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Copying and spreading in phonological theory: Evidence from echo epenthesis*

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0. Abstract

Correspondence plays a fundamental role in current phonological theory: it governs input-output mapping as well as reduplicative copying (McCarthy and Prince 1995). A number of recent proposals claim that correspondence-based copying should be extended to non-reduplicative domains such that it replaces works previously explained by autosegmental spreading (e.g., Kitto and de Lacy 1999; Krämer 1999; Rose and Walker 2004). The role of spreading in phonological theory has thus been questioned. However, based on a cross-linguistic typological study of reduplication and echo epenthesis (also known as copy-vowel epenthesis), this paper argues that echo epenthesis is invariably achieved by spreading, and never by correspondence-based copying. This proposal entails that spreading is a necessary part of phonological theory distinct from correspondence-based copying, and further requires that correspondence never be used to satisfy purely phonological requirements. This claim is a defense of Prince's (1987) view within the more recent framework of Optimality Theory (Prince and Smolensky 1993) that copying is fundamentally morphological.

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1. Introduction

It is not uncommon for a single underlying segment to appear more than once in surface forms. A simple example is gemination, where an underlyingly single consonant is doubled in the output. Autosegmental spreading (Goldsmith 1976 et seq.) has figured prominently in discussion of this and related phenomena. A copy of a segment is created by total spreading.

Another mechanism commonly used in analyzing these phenomena is melodic copying, proposed by Marantz (1982), and more recently, correspondence-based copying (McCarthy and Prince 1995) within the framework of Optimality Theory (OT; Prince and Smolensky 1993). This mechanism, just like autosegmental spreading, creates a copy of an underlyingly single segment. This sort of copying mechanism was originally proposed for reduplication. Some proposals, however, extend this mechanism to non-reduplicative contexts, claiming that copying can and should be used for some or all phenomena hitherto explained by spreading (Bat-El 1984; Buckley 1990; Steriade 1986; Sloan 1988 for pre-OT literature; see §3 for OT-based proposals). As a consequence, the role of spreading in phonological theory has recently been called into question (Bakovic 2000; Kitto and de Lacy 1999; Krämer 1999); at the very least, the distinction between copying and spreading has been blurred. If copying and spreading have similar functions, is spreading independently necessary? To the extent that these two are different mechanisms, is there a clear division of labor between spreading and copying? If so, where does the border lie? These questions have not been satisfactorily addressed in current phonological theory.

Based on the typology of echo epenthesis (also known as copy-vowel epenthesis) in comparison with that of reduplication, this paper addresses these questions, and provides evidence that there is a clear distinction between spreading and copying. I propose an explicit division of labor between spreading and copying, where copying is strictly restricted to the domain of morphology. The use of correspondence outside of morphological contexts (i.e., reduplication) predicts unattested patterns, and therefore should be eliminated from phonological theory. Spreading, instead, is responsible for all purely phonological phenomena. This claim that the use of correspondence is restricted to morphology is a revival of Prince's pre-OT claim that "copying […] is fundamentally obliged to morphology" (1987: 507). This paper is fundamentally a defense of Prince's view within the context of Optimality Theory (Prince and Smolensky 1993).

The primary evidence for my claims comes from the typology of echo epenthesis, in comparison with reduplication. In echo epenthesis, the epenthetic vowel quality is determined by a neighboring vowel. Illustrative examples from Kolami are given below, in which the epenthetic vowels agree with the preceding vowels in quality:

(1) Kolami echo epenthesis (Zou 1991: 463)

/ayk+t/ →	[ay<u>a</u>kt]	'swept away'	cf. /ayk/ →	[ayk]
/erk+t/ →	[er<u>e</u>kt]	'lit (fire)'	cf. /erk/ →	[erk]

I show that, though echo epenthesis is superficially similar to reduplication in that one underlying segment is pronounced twice in the output, it exhibits different typological properties from reduplication. To account for the differences between echo epenthesis and reduplication, I argue that echo epenthesis is always achieved by autosegmental spreading and never by correspondence-based copying, despite Kitto and de Lacy's claim (1999) to the contrary. I show that with rather uncontroversial assumptions about spreading—that it is subject to a locality requirement and that it affects intervening segments—all of the properties of echo epenthesis follow without further stipulation. A view that recognizes only correspondence-based copying and not spreading is less restrictive than a theory that admits both copying and spreading with a clear division of labor. The copying-only theory might seem simpler, but it predicts patterns that never occur, and this theory would thus require unmotivated stipulation to be appropriately restrictive.

The rest of the paper proceeds as follows. §2 summarizes typological observations about echo epenthesis in comparison with reduplication, which the rest of the paper attempts to account for. In §3 I formalize my proposal while laying out my background assumptions. §4-§7 each take up one difference between echo epenthesis and reduplication, showing in detail how my proposal explains such differences, and how a theory with no spreading/copying distinction fails to account for the differences. The final section concludes this paper.

2. Differences between echo epenthesis and reduplication

Based on my cross-linguistic typological survey of echo epenthesis patterns (see the Appendix for the list), I have identified four characteristics of echo epenthesis that differ from reduplication. These differences, which any theory of phonology must account for, are the major concerns of this paper. In order to clearly distinguish echo epenthesis and reduplication, all echo epenthesis patterns surveyed here are inherently phonological (i.e., triggered by phonological requirements), whereas all the reduplicative patterns discussed in this paper are clearly morphological in that an additional morpheme is involved.

The first difference between echo epenthesis and reduplication is that consonants are freely copied across vowels in reduplication. This is a very common pattern, as illustrated in Agta: /RED+takki/ → [t̲ak̲-takki] 'leg(s)' (Marantz 1982: 447). On the other hand, long-distance consonantal echo epenthesis is never found: there are no patterns like (2), where, without a RED morpheme, onset consonants are created via long-distance echo epenthesis of consonants across vowels.

(2) Hypothetical long-distance consonantal echo epenthesis: unattested

/apa/	→	[p̲apa]
/ata/	→	[t̲ata]
/aka/	→	[k̲aka]

Second, reduplication can skip the closest available segment to satisfy other phonological requirements, but such a pattern is unattested for echo epenthesis. For instance, reduplication in Nakanai (Johnston 1980) preferentially targets the most sonorous segment in the base regardless of the distance between corresponding segments, as the data in (3a) illustrate. Such a pattern (as in (3b)) is unattested in echo epenthesis.

(3) a. Sