in the same output string, S_2 corresponds to S_1
Corr-$S_{1\leftarrow}S_2$: For any S_1, S_2 that are segments in the same output string, S_1 corresponds to S_2
Corr-S_1S_2: For any S_1, S_2 that are segments in the same output string, S_1 and S_2 correspond

The numerical subscripts in (9), which indicate linear precedence, will henceforth be omitted in practice to avoid clutter, as linear order is generally self-evident.

Correspondence in and of itself has no phonetic effect. However, it sets the stage for the enforcement of featural identity, via Ident constraints that hold over pairs of corresponding segments in the output. The general schema for Ident constraints holding over string-internal output correspondence is shown below:[6]

(10) Ident-[F]-O: Corresponding segments in the output must be identical with respect to the feature(s) in F

The tableau in (11) illustrates how Corr and Ident are evaluated with respect to two input segments, /t/ and /d/. The fully general Corr-SS constraint requires any two segments in the output to correspond. Ident-SS requires corresponding output segments to be identical. Ident-IO requires output segments to be identical to their input correspondents. Depending on constraint ranking, it is possible either for candidates (a), (b) or (d) to win; candidate (c) is harmonically bounded by candidates (a) and (d):

(11)

		/t d/	CORR-SS	IDENT-SS	IDENT-IO
a.	no correspondence, no identity	t d	*		
b.	correspondence, no identity	t_i d_i		*	
c.	no correspondence, identity	t t	*		*
d.	correspondence, identity	t_i t_i			*

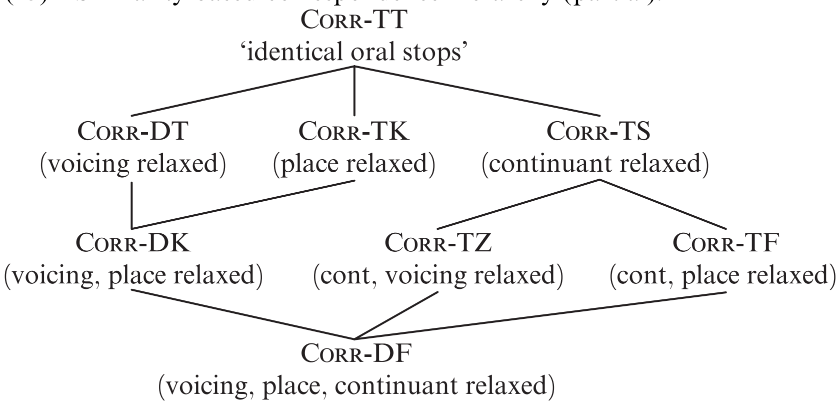
Input-output correspondence is, by convention, also normally indexed with subscripts (see e.g., Hansson 2001), but to avoid cluttering the representations of output candidates, input-output indexation will be suppressed in cases like (11), where input-output correspondence is self-evident.

3.1.1. *The similarity condition.* Inasmuch as correspondence is used to model assimilation, dissimilation and co-occurrence constraints, which typically involve proper subsets of the segment inventory, CORR constraints are most useful when relativized to natural classes of segments, defined in terms of features or even structural positions (e.g., Onset, Coda, Word-initial). Thus, for example, the following are all possible CORR constraints:

(12) CORR-CC (where 'C' = any consonant)
CORR-NN (where 'N' = any consonant specified as [+son, +nasal])
CORR-$C_{\alpha Place}C_{\alpha Place}$ (any two consonants that agree in place features)
CORR-$C_{ons}C_{ons}$ (any two onset consonants)
CORR-$N_{ons}N_{ons}$ (any two onset nasals)
CORR-$C_{\alpha F}C_{\alpha F}$ (any two identical consonants)

Drawing on the familiar generalization that more similar two elements are, the more prone they are to interacting with one another, Walker (2000c), Rose and Walker (2004) and Hansson (2001: 298) propose that correspondence relations exist in scales, in which the ranking of the correspondence mandate for two segments S1 and S2 increases with the minimum degree of feature identity that is a prerequisite for correspondence. A sample section of the similarity scale is given below, adapted from Walker (2000c):

(13) Similarity-based correspondence hierarchy (partial):



The tableau below, adapted from Hansson (2001: 321), illustrates how Ngizim enforces long-distance voicing agreement in converting the /k. . .z/ consonants of Hausa [kà:zá:] 'chicken' to the /g. . .z/ consonantism of the winning candidate in (d). In Ngizim, obstruents in the same root must agree in voicing, even if they disagree in [place] or [continuant]. This is modeled in the tableau by ranking Corr-TF (and hence Corr-TS) and Ident-[voi]-O above Ident-[voi]-IO, which in turn outranks Corr-CC (the requirement that any pair of consonants correspond no matter what their featural differences may be).[7] Because the example is concerned with consonant harmony, only consonantal correspondences are shown here (by indexation).

(14) Ngizim voicing agreement (between stop and fricative which are heterorganic)

	kâazá	Ident-[voi]-O	Corr-TG	Corr-SG	Ident-[voi]-IO	Corr-CC
a.	kâazá			*!		
b.	k$_i$âaz$_i$á	*!				
c.	gâazá			*!	*	
☞ d.	g$_i$âaz$_i$á				*	

Corr-SG compels correspondence between obstruents, even if they differ in [place] and [continuant]. As all the candidates contain two obstruents, each is subject to Corr-SG, which candidates (14a) and (14c) violate. Ident-[voi]-O is enforceable only on candidates which have corresponding consonants to begin with, namely candidates (14b) and (14d); of these two, only (14d) satisfies Ident-[voi]-O, and therefore wins the competition to become the output of input /kâazá/.

It can also happen that the winning candidate is the one in which correspondence fails to be established. As Hansson notes, in Ngizim, voiced implosives do *not* trigger voicing agreement on preceding (non-implosive) obstruents; the two classes of consonants are too dissimilar to be compelled to correspond, and hence to agree in voicing. Data are given in (15):

(15)	pə́ɗə́k	'morning'	*bə́ɗə́k
	kìiɗú	'eat (meat)'	*gìiɗú
	fə́ɗú	'four'	*və́ɗú
	sàpɗú	'pound (v.)'	*zàbɗú

The same ranking that establishes voicing agreement between obstruents in (14) ensures its non-application in (15). The only Corr constraint general enough to enforce correspondence between an implosive and non-implosive consonant, represented here by the maximally general Corr-CC, is ranked below Ident-[voi]-IO. It being impossible to change input voicing to accommodate the high-ranked Ident-[voi]-O, the best solution is simply for the consonants not to correspond in the first place, as in the faithful, noncorresponding candidate (16a):

(16) Ngizim voicing agreement not enforced between implosive and egressive consonants:

	kìiɗú	Ident-[voi]-O	Corr-TG	Corr-SG	Ident-[voi]-IO	Corr-CC
☞ a.	kìiɗú					*
b.	k$_i$ìiɗ$_i$ú	*!				
c.	gìiɗú				*!	*
d.	g$_i$ìiɗ$_i$ú				*!	

Thus, correspondence will not be enforced if the cost of correspondence is too high, a situation Kim (2007) characterizes as "sour grapes" correspondence. The similarity hierarchy, illustrated in (13), which ranks mandated correspondence between similar consonants over mandated correspondence of less similar consonants, ensures that when agreement is differentially enforced, as in Ngizim, it will be enforced over pairs of more similar consonants rather than over pairs of less similar ones.[8]

3.1.2. *Proximity in correspondence.* The aspect of correspondence theory most relevant to phonological segment duplication is the proximity factor. In total segment copy, degree of input similarity is not a factor, but proximity is crucial to predicting which segment will duplicate.

A minimal pair of nasal harmony patterns, discussed by Rose and Walker (2004: 494), neatly illustrates the role of proximity. The Bantu languages Kikongo and Ndonga both show stem-internal nasal harmony, in which suffixal /l/ assimilates in nasality to a nasal consonant in the preceding root. Stems are bracketed in the data in (17), from which it can be seen that the /l/ of the perfective suffix in Kikongo assimilates to any root nasal, even if an oral consonant intervenes, while the /l/ of the applicative suffix in Ndonga assimilates only to a nasal in an adjacent syllable. In Ndonga, an intervening oral consonant *blocks* the harmony:

(17)	a.	Kikongo		b.	Ndonga	
		m-[bud-idi]	'I hit'		[pep-el-a]	'blow towards'
		tu-[kun-ini]	'we planted'		[kun-in-a]	'sow for'
		tu-[nik-ini]	'we ground'		[nik-il-a]	'season for'

Rose and Walker (2004: 494) propose that the difference between the two languages lies in the minimal degree of proximity required to establish consonantal correspondence. While Rose and Walker utilize just one proximity constraint on correspondence, requiring correspondent consonants to be in adjacent syllables, the more articulated proximity scale of Hansson (2001), inspired by Suzuki's (1998) work on dissimilation, will be used here. Hansson proposes that Corr constraints are scaled by relative proximity thresholds required between the corresponding elements. As shown, each Corr constraint can be split into at least four: one requiring correspondence between adjacent elements, one requiring correspondence between elements separated by at most a mora, one requiring correspondence between elements separated by at most a syllable, and one that is fully general, with no proximity threshold. The scale, below, is adapted from Hansson, but generalized beyond consonant harmony; S = any segment. (Hansson's constraint Corr-S-∞-S, which mandates correspondence between any consonants, no matter how far apart, is renamed Corr-SS, for typographical simplicity.)

(18) Proximity scaling of CORR-constraints (modified very slightly from Hansson 2001: 298)

CORR-S-S	≫ CORR-S-μ-S	≫ CORR-S-σ-S	≫ CORR-SS
"adjacent segments"	"segments no farther apart than one mora"	"segments no farther apart than one syllable"	"segments that are any distance from one another"

Because proximity conditions are stated as upper bounds on distance, any violation of a more relaxed constraint — e.g., CORRS-σ-S is also a violation of a more restrictive constraint — e.g., CORR-S-S.

Proximity and similarity are orthogonal dimensions, so that any CORR constraint from the similarity hierarchy can be split into the members of a proximity scale. In Kikongo and Ndonga, the relevant CORR family is CORR-NL ("two sonorants must correspond if they differ at most in the feature [nasal]"). In Kikongo, correspondence is not limited to consecutive consonants, meaning that CORR-NL is ranked above IDENT-[nas]-IO, while in Ndonga, correspondence is enforced only on consonants separated by no more than one mora, meaning that only CORR-N-μ-L is ranked high enough to have an effect. In the tableaux below, IDENT-[son]-IO is top-ranked, meaning that obstruents cannot be affected by nasal harmony. IDENT-[nas]-IO is always ranked below CORR-N-μ-L and IDENT-[NAS]-O, meaning that /n...l/ pairs separated by just one vowel will always enter into correspondence and nasal harmony, as illustrated below for Ndonga (Kikongo works identically):

(19) Proximity-constrainted nasal harmony in Ndonga (same for Kikongo): sonorants in adjacent syllables are compelled by CORR-N-μ-L to correspond, and by IDENT-[nas]-O to agree in [nas]:

	kun-il-a	IDENT-[son]-IO	IDENT-[nas]-O	CORR-N-μ-L	IDENT-[nas]-IO
a.	kunila			*! (nl)	
b.	$k_i un_i il_i a$		*!* (kn, nl)		
c.	$kun_i il_i a$		*! (nl)		
d.	kunina			*! (nn)	*
e.	$ŋ_i un_i in_i a$	*!			**
☞ f.	$kun_i in_i a$				*

At play is the ranking of CORR-NL. In Kikongo, CORR-NL ≫ IDENT-[nas]-IO, such that even long-distance /n...l/ pairs are compelled to correspond and harmonize (20a). In Ndonga, the ranking is the opposite, and sonorant pairs in nonadjacent syllables do not correspond (20b):

(20) a. In Kikongo, nasal harmony operates at-a-distance:

	nik-ili	IDENT-[son]-IO	IDENT-[nas]-O	CORR-N-μ-L	CORR-NL	IDENT-[nas]-IO
i.	nikili				*! (nl)	
ii.	$n_i ik_i il_i i$		*! (nk)			
iii.	$n_i ikil_i i$		*! (nl)			
iv.	nikini				*! (nn)	*
v.	$n_i i\eta_i in_i i$	*!				**
☞ vi.	$n_i ikin_i i$					*

b. ... but in Ndonga, nasal harmony is strictly local

	nik-il-a	IDENT-[son]-IO	IDENT-[nas]-O	CORR-N-μ-L	IDENT-[nas]-IO	CORR-NL
☞ i.	nikila					* (nl)
ii.	$n_i ik_i il_i a$		*! (nk)			
iii.	$n_i ikil_i a$		*! (nl)			
iv.	nikina				*!	* (nn)
v.	$n_i i\eta_i in_i a$	*!			**	
vi.	$n_i ikin_i a$				*!	

The opaqueness of intervening obstruents in Ndonga thus follows not directly from their failure to nasalize but from the fact that they cause sonorants on either side to be too distant from one another to be compelled to correspond.

3.2. *Extension to segment copy*

As developed in the work cited above by Walker, Rose and Walker, and Hansson, and as seen in the cases from Ngizim, Kikongo and Ndonga, string-internal output correspondence works well to derive single feature assimilation in long-distance harmony.

Phonological duplication of whole segments is simply the logical extension of this effect; it constitutes the extreme case of assimilation in which an otherwise featureless segment — e.g., only newly added by epenthesis — derives every one of its features from assimilation. Phonological segment duplication is constrained, just like single-feature assimilation, by proximity. The closest segment of the relevant type is the one which a copy segment will emulate.

Phonological duplication commonly results when a consonant or vowel is required to be present in the output but is not present, or if present is not featurally specified, in the input. This scenario can arise via epenthesis of a consonant or vowel whose features, following the standard approach to epenthesis in OT, must be determined by the grammar; it can happen if a particular morphological construction imposes a template requiring a consonant, vowel, or mora in a position where the input has none to provide. In both cases, a segment is required to be present in the output for which there is no featurally specified counterpart in the input; in both cases, the grammar is responsible for providing the featural makeup of the segment in question. There are always two options in such cases: the insertion of default epenthetic features, or copy-by-correspondence. Following Yu (2005a), we assume that epenthesis violates Dep-feature, while correspondence violates Integrity, the requirement that the input and output indexation of a feature to segments be the same. Integrity is violated by every new correspondence that an input feature takes on in the output.

The tableau in (21) shows schematically how an empty input consonant can be compelled to assimilate entirely to the closest available consonant. Dep-feature outranks Integrity, compelling copy by correspondence rather than insertion of default epenthetic consonant features. Ident-IO ensures that only the empty input consonant, not the fully specified input consonants, will assimilate to another output consonant. As shown below, the requirement of total featural identity on correspondence results in minimal correspondence: only the copy candidate and its counterpart segment correspond. That is, candidate (21b), $g_i a g_i a t$, with one, identical, corresponding pair, fares better than candidate (21d), $g_i a g_i a t_i$, with two corresponding pairs; the pair consisting of consonants fully specified in the input, and hence subject to Ident-IO, necessarily violates Ident-[allF]-O.

(21) Illustration of full consonant copy

	Cagat	IDENT-IO	DEP-F	INTEGRITY	IDENT-[allF]-O	CORR-CC
a.	ʔagat		*!			** (ʔg, gt)
☞ b.	$g_i a g_i a t$			*		* (gt)
c.	$t_i a g a t_i$			*	*! (gt)	** (tg, gt)
d.	$g_i a g_i a t_i$			*	*! (gt)	
e.	$t_i a g_i a t_i$			*	*!* (tg, gt)	
f.	$t_i a t_i a t_i$	*!		*		

There are in fact two candidates in this tableau with full identity between the correspondents: candidate (21b), $g_i a g_i a t$, which manifests local copy, and candidate (21c), $t_i a g a t_i$, which manifests nonlocal copy. The superiority of the local-copy candidate follows from the way that IDENT-O and CORR are assessed in candidates such as these, which have many potential correspondents.

Following Hansson (2007), we assume that IDENT and CORR are assessed locally in correspondence chains. For CORR, this means that in a sequence of n segments of the type eligible for correspondence, there are n-1 possible local correspondence pairs to be assessed. For example, in the case of a fully general CORR-CC constraint and a candidate like *ʔagat* (21a) with three consonants, there are two pairs of "closest" consonants, namely *ʔg* and *gt*. Since the consonants of neither pair in (21a) are in correspondence with one another, CORR-CC is violated twice, once for each pair. The correspondence between *ʔ* and *t* is not directly assessed in this candidate. In candidate (21c), $t_i a g a t_i$, the two "closest" consonant pairs are *tg* and *gt*. Neither pair exhibits internal correspondence, and thus this candidate also incurs two violations of CORR-CC. It does not matter that, more globally, the distant *t*'s in this candidate correspond with each other.

Local assessment of IDENT means that in a correspondence chain, as in candidates (21d) and (21e) where there are more than two corresponding segments, IDENT-O is evaluated independently for each local pair. Thus for candidate (21e), IDENT evaluates the correspondent pairs *gg* and *gt*, finding an IDENT violation only in the second. The fact that the *g* of the first pair is non-identical to the *t* of the second pair is not registered. Hansson (2007) argues convincingly that local assessment is the only reasonable option for assessing IDENT and CORR in strings containing many (potential) correspondents; global assessment flies in the face of intuitions about locality and makes the wrong predictions regarding harmony and neutralization.

We turn now to two real-life examples of full-segment copy, showing how they follow from the scheme developed thus far. The first, from Spokane, is structurally similar to the schematic (21). As discussed earlier and illustrated in (2), full consonant duplication occurs in Spokane to supply an onset for the syllable created by repetitive -*e*- when combined with CV-initial verbs.

(22)	a.	/-e-, šəl'/	→ š-e-šil'
		/REP, chop/	'I cut it up repeatedly'
	b.	/-e-, nič'-n'-t-əx^w/	→ n'-e-níč'n'tx^w
		REP, cut-CTR-TR-2SGTRS	'you kept cutting'

A full analysis of example (22b) is provided in (23). ONSET ≫ DEP-C compels the insertion of a consonantal root node to serve as the onset to the syllable headed by repetitive -*e*-. The ranking DEP-feature ≫ INTEGRITY, not shown in the tableau, compels copy by correspondence, rather than insertion of default epenthetic consonant features (Yu 2005a). As shown in (23), total copy is achieved via a high-ranking IDENT-[allF]-O, which requires featural identity of corresponding segments. The result is, as in (21), minimal local correspondence: only the copy and its closest potential correspondent in fact correspond, and they agree in all their features.

(23)

	/e-nič'-n'-t-əx^w/	ONSET	DEP-C	IDENT-[ALLF]-O	CORR-CC
a.	enič'n'təx^w	*!			4 (=nč', č'n, n't, tx^w)
☞ b.	n$_i$en$_i$ič'n'təx^w		*		4 (=nč', č'n, n't, tx^w)
c.	t$_i$enič'n't$_i$əx^w		*		5! (=tn, nč', č'n, n't, tx^w)
d.	n$_i$en$_i$ič$_i$'n$_i$'t$_i$əx$_i$^{w}		*	4! (=nč', č'n, n't, tx^w)	
e.	t$_i$en$_i$ič$_i$'n$_i$'t$_i$əx$_i$^{w}		*	5! (=tn, nč', č'n, n't, tx^w)	

In Makassarese, copy vowels protect stem-final consonants from No-Coda violations through insertion of a copy vowel.[9] Makassarese has the extra complication of manifesting final epenthetic consonants whose function is to satisfy a high-ranked Final-C constraint.

(24) Makassarese: copy vowel (with epenthetic ʔ) follows stem final Cs that can't be codas (McCarthy and Prince 1994c, citing Aronoff et al. 1987 and others)
a. /rantas/ rántas-aʔ 'dirty'
b. /teʔter/ téʔter-eʔ 'quick' > [téttereʔ]
c. /jamal/ jámal-aʔ 'naughty'

The difference between epenthesis and copy is simply the difference in preference between unmarked phonological features and the extension of existing features. The tableaux, below, show how this follows in Makassarese from the ranking of DEP-V-features ≫ INTEGRITY ≫ DEP-C-features:

(25)

	/jamal/	DEP-Vfeatures	INTEGRITY	DEP-Cfeatures
a.	jamaləʔ	*!		*
☞ b.	jamal$_i$a$_i$ʔ		* (a)	*
c.	jamal$_j$əl$_j$	!*	* (l)	
d.	jama$_i$l$_j$a$_i$l$_j$		**! (a,l)	
e.	jam$_j$a$_i$la$_i$m$_j$		**! (a,m)	

Phonologically epenthetic segments behave no differently than ones inserted by the morphology. In Shuswap, for example, the diminutive is formed by infixation of a consonant following the stressed vowel. Rather than having a fixed segmentism (default or otherwise), it draws its featural content through correspondence with the closest preceding consonant:

(26) Shuswap diminutive (Yu 2007, based on primary sources cited therein)

sqéx̌he	'dog'	sqéq̱x̌he	'little dog'
pésəłkʷe	'lake'	pép̱səłkʷe	'small lake'
cq'éɬp	'tree'	cqéq̱'ɬp	'small tree'
qéʔce	'father'	ɣn-qéq̱ʔece	'my father'

The same correspondence, faithfulness, and markedness constraints derive assimilation in this case:

(27)

	/sqé-C-x̌he/	Dep-Cfeatures	Integrity	Corr-CC
a.	sqéʔx̌he	*!		4 (=sq, qʔ, ʔx̌, x̌h)
☞ b.	sq_iéq_ix̌he		*	3 (=sq, qx̌, x̌h)
c.	$s_i$qés_ix̌he		*	4! (=sq, qs, sx̌, x̌h)

3.3. *Transparency in harmony vs. full copy*

Consonant and vowel harmony are known to exhibit transparency, in which consonants meeting a certain featural description will be immune to consonant harmony affecting other consonants, and vowels meeting a certain featural description will be invisible to harmony affecting other vowels. We do not find a parallel phenomenon with copy epenthesis, which always targets the closest consonant (in the case of an epenthetic consonant) or closest vowel (in the case of an epenthetic vowel). This is predicted by the correspondence approach outlined above. Transparency in consonant harmony, for example, results when Corr constraints require a degree of similarity between corresponding consonants which the transparent consonant in question does not meet (and is not permitted, by IO faithfulness, to morph into conformity with). With copy epenthesis, or for that matter any assimilation process affecting a segment without its own input specifications, Integrity is the only obstacle to assimilation, and therefore proximity, not similarity, determines which segment will be assimilated to.

Compare, for illustration, the long-distance nasal harmony in Kikongo (e.g., /nik-ili/ → *nikini*) to the case of Spokane, above. In Kikongo, the Corr constraint establishing correspondence between the input /n/ and /l/ of /nik-ili/ is Corr-NL, to which the intervening /k/, belonging neither to the natural class 'N' (nasals) nor 'L' (sonorants), is invisible. Thus in the input /nikili/, the two sonorants form the closest local pair, and Corr-NL is satisfied when they correspond (28aii). In Spokane, by contrast, the correspondence constraints compelling copy are not dependent on the particular features of the corresponding consonants. They demand identity, but exclude no consonant from potential participation in the correspondence. Both candidates in (28b) violate Corr-CC, in that not all the potential local correspondence pairs are in fact in correspondence, but candidate (28bi) has a local corresponding pair while candidate

(28bii) has none. The long-distance correspondence in (28bii) does not reduce the number of (locally computed) violations of CORR-CC, and thus has no beneficial effect.

(28) a. Non-local copy (transparency) possible in Kikongo as a result of CORR-NL

	nik-ili	IDENT-[nas]-O	CORR-NL
i.	nikili		*! (nl)
☞ ii.	$n_i$ikin$_i$i		

b. Strictly local copy necessary in Spokane as a result of CORR-CC

	/e-nič’-n’-t-əx^w/	IDENT-[ALLF]-O	CORR-CC
☞ i.	$n_i$en$_i$ič’n’təx^w		4 (=nč’, č’n, n’t, tx^w)
ii.	$t_i$enič’n’t_iəx^w		5! (=tn, nč’, č’n, n’t, tx^w)

In both cases, the closest pair of potential correspondents is forced to correspond; the difference is that in Kikongo, the closest pair is defined in terms of sonorants, while in Spokane it is defined on all consonants. There can be no transparency in the latter case.

3.4. *Structural role as a factor in similarity*

While the feature-based similarity hierarchy does not play a role in full segment copy — since full copy surpasses any featural similarity threshold, by definition — structural similarity can be very relevant to determining which segment a copy assimilates to. Consider, for example, the well-known data from Semai illustrated briefly below:[10]

(29) Semai expressive reduplication (Hendricks 2001: 289, 291, citing Diffloth 1976):

pɲ-payaɲ ‘appearance of being disheveled’
ct-cʔɛːt ‘sweet’
kc-kmrʔɛːc ‘short, fat arms’
sw-slayɛːw ‘long hair in order’

We can describe the expressive construction as prefixing an empty mora to the stem; its contents are fleshed out via consonant copy. What is intriguing about this case is that the first copy consonant corresponds to the closest *onset*, while the second copy consonant — a coda — corresponds to the closest *coda* — which, due to Semai syllable structure, happens also to be the word-final consonant. This pattern can be modeled using the similarity scale: segments which occupy identical syllable positions must correspond (and, by IDENT, be forced to be identical).[11]

(30) CORR-$S_{\alpha Srole}S_{\alpha Srole}$: the two closest segments (defined featurally as the case may be) occupying the same syllable position (onset, nucleus, coda) must correspond

CORR-$C_{\alpha Srole}C_{\alpha Srole}$ mandates correspondence between onsets (syllable-initial consonants) or between codas (syllable-final consonants). In candidate (31a), the onset consonants are $s_i \ldots s_i \ldots y$; since only the two *s*'s correspond, the local *sy* pair violates CORR-$C_{\alpha Srole}C_{\alpha Srole}$. The coda consonants are *l*...*w*, and since these do not correspond, they constitute the second violation of CORR-$C_{\alpha Srole}C_{\alpha Srole}$. Violations are assessed in a similar manner for the other candidates. The winner, candidate (31c), has the maximal correspondence possible in its two onset pairs ($s_i \ldots s_i \ldots y$) and its one coda pair ($w_j \ldots w_j$), and thus is the optimal output.

(31) Syllable role as a factor in copy: Semai

	μ, slayɛ:w	IDENT-[ALLF]-O	CORR-$C_{\alpha Srole}C_{\alpha Srole}$
a.	$s_il_j.s_il_ja.y\varepsilon{:}w$		**! (sy, lw)
b.	$s_iy_j.s_ila.y_j\varepsilon{:}w$		**! (sy, yw)
☞ c.	$s_iw_j.s_ila.y\varepsilon{:}w_j$		* (sy)
d.	$l_iw_j.sl_ia.y\varepsilon{:}w_j$		**! (ls, sy)

Hendricks (2001) offers a different analysis, in which the prefix is an abstract RED morpheme which must be both left-anchored and right-anchored to the base. The restrictive prosodic structure of Semai words makes these two analyses difficult to tell apart. However, later in this article it is argued that BR correspondence is no longer needed, in which case the right-Anchoring constraint used by Hendricks is no longer available per se.

The most long-distance type of segment copy occurs when the similarity condition of morpheme-initiality is placed upon correspondence.

A dramatic instance of this occurs in Koasati (Kimball 1991: 325; data cited from Yu 2007), in which the punctual infix *-o:-*, which precedes the stem-final syllable, is supplied with an onset which is a copy of the first consonant in the stem — not of the closest onset consonant.[12]

(32) Koasati punctual reduplication

cofóknan	cofokc̳ó:nan	'to be angled'
copóksin	copokc̳ó:sin	'to be a hill'
lapátkin	lapatl̳ó:kin	'to be narrow'
polóhkin	polohp̳ó:kin	'to be circular'
taháspin	tahast̳ó:pin	'to be light in weight'
talásban	talast̳ó:ban	'to be thin'

The most plausible account of this long-distance copy is that it is governed by a correspondence constraint on morpheme-initial segments (a constraint which would be useful in enforcing alliteration).

(33) Corr-$C_{Morpheme\text{-}Init}C_{Morpheme\text{-}Init}$

Assuming that (possibly emergent) bans on gemination and resyllabification, not shown here, prevent the immediately preceding consonant from serving as the onset of the syllable headed by *-o:-*, Corr-$C_{M\text{-}Init}C_{M\text{-}init}$ favors the candidate in (b) over the candidate in (a) which copies from a closer, but not a morpheme-initial, onset. (For an analysis of the positioning of the infix, see Yu 2007.)[13]

(34)

	cofoknan, -o:-	Ident-[allF]-O	Corr-$C_{M\text{-}Init}C_{M\text{-}Init}$	Corr-$C_{ons}C_{ons}$
a.	cof$_i$ok-f$_i$o:-nan		*! (cf)	** (cf, fn)
☞ b.	c$_i$ofok-c$_i$o:-nan			*** (cv, fc, cn)

Koasati presents a dramatic case of what is otherwise a fairly commonplace phenomenon, the infixation of a copy of the initial consonant. Many cases have been documented of infixation of a copy of the initial consonant after the first vowel, as in Hopi (Riggle 2006), Pima and Tohono O'odham (e.g., Riggle 2006; Fitzgerald 1999), Kwakwala and Cupeno (e.g., Haynes 2007a), and other languages. For example, Yu (2007), citing Riggle (2006), invokes the following Pima data to illustrate the copy of a preceding consonant to supply featural content to an infixed consonant:[14]

(35)

Singular	Plural	Gloss
mavit	ma<u>m</u>vit	'lion'
koson	ko<u>k</u>son	'packrat'
sipuk	si<u>s</u>puk	'cardinal'

Pima yields to more analyses than Koasati; the consonant duplication could be analyzed by any of CORR-$C_{\text{M-Init}}C_{\text{M-Init}}$, CORR-$C_{\text{-ons}}C_{\text{ons}}$, or even CORR-CC, possibly supporting Anttila's (1997) hypothesis that the more possible OT analyses there are of a phenomenon, the likelier it is to occur. Cases like Pima are quite common in comparison to cases like Koasati.

3.5. *Phonological duplication of more than one segment*

The preceding cases of phonological duplication have all involved single segments. However, Yu (2005a) has observed that phonologically motivated duplication is not necessarily limited in this way. In Washo, to take one example, the morphological category of plurality is realized via prosodic expansion in the stressed syllable, which is normally penultimate (Yu 2005b). In stems like those in (36), the only way to expand the penultimate syllable is to insert a new mora, which is fleshed out by segmental copy of material to the right. Copy is sensitive to syllable role: in pluralizing reduplication, e.g. *ʔešiw.šiʔ* 'father's brother', for example, the new mora copies not the closest consonant to its right (the coda /w/) but the closest onset, namely /š/.

(36) Washo plural reduplication (Yu 2005b: 440)

Singular	Plural	Gloss
ʔéw.šiʔ	ʔe<u>ší</u>w.šiʔ	'father's brothers'
nén.t'uš	ne.<u>t'ú</u>n.t'uš-u	'old women (nom.)'
sák.sag	sa.<u>sá</u>k.sag	'father's father's brother'
mók.go	mo.<u>gó</u>k.go	'shoe'

CORR-$C_{\alpha\text{Srole}}C_{\alpha\text{Srole}}$ (implemented as a directional, right-to-left correspondence constraint) plays a crucial role in Washo, as shown below. Only candidates with the inserted mora in the correct position are considered; see Yu (2005b) for a complete discussion of this aspect of the analysis.

(37)

	ʔew.šiʔ	IDENT-[allF]-O	CORR-$C_{\alpha Srole}C_{\alpha Srole}$
a.	ʔe.$w_i i_j w_i$.$ši_j$ʔ		***! (ʔw, wš, wʔ)
☞ b.	ʔé.$š_i i_j$w.$š_i i_j$ʔ		** (ʔš, wʔ)

In this Washo case, two-segment duplication is not mandated per se but comes about through the interaction of templatic and phonological constraints. Yu shows that in stems of other prosodic shapes, the same prosodic expansion imperative can result in the addition of a single consonant, so that the template itself does not require a two-segment manifestation. Simple segment insertion is sufficient to satisfy the prosodic expansion imperative; ONSET is what drives the additional copy consonant epenthesis in (36).

Yu cites other cases, however, where phonologically-driven duplication of a substring appears to be less of a coincidence and more of a direct phonological mandate. In Cantonese loanword adaptation, for example, Yu shows that "[l]oanwords that begin with certain C + liquid clusters are borrowed into Cantonese with a copy of the rhyme of the [following] syllable inserted to break up the onset cluster''.

(38) 'break' [pʰɪk̚lɪk̚] (br → pʰVCl)
'blood' [pʌt̚lʌt̚] (bl → pVCl)
'straight' [siːtɪk̚lɪk̚] (tr → tVCl)

The presence of an epenthetic copy vowel inside the offending /CL/ clusters is unsurprising, and could be handled in the way seen above; what is more puzzling is that the coda of the following syllable copies as well. Yu (2003, 2004, 2005a, 2007) argues that syllable rime duplication of this type follows from syllable correspondence, proposing the principle in (39):

(39) Surface Correspondence Percolation:
If syllable σ_i contains a segment S_i that is in surface correspondence with segment S_j in syllable σ_j, all segments in syllable σ_i must be in correspondence with segments in syllable σ_j.

Without going into the details of Yu's analysis, the reasoning is as follows: the epenthetic vowel required to break up the CL clusters heads a syllable; the epenthetic vowel corresponds (by CORR-VV) to the following vowel, and by (39) (represented by CORR-σσ), the syllables headed by those vowels must also correspond. Without epenthesis of a coda consonant into the first syllable, the syllables will differ in size; copy consonant epenthesis brings them into closer conformity. The tableau in (40), modified from Yu's (2005a) example (23), represents the intuition behind Yu's analysis:

(40)

	blood	IDENT-IO	CORR-VV	IDENT-σ-O	CORR-σσ	DEP-C
a.	[pʌ$_i$]$_k$[lʌ$_i$t̚]$_k$			**!(pl, Øt)		
☞ b.	[pʌ$_i$t$_j$̚]$_k$[lʌ$_i$t$_j$̚]$_k$			*(pl)		*
c.	[l$_n$ʌ$_i$t$_j$̚]$_k$[l$_n$ʌ$_i$t$_j$̚]$_k$	*!				*

Syllable identity is not a consequence but rather a prerequisite for correspondence in phenomena analyzed by Zuraw (2002), who applies the term "aggressive reduplication" to a type of correspondence that occurs, for example, in the (fairly conventionalized) assimilations in English illustrated in (41). This particular example is a case of syllable rimes that meet a certain similarity threshold becoming more similar (becoming identical).

(41) Assimilatory "errors" (Zuraw 2002)

	Standard	Non-standard
a.	pompon	pompom
b.	orangutan	orangutang
c.	smorgasbord	smorgasborg
d.	Inuktitut	Inuktituk

Zuraw states correspondence constraints over substrings, not prosodic constituents per se. However, nucleus or rime similarity is involved in all of the cases in (41) except perhaps for *smorgasborg*; even here, though, the *org* strings in question would both be considered syllable rimes if one adopts the position that post-tonic consonants in the onset of unstressed syllables are ambisyllabic (e.g., Kahn 1976, Gussenhoven 1986) or codas (Myers 1987).

3.6. *Summary*

Phonological duplication is the means of providing necessarily phonological content to an epenthetic or templatic segment. It is accomplished by the same technology that handles assimilation in general and, like assimilation, is governed by proximity and similarity conditions on the establishment of correspondence. Phonological duplication increases the phonological harmony of the output; it is motivated by phonological constraints in grammar.

4. Phonological duplication vs. morphological doubling

Having covered the basics of morphological doubling and phonological duplication, we focus next on some key differences between the two mechanisms regarding the reduplication phenomena that they can describe.

4.1. *Phonological size of reduplicants*

Phonological duplication is a purely phonological process, and is limited in its targets to phonological constituents: single segments, moras, syllable rimes, syllables. When it provides content to epenthetic segments, the size of its targets follows from the size of phonological constituents that can be epenthesized (segments, moras, sometimes syllables). When it provides content to templatic positions, the amount of material copied follows from the size of the template.

Morphological doubling, by contrast, is a process of the double selection of a morphological entity — affix, root, stem, word — and carries no intrinsic phonological size limitations with it. Phonological size limits can be extrinsically imposed as part of the cophonology associated with a morphological doubling construction. We have seen this with partial reduplication, associated with truncation. However, we have also seen cases in which a morphological constituent is doubled regardless of its size, resulting in the duplication of strings far longer than any that purely phonological duplication could copy.

4.2. *Phonological identity between copies in reduplication*

Phonological duplication is all about phonological identity, formally and descriptively. Its phonology is the same as the phonology of assimilation. The opposite is true of morphological doubling, in which no phonological correspondence is established. The phonology of morphological doubling is the phonology of stem-formation constructions. Phonological identity in morphological doubling is epiphenomenal, the result of the double selection of the same morphological constituent. Inkelas and Zoll (2005) explore one consequence of this aspect of morphological doubling by focusing on "divergent modification" within morphological reduplication constructions, in which the two copies are modified in different ways, ending up more different phonologically than they started out.

4.3. *Markedness and TETU*

A major difference between phonological duplication and morphological doubling is that the former is subject to "emergence of the unmarked" (TETU) effects, while the latter is not.

Research on reduplication over the past two decades has focused attention on the phenomenon of emergent unmarkedness in reduplicants. In BRCT, TETU effects arise when some markedness constraint is ranked lower than IO-faithfulness, hence not enforced generally in stems, but is ranked above BR-faithfulness, such that reduplicants will obey the markedness constraints at the expense of identity with the base (McCarthy and Prince 1994a, Alderete et al. 1999).

(42) $\text{F}{\scriptstyle\text{AITH}}_{\text{IO}} \gg \text{Markedness} \gg \text{F}{\scriptstyle\text{AITH}}_{\text{BR}}$

A very well-known example of TETU is the gerundive construction in Yoruba, in which a preposed CV reduplicant takes its onset consonant from the following base, but invariably uses the vowel /i/ as its nucleus. Alderete et al. (1999) treat the features of /i/ as epenthetic, inserted to satisfy markedness constraints which outrank the need for /i/ to correspond featurally to its counterpart in the base.[15]

(43)

		the TETU ranking			
	RED, g͡bóná	IDENT-IO	*[−hi], *[+bk], *[+rd]	IDENT-BR	*consonant place
a.	g͡b$_1$ó$_2$-g͡b$_1$ó$_2$ná		***!		***
b.	h$_1$ó$_2$-g͡b$_1$ó$_2$ná		***!	*	**
c.	g͡b$_1$í$_2$-g͡b$_1$ó$_2$ná		**	*	***
d.	h$_1$í$_2$-g͡b$_1$ó$_2$ná		**	**!	**
e.	g͡b$_1$í$_2$-g͡b$_1$í$_2$na	*!	*		***

Because BRCT handles all reduplication, even total reduplication, with a RED morpheme that is in a BR correspondence relation with the base, BRCT predicts TETU effects for all types of reduplication, from partial to total. This is, however, a pathological prediction for total reduplication, in which TETU is virtually never observed. Consider, for example, the total reduplication construction in Yoruba, illustrated below (Pulleyblank 2008):

(44) Yoruba agentive reduplication

a.	woléwolé	'sanitary inspector'	wolé	'look at the house'
b.	pẹjapẹja	'fisherman'	pẹja	'kill fish'
c.	yọyínyọyín	'dentist'	yọyín	'extract tooth'
d.	jẹdíjẹdí	'piles'	jẹdí	'eat anus'
e.	yínrùnyínrùn	'meningitis'	yínrùn	'twist neck'
f.	náwónáwó	'extravagant person'	náwó	'spend money'
g.	jayéjayé	'lover of pleasure'	jayé	'enjoy life'

Whichever copy — the first or the second — is labeled "Red" in the total reduplication forms in (44), it is clear that TETU is not being observed; both copies preserve segment quality, and neither reduces its vowels to /i/, as in the gerundive reduplicants in (43). Indeed, in our survey of cross-linguistic patterns of reduplication we have found no cases of segmental TETU effects in total reduplicants.

This is exactly what the Dual Theory predicts. Total reduplication is accomplished by morphological doubling, in which there is no phonological correspondence between the two copies. Without a Red morpheme to correspond, BR-fashion, to the base, and without the phonological correspondence that is present in phonological duplication, morphological doubling predicts that TETU should be no more common in reduplication than it is in any other kind of stem-formation construction — in other words, not expected at all.[16]

By contrast, the Dual Theory does predict the possibility of TETU effects in phonological duplication. TETU is accomplished through string-internal output correspondence, in a fashion parallel to that of BRCT — except that the correspondence is not reduplication-specific, but general. TETU effects arise when assimilation is prevented by some higher-ranking markedness constraint from being total, and ends up being only partial. The ranking in question is as follows:

(45) TETU ranking in BRCT: Faith-IO ≫ Markedness ≫ Faith-BR
TETU ranking in phonological duplication: Ident-IO ≫ Markedness ≫ Ident-O

An example of TETU in phonological duplication is illustrated below using data from Nupe. Like Yoruba, Nupe has CV prefixing gerundive reduplication in which the vowel is [+high] (Smith 1969; Hyman 1970; Kawu 2002; Downing 2006: 227; among many others). Pulleyblank (2008) argues persuasively that Yoruba is a case of vowel prefixation with concomitant copy consonant epenthesis (as in our analysis of Spokane, above), and we will assume here the same is true for Nupe as well. Our focus here will not be on consonant duplication, which works exactly as in Spokane, but on vowel quality. In Nupe, the prefix vowel assimilates in [+round] to a following /o/ or /u/; thus it alternates between /i/ and /u/ depending on context:

(46) Nupe gerundive reduplication
ji-jákpe 'stooping'
gi-gãya 'being too long'
gu-gòba 'surrounding'
ku-kúta 'overlapping'

This is a TETU effect within an overall phonological duplication process of total vowel copy. Let us assume that in Nupe, as Alderete et al. do for Yoruba, the quality of the prefixal vowel is entirely determined by grammar, not by any features in its input representation. The epenthetic vowel requires surface specification and is thus obliged either to receive default (unmarked) vowel features and/or to assimilate to a nearby surface vowel. In the analysis sketched below, CORR-VV is enforced generally. IO-faithfulness ensures that assimilation will not destroy input feature specifications, and *[−high] ensures that marked low vowels will not be created (e.g., via assimilation). This gives rise to the TETU effect in reduplicants, as illustrated in (47). Since the prefix vowel must, by virtue of *[−high], surface as [+high], it can assimilate only partially to a following [o], surfacing as [+round]. (Only correspondence between the first two vowels is shown, below, since other correspondences are not relevant.)

(47)

	V-gòba	IDENT-Vfeatures-IO	*[−high]	CORR-VV	IDENT-Vfeatures-O
b.	gi-gòba		**	*!	
c.	gu-gòba		***!	*	
d.	gi_1-$gò_1$ba		**		**!* (io; [hi], [bk], [rd])
☞ e.	gu_1-$gò_1$ba		**		* (uo; [hi])
f.	gi_1-gi_1ba	*!	*		
g.	go_1-$gò_1$ba		***!		

Igbo, discussed in Alderete et al. (1999), is an interesting case in which full copy occurs, in satisfaction of IDENT-[all]-VV-O, but if full copy would violate the higher-ranking markedness constraint *[−high], partial copy results instead. As seen in the data below, a high vowel is copied in its entirety (a), but in case the closest vowel is [−high], the emergent requirement that vowels agree with the preceding consonant in labiality (b) or palatality (c) is enforced; even more submerged is the emergent requirement of rounding harmony, which occurs when neither total vowel identity nor CV agreement are possible. When neither total identity nor CV harmony are enforced, the prefix vowel simply defaults to [i], as in Nupe (and Yoruba) (e), though it still obeys ATR harmony.

(48) Igbo gerundives:

a.	ti-ti	'cracking'	b.	cɪ-cɔ	'seeking'
	ji-ji	'snapping'		nʸi-nʸu	'shadow'
	mɪ-mɪ	'drying'	c.	bu-be	'cutting'
	nu-nu	'pushing'		g͡bu-g͡be	'crawling'
	ju-ju	'being full'	d.	kʊ-kɔ	'telling'
	mu-mu	'learning'		nu-no	'swallowing'
			e.	ki-ke	'sharing'
				nɪ-na	'going home'

This pattern has many facets, including two interesting TETU effects — emergent CV harmony and emergent VV-harmony in single features. CV harmony is enforced by CORR-CV, which compels the segments in a CV sequence to correspond, and IDENT-[lab/pal] CV-O, which compels corresponding C and V to agree in the features [labial] and [palatal]. VV harmony is enforced by CORR-VV, which compels vowels to correspond, and IDENT[+rd]-VV-O, which compels corresponding vowels to agree in [+rd]. Both CV and VV harmony are potentially obscured by the imperative of total VV identity, IDENT-[all]-VV-O, that compels corresponding vowels to be identical. But when satisfaction of IDENT-[all]VV-O is made impossible by the demands of the higher-ranked markedness constraint against [−high] vowels whose effects emerge on the prefix vowel, the lower ranking correspondence imperatives take effect, and harmony emerges. In the tableau below, the total VV identity mandate, IDENT-[all]-VV-O, ranks below *[−high] and CORR-VV, ensuring correspondence even when total identity cannot be enforced. CORR-CV and its counterpart, Ident-[lab/pal]-CV-O, rank below IDENT-[all]-VV-O, such that they are satisfied only when they don't conflict with total identity. Even lower ranked are the individual feature identity constraints on the corresponding vowels, requiring them to be identical in [round].

(49)

	/V-mɪ/	*[−high]	CORR-VV	IDENT-[all]-VV-O	IDENT-[lab/pal]-CV-O	IDENT-[+rd]-VV-O	CORR-CV
a.	m$_1$ɪ$_{1,2}$-mɪ$_2$				*!		
b.	m$_1$ʊ$_{1,2}$-mɪ$_2$			*!		*	
☞ c.	m$_1$ɪ$_2$-mɪ$_2$						*
	/V-n^{y}o/						
☞ e.	n$^y{}_1$i$_{1,2}$-n^{y}o$_2$	*		*		*	
f.	n$^y{}_1$o$_{1,2}$-n^{y}o$_2$	**!			*		
g.	n$^y{}_1$u$_2$-n^{y}o$_2$	*		*	*!		
h.	n$^y{}_1$i$_2$-n^{y}o$_2$	*		*		*	*!
	/V-kɔ/						
i.	k$_1$i$_{1,2}$-kɔ$_2$	*		*		*!	
☞ j.	k$_1$u$_{1,2}$-kɔ$_2$	*		*			
k.	k$_1$i$_2$-kɔ$_2$	*		*		*!	*
l.	k$_1$u$_2$-kɔ$_2$	*		*			*!
m.	k$_1$ɔ$_{1,2}$-kɔ$_2$	**!					

This brief demonstration should be sufficient to show that partial assimilation, rather than total assimilation, can be forced when markedness constraints rank high enough. This is just like the BRCT approach to TETU, in which total reduplicative identity is reduced to partial identity under the impetus of markedness considerations. But in (49) the correspondence is strictly phonologically motivated; there is no abstract morpheme RED and there is not BR correspondence per se.

As Kim (2007) has observed, the default to partial assimilation when total assimilation is impossible is not the only option. It is also possible for the next-best option, after total assimilation, to be reversion to the default segment, without partial assimilation at all. Kim documents one such case — which she terms 'sour grapes' harmony — in Huave, where underspecified suffix vowels either assimilate totally to a preceding vowel or default to /i/, depending on whether total assimilation is allowed by high-ranking markedness constraints.

To sum up to this point, the Dual Theory predicts TETU effects in phonological duplication, but not in morphological doubling. The prediction that TETU effects do not occur in morphological doubling is supported by the observation that TETU does not occur in total reduplication.

An interesting elaboration of this observation is that even internal to partial reduplication, TETU effects are much stronger with CV or single-segment reduplication than they are with reduplication patterns in which the reduplicant is foot-sized. An interesting take on this generalization is suggested in Urbanczyk (2006), who observes that internal to Lushootseed, CV reduplication exhibits more TETU effects than CVC partial reduplication. Urbanczyk captures the difference between the two patterns by treating CVC reduplicants as morphological roots, and CV reduplicants as affixes. Because Faith-BR-Root always outranks Faith-BR (which applies to roots and affixes alike), Urbanczyk is able to model the situation in which only affixal reduplicants are subject to reduction:

(50) $\text{F}\textsc{aith}_{\text{BR}}$-Root ≫ Markedness ≫ $\text{F}\textsc{aith}_{\text{BR}}$

However, nothing rules out the ranking of Markedness higher than both $\text{F}\textsc{aith}_{\text{BR}}$ constraints, in which case TETU effects would apply to reduplicants of any morphological category, whether total, Foot-sized or Affix-sized. By contrast, the Dual Theory predicts TETU effects only in very small reduplicants, those derived by phonological duplication.

A survey of a number of cases of partial reduplication that are unambiguously morphologically driven suggests that while some reduplicants exhibit stress shift, tone melody replacement, or ablaut, we do not find clear and obvious cases of segment inventory reductions or syllable structure simplification. Thus, for example, we observe foot reduplication in Manam: *salaga* → *salaga-laga* 'long', *malaboŋ* → *malaboŋ-boŋ* 'flying fox'. We do not find, or expect to find, the TETU counterpart: **salaga-ʔaʔa* or **salaga-tata* or **salaga-titi*; we do not find **malaboŋ-boʔ or* **malaboŋ-ʔoŋ*. Diyari disyllabic foot reduplication is faithful, other than the ban on final consonants imposed on all prosodic words, not just reduplicants: *wil̪a-wil̪a* 'women', *t^j^ilpa-t^j^ilparku* 'bird sp.' (Austin 1981; Poser 1989; McCarthy 1999: 263). We do not find cluster reduction and/or inventory reduction: **t^j^ipa-t^j^ilparku,* **t^j^ilta-t^j^ilparku*, etc. Partial reduplication is thus really no different from total reduplication: when reduplication is clearly morphological, TETU effects do not arise.

In sum, TETU effects, namely the suppression of marked features or other structures in reduplicants is predicted in the Dual theory to occur systematically only under phonological duplication (and even there TETU is of course not necessary); TETU is not predicted to be occur systematically in morphological doubling, any more than context-free structural simplification or segment inventory contraction is expected in any stem-forming cophonology.

4.4. *Locality*

It is a characteristic of phonologically driven duplication that the elements which duplicate are the closest possible segments. In Ponapean, when a copy vowel is needed to break up an illegal consonant cluster, it is the closest following vowel that is chosen (51a). In Hausa, when a consonant from the stem is copied to provide an onset within the plural suffix *-o:Ci:*, it is the closest consonant (51b). Proximity is a characteristic of phonological assimilation as well. Even when assimilation occurs at a distance, as in consonant harmony or the coda-to-coda cases collected by Zuraw (2002) and illustrated in (51c), the target assimilates to the closest trigger in the word.

(51) Phonological targets

a. Closest vowel: *ak-dei* → *ak-e-dei*, not **ak-i-dei*, etc. (Ponapean) (Rehg and Sohl 1981)

b. Closest C: *gulà:* → *gul-ò:li:*, not **gul-ò:gi:*, etc. (Hausa) (Newman 2000)

c. Closest coda: *orangutan* → *orangutang*; *pompon* → *pompom*, etc. (Zuraw 2002)

By contrast, in cases of partial reduplication in morphological doubling, it is not the case that the phonologically similar elements in "base" and "reduplicant" need be close to each other. They come from independent inputs and do not correspond, hence are not subject to mutual proximity requirements. Dramatic evidence of this come from cases of opposite side reduplication, here illustrated by Koryak reduplication (Riggle 2003), which marks absolutive case:

(52)

mɪtqa	→ mɪtqa-mɪt	'oil'
kilka	→ kilka-kil	'shellfish'
qanga	→ qanga-qan	'fire'
yilqa	→ yilqa-yil	'sleep'

Koryak meets the description of morphological doubling. The purpose of reduplication is strictly morphological; the size of the reduplicant is larger than the typical phonological target; there is no segmental reduction or simplification. In the Dual Theory, Koryak reduplication is handled via morphological doubling, the juxtaposition of a noun stem and its truncated counterpart to form a derived stem whose meaning is the same as that of its input daughters but which, in addition, encodes the absolutive case. There is no connection in MDT between the part of the stem that survives truncation — beginning, end, middle — and whether it precedes or follows its (nontruncated) sister in the doubling construction. In MDT, actual Koryak is just as possible as Koryak', in which the truncated stem — e.g., *mɪt* — happens to precede (rather than follow) its nontruncated counterpart; thus both *mɪt-mɪtqa* and *mɪtqa-mɪt* are equally possible.

In phonological duplication, however, similarity and proximity determine the relationship between copy segments. If Koryak marked the absolutive with an affixed copy vowel, the linear alignment of affix and stem would determine which vowel gets copied. Thus, in hypothetical Koryak', **ɪ-mɪtya* and **mɪtya-a* would be possible outcomes, but not **a-mɪtya* or **mɪtya-ɪ*, with illegal opposite-edge copy. The proximity hierarchy makes it impossible to described mandated opposite-edge copy in general.

4.5. *Infixation*

Internal, or infixing, reduplication is a common subtype both of reduplication and of infixation. One well-known example from the literature (see e.g., Inkelas and Zoll 2005: 107, Klein 1997, Yu 2007: 126) is cited below:

(53) Chamorro (Topping 1973) stressed CV reduplication

hátsa	'lift'	háhatsa	'one that was lifting'
hugándo	'play'	hugágando	'playing'

As extensive surveys such as that of Yu (2007) have shown, internal reduplication is limited in two ways. First, internal reduplication is always local, as in the Chamorro example in (53); we never see Koryak-style opposite edge copying with infixation. Second, internal reduplication is, almost without exception, small. A rough count of the cases of internal reduplication cited in Yu turned up seven cases of CV reduplication (as in Chamorro), three cases of VC reduplication, five cases of C reduplication (as in Pima (35)), and three cases of V reduplication; all copied the nearest segments. Yu also describes at least four cases of internal reduplication of the initial consonant (e.g., Koasati (32)).

These proximity and size effects follow if internal reduplication results from phonological duplication, rather than morphological doubling. And, indeed, internal reduplication is very difficult to describe in morphological doubling theory, in which two morphological constituents of the same type and meaning are sisters in a morphological construction. Endowing the morphology with the ability to infix one stem inside another would make the pathological prediction that compounding, or incorporated nouns, or other stem-stem constructions could involve infixation as well.[17] The hypothesis made here is, thus, that because internal reduplication is not possible to describe in terms of morphological doubling, it should always show the hallmarks of phonological duplication.[18] Thorough documentation and discussion of internal reduplication is beyond the scope of this article, but the predictions are testable and await examination in future research.

5. The potential for ambiguity in (C)V reduplication

Despite their apparent differences, there is one area in which the descriptive scopes of morphological doubling and phonological duplication come close to overlapping. This is in the area of CV or VC reduplication, fairly common types of partial reduplication crosslinguistically, and illustrated below by the intensifying construction in Chamorro, which duplicates the final CV of the stem (Topping 1973: 183):

(54) Chamorro intensifying reduplication

ñálang	'hungry'	ñálalang	'very hungry'
métgot	'strong'	métgogot	'very strong'
buníta	'pretty'	bunítata	'very pretty'

CV reduplication can be handled easily as morphological doubling, with truncation of one copy to CV. It can also, fairly easily, be handled as phonological duplication, as we have seen in Yoruba, Nupe and Igbo, in which prefixation of a bare V can lead to CV reduplication. Ambiguity of analysis like this is natural and inevitable, given the presumed diachronic course of reduplication. Although not enough is yet known about the evolution of partial reduplication, it is commonly believed that partial reduplication evolves from total reduplication, and that the end stage in the developmental pathway is gemination (or, presumably, vowel lengthening). The chart in (55) is drawn from Niepokuj (1997):

(55) Presumed historical pathway of reduplication (Niepokuj 1997)
Stage 1: total: X > XX
Stage 2: one copy is reduced
Stage 3: partial
Stage 4: gemination

Support for treating CV (or VC) reduplication as deriving from V affixation — i.e., as essentially phonological in character — comes from cases in which vowel lengthening and CV (or VC) reduplication are contextually determined allomorphic alternatives. The V ~ CV alternation is reported, for example, for Miya Schuh (1998) and Bissell (2002), cited in Inkelas and Zoll (2005: 202), Kuuk Thayorre (Gaby 2006), Halkomelem (Urbanczyk 1998), and many other languages. A particularly dramatic case occurs in Cupeño, in which the habilitative is, according to Haynes (2007b), an empty mora infixed between a trochaic foot and a final consonant.[19] For penultimately stressed input stems like *yúymuk* 'be cold', the output of the habilitative is *yúymuʔuk*, with the infixal mora realized segmentally through a combination of correspondence (vowel copy) and epenthesis (the *ʔ* consonant). Confirming that these realizational tactics are phonological, stems which are monosyllabic in the input surface with two new moras, one from the habilitative infix and one inserted by the grammar to render the pre-infixal stress foot disyllabic: *tewáʂ* → *tewáʔaʔaʂ*. Regardless of the provenance of the (otherwise) empty mora — underlying representation vs. epenthesis to repair the foot — its consonant and vowel are supplied in the same way, namely the optimal way given the ranking of constraints in Cupeño grammar. Treating V insertion and CV reduplication as possible co-existing outcomes of empty mora insertion in a given language also generates the further expectation that CV reduplication could alternate with consonant gemination as a means of realizing the inserted mora. This alternation is found in Washo (Yu 2005b), Bole (Schuh 2001), and many other languages. The evolution from CV reduplication to C gemination (via syncope) is extremely well documented (see e.g., Blevins 2004).

6. Implications for GTT

Generalized Template Theory (GTT; McCarthy and Prince 1994b, Urbanczyk 1995, 1996, 2000, 2006 and, from a different perspective, Downing 2006) is a theory developed within the overall framework of BRCT in which reduplicative size and shape are determined by classifying individual RED morphemes as roots vs. affixes. This dichotomy has an essentially phonological purpose, as seen in the earlier discussion of Urbanczyk's (2006) analysis of Lushootseed, in which reduplicants classified as Roots are subject to minimal size constraints — typically two moras or more — and are less prone to structural simplification or segmental reduction than are Affix reduplicants. The essential insight of GTT is that Root-sized reduplicants will show Root-style phonology, while Affixes will show Affix-style phonology, whatever that might be for the language in question; as Urbanczyk (2006) observes, this generates an implicational prediction within every language to the effect that Root-sized reduplicants will never be required to be smaller than, or less faithful to, the Base than Affix-sized reduplicants will be required to be. Urbanczyk confirms this prediction for Lushootseed, in which the reduplicative distributive prefix is both larger and more marked — Cə́C — than the diminutive, which is Cí in form:

(56) Lushootseed (Urbanczyk 2006)
a. ǰə́səd ǰə́s-ǰəsəd 'foot/feet'
b. ǰə́səd ǰí-ǰəsəd 'foot/little foot'

An alternative analysis of Lushootseed, in the Dual Theory, would be to classify CVC reduplication as morphological doubling (with truncation), and CV reduplication as phonological duplication. This distinction would explain the same phonological asymmetries Urbanczyk points out. An advantage to making the needed distinction via the Dual Theory rather than by classifying one reduplicant as a Root and another as an Affix is that, as Inkelas and Zoll (2005) have observed, the Root-Affix distinction may be needed for an independent, purely morphological purpose, not for the purpose of predicting phonological size or susceptibility to reduction. Inkelas and Zoll cite a number of languages exhibiting affix doubling constructions in which a particular affix is doubled, either partially or in its entirety, to some morphological end (see also Mühlbauer 2003). These are different from stem doubling constructions, in which an entire stem, whether simplex or complex, is the target of doubling. In Dyirbal, for example, the nominal suffix *-ŋaŋgay* 'without' can reduplicate, intensifying its semantic contribution (Dixon 1972: 242, cited in Inkelas and Zoll 2005: 27):

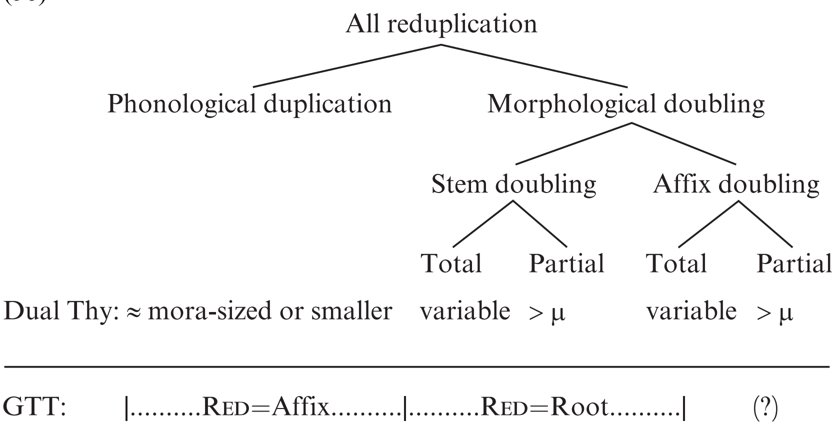
(57) bana 'water'
bana-ŋaŋgay 'without water'
bana-ŋaŋgay-ŋaŋgay 'with absolutely no water at all'

When affix doubling has no apparent semantic effect distinct from what would be expected from a single instance of the affix, the term 'multiple exponence' is often used; see e.g., Stump 1991. In cases where affix doubling contributes new meaning, either iconic (as in Dyirbal) or more idiomatic (as in some other cases cited in Inkelas and Zoll 2005), it can only be called affix reduplication.

Further support for transferring the responsibility for prosodic size of reduplicants, in particular, away from the Root-Affix distinction is the evidence assembled by Downing (2006) that there is a tight correlation between prosodic size and morphological complexity, with morphologically complex constituents required to be phonologically binary, a size restriction that monomorphemic constituents, even roots, can evade.

In sum, there is much evidence within reduplication that the reduplication of small amounts of material functions differently, phonologically, from the reduplication of larger amounts of material, and that the duplication of roots can be distinguished from the reduplication of affixes. The major cuts drawn in reduplication by the Dual Theory and by GTT are shown below. (Affix doubling per se is not discussed in the GTT literature, though we assume that, since the affix doubling cases we are aware of include large size and do not show reduction, they would need to be included under the Red=Root category.)

(58)



As can be seen, there is significant isomorphism in the major theory-internal classification of reduplication types, though the character of the division is explained very differently in the two approaches.

7. Implications for BRCT

A result of adopting the Dual Theory of reduplication is that the abstract morpheme Red that drives reduplication and reduplicative correspondence in BRCT plays no role either in phonological duplication or in morphological doubling. The Dual theory thus takes to the logical limit a recent steady trend towards a-templatic reduplicative analyses, even within BRCT, in which the role of Red and constraints specific to it have been eroding (see e.g., Gafos 1998b; Hendricks 1999, 2001; Riggle

2006; Yu 2005a; Pulleyblank 2008). The loss of RED aside, however, one very essential insight of BRCT does live on in the Dual Theory, and that is that reduplication can result from string-internal output correspondence. In BRCT, all reduplication is characterized in this manner, while in the Dual Theory, only phonological duplication is arrived at through correspondence. As we have seen, restricting correspondence to phonological duplication correctly predicts the clustering of TETU effects just in this domain.

Another advantage of recognizing the more limited role that correspondence plays in reduplication lies in the elimination of certain pathological predictions that BRCT has been observed to make for morphological reduplication. As carefully argued in McCarthy and Prince (1995), a prediction BRCT makes is that BR correspondence, being bidirectional, can produce opacity effects (overapplication/overcopying, or underapplication/undercopying) in reduplicants or in bases. In support of this prediction, they cite cases like Chumash, in which the posited input /s-RED-ikuk/ surfaces as *sik-sikuk* 'he is chopping, hacking', with an opaque root-initial *s*, not the expected **s-ik-ikuk* which the input structure would seem to predict. McCarthy and Prince (1995) attribute this opaque overcopying effect to BR correspondence. Inkelas and Zoll (2005: Chapter 5) argue that this and many other key examples of opacity in the BRCT literature do not require BR correspondence to achieve, that many opacity effects in reduplication either vanish (as in the Chumash case) under a different morphological analysis (namely: /RED-s-ikuk/) or are simply cyclic phonological effects of the type that normally arise in complex morphological structures, along the lines of the approach to opacity taken in Kiparsky (2000). Inkelas and Zoll point out (pp. 162–163, 175) that by deriving all reduplication, even total reduplication, by correspondence, BRCT predicts apparently unattested opacity effects like the following hypothetical examples: /bihan-RED/ → *biham-biham* (overcopying of an internal junctural assimilation) or /tapan-RED-la/ → *tapal-tapal-la* (overcopying of an external junctural assimilation). However, the insight in BRCT that opacity can result from correspondence is still correct, even if correspondence happens not to be the source of opacity in all of the examples cited in the BRCT literature, and even if it makes pathological predictions for morphological reduplication examples like the ones just cited. In the Dual Theory, opacity by correspondence is predicted to be possible just where correspondence itself is the source of reduplication — namely in phonological duplication. This is correct. A striking illustration can be found in Woleaian, in which a structure created via reduplication is itself reduplicated (Kennedy 2003, citing primary sources). In Woleaian, progressive verbs are formed by prefixing a CV reduplicant and geminating the base-initial consonant, as shown below:

(59)	metafe	'to be clear'	mem-metafe	'to become clear'
	pirafe	'steal'	pip-pirafe	'to be stealing'
	toro-fi	'catch it'	tot-toro	'to catch'

The opacity effect in Woleaian has to do with junctural geminate consonants. Several consonants in the Woleaian inventory change in quality when geminated; singleton *l* geminates as *nn*, *g* as *kk*, r and *š* as *cc*, and *ß* as *bb*. Under progressive reduplication, the copied onset consonant reflects the qualitative changes in the outcome of gemination (Kennedy 2003: 173):

(60)	gematefa	'explain it'	kek-kematefa	'be explaining it'
	lüwanee-y	'think (it)'	nün-nüwane	'to think'
	raŋe	'yellow powder'	cec-caŋe	'apply powder'
	ʃalü-w	'water'	cec-calü	'to stick to'

This is not a situation that morphological doubling can handle — since in morphological doubling there is no phonological correspondence between the copies that could motivate the "overapplication" of geminate phonology in the reduplicant — but it is a situation that phonological duplication can, and should, handle. Progressive reduplication in Woleaian geminates the stem-initial consonant, an operation used independently in the language for the formation of denotatives (e.g., *feragi* 'spread', *fferagi* 'to be spread'; *ßuga* 'boil it', *bbuga* 'to boil') (Kennedy 2003: 174) and prefixes a vowel which copies its features from the closest following vowel. Onset requires insertion of an epenthetic consonant, which copies its features from the closest following consonant — which happens to be the stem-initial geminate. Thus epenthetic onsets opaquely reflect geminate phonology.

This is the kind of phenomenon that BRCT handles well, except that BRCT overgenerates by predicting it in the areas of total and partial morphological reduplication, where it does not occur to the same degree as in the phenomena classified here as phonological duplication. Inkelas and Zoll (2005: 162) cite hypothetical cases like *bihan-Red → biham-biham* to show that reduplication of junctural phonology does not occur in morphological reduplication (see also McCarthy and Prince 1995: 327–328).[20]

In sum, the prediction of BRCT that overapplication can be driven by correspondence is correct — but only for a restricted subset of types of reduplication, namely those driven by the phonology. The difference between the Dual theory and BRCT in this regard lies not in whether correspondence is used but in the extent of its role.

8. Conclusion and implications

This article has argued, building on Inkelas and Zoll (2005), Yu (2005a), and Pulleyblank (2008), for the Dual Theory, an essential typological distinction within reduplication between phonological vs. morphological doubling. This is not a unidimensional taxonomy but rather a typology in which many properties cluster together. We have argued, first, that phonological duplication, (i.e., duplication for a phonological purpose such as providing an onset or nucleus for a syllable), is a kind of phonological copying or assimilation. It follows from this that duplication will be minimal in size, that phonological copying will be maximally proximal, that phonologically duplicated material will show TETU and opacity effects relating to the phonological correspondence that spawns it. The second category, morphological doubling, is the double insertion of a morphological constituent, as required by the morphology. Its function is to mark a change in meaning or create a new stem type. In general morphological doubling is not size-restricted (phonologically); "source" and "copy" (insofar as those terms even mean anything) are not necessarily proximal, and morphological doubling shows no TETU or opacity effects relating to phonological correspondence, because there is none.

The Dual Theory maintains key insights of previous approaches to reduplication: the correspondence relation that drives BRCT is very much a force in phonological duplication; the trend towards a-templatic analyses of reduplication also find a home in phonological duplication; and the growing literature on multiple exponence and copy without deletion resonate with the morphological doubling analysis.

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Notes

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1. Black analyzes weak roots with underlying schwa; as vowel quality is predictable I have omitted the vowel here, to make the distinction between root types clearer. See Black (1996: 203, 210 ff.) for discussion of weak vs. strong roots.
2. Stem-forming constructions of this type might be classified under "readjustment" in theories like Distributed Morphology, where all morphology is exponence-driven; Halle and Marantz (1994).
3. One case of truncation to CV in Zuni — accompanied by suffixation — is discussed in McCarthy and Prince (1986) (see e.g., McCarthy and Prince 1996: 49), based on Newman (1965).
4. Prior to OT, a version of string-internal correspondence was developed by Hayes (1990), who recognized the virtues of correspondence (co-indexation) over autosegmental spreading in the analysis of diphthongization.
5. Vowel harmony (and vowel copy) are handled with autosegmental spreading instead of correspondence by Kawahara (2003), Rose and Walker (2004), based in part on the observation that consonantal interactions operate at greater distances than vowel interactions; it would take more space than is available here to address their arguments in proper detail, but it is hoped that the greater sensitivity of the correspondence theory used here overcomes the objections they raise.
6. As Hansson (2001) notes, building on Suzuki (1998), correspondence relations can also be used to generate dissimilation effects. These would require anti-identity (¬IDENT-F-O, rather than IDENT-F-O) constraints.
7. Note: in Hansson's analysis of Ngizim, CORR-TS is called 'CORR-[voi,Place]'; CORR-SG is called 'CORR-[voi,Place,cont]'; CORR-TN is called 'CORR-[voi,son]'. Hansson names similarity-based correspondence constraints according to the features in which the corresponding consonants are allowed (though of course not required) to differ.
8. Interestingly, although it is not the subject of this article, dissimilation is subject to the same correspondence similarity thresholds. Hansson (2001) notes, for example, that in Bade, voicing *dissimilation* applies under the same similarity conditions that voicing *assimilation* applies in Ngizim: a nonimplosive consonant will dissimilate in voicing relative to another nonimplosive consonant in the same root. Thus not only IDENT but also the OCP (or other dissimilation-triggering markedness constraints) is stated on pairs of corresponding segments.
9. See Kawahara (2003) and Kim (2007) for recent discussion of "echo epenthesis" effects of this sort.
10. A similar phenomenon obtains in Temiar; see e.g., Gafos (1998a).
11. Rather than folding structural role in to the similarity hierarchy, as is done here, Rose and Walker (2004) state the constraint independently. As their focus is consonant harmony, the constraint is stated in terms of consonants. σ-ROLE(CC), based on the earlier StRole used in BRCT by e.g., McCarthy and Prince (1995), says that "corresponding consonants (in the output) must have identical syllable rules" (Rose and Walker 2004: 511). This form of the constraint is also used by Yu (2005b) in his analysis of Washo.
12. In the case of vowel-initial stems, the first stem consonant — even though not absolutely initial in the stem — copies: *alóːtkan* → *alotlóːkan* 'to be full'. The choice of copy, rather than epenthesis or resyllabification, to supply *-oː-* with an onset is due to higher-ranked constraints, not shown in this tableau.
13. Evaluation of CORR here glosses over the issue that the stem *cofoknan* is itself multimorphemic; however, on any kind of theory of 'bracket erasure', only the boundary between the affix and the base of affixation will be visible on any affix cycle, boundaries internal to the base of affixation being inaccessible (see e.g., Orgun and Inkelas 2002). That is what I will assume here.

14. As discussed by Haynes (2007a), facts like these in Kwakwala and Lushootseed led Struijke (1998, 2000a, 2000b) — who assumed a prefixing analysis — to propose Existential Faithfulness as a means of accounting for the apparent effect where the reduplicative prefix faithfully reflects the input while the base is reduced (here, by vowel loss). However, on the infixing analysis, this theoretical "fix" of BRCT is unnecessary.
15. Alderete et al. (1999) explain that their analysis would work equally well whether the entire /i/ vowel were epenthetic, or just its features; in their paper they illustrate the former option, but I choose the latter here since it better illustrates the potential for TETU in phonological duplication. They also use, with explanation, the shorthand constraint "Reduce" to cover the specific bans on marked vowel feature values that I use here for greater clarity in this particular example. The choice of [h] to serve as the hypothetical default consonant in Yoruba is based on a hypothetical consonant epenthesis candidate in a discussion of Yoruba reduplication in Pulleyblank (2008).
16. As Downing (2005) has observed, tonal neutralization is a not infrequent concomitant of total reduplication. Tone is one of the few phonological dimensions along which it is fairly common to find total replacement, or neutralization, in stem-formation as well.
17. As Anne Pycha points out, expletive infixation in English is presumably a case of exactly this kind; however, expletive infixation lives on the margin between grammar and language games, and if the only cases of stem infixation belong to language play, they may thus constitute the exception that proves the rule — in this case the rule that morphology does not infix stems inside other stems.
18. Yu (2007: Chapter 4) does discuss three cases of foot reduplication — seemingly, because of reduplicant size, all cases of morphological duplication — in Kamaiurá, Amis, and Thao, which are classified as internal reduplication inasmuch as the reduplicant appears to be infixed before the final consonant. In Kamaiurá, for example, *omotumuŋ* reduplicates as *omotumutumuŋ* 'he shook it repeatedly' (p. 113), with the second *tumu* substring identified as the reduplicant. In all three of these cases, however, consonant clusters of the type that would be produced if a copy of the final foot were suffixed are phonotactically impermissible, making it possible to suggest that the appearance of infixation is actually the result of juxtaposition and consonant cluster reduction (*omotumuŋ-tumuŋ* → *omotumutumuŋ*). This is what would be required to maintain the claim that internal reduplication is always phonological duplication. Yu (2007: Chapter 6) also discusses a number of language games whose infixing reduplication goes beyond what is possible to describe as phonological duplication, but which do not appear really to meet the description of morphological doubling either.
19. Haynes takes her data from Hill (2005); the data have also been discussed by Crowhurst (1994), who provides a different, templatic analysis.
20. The famous example of Malay total reduplication (McCarthy and Prince 1995), with opaque overapplication of vowel nasalization, is an exception.

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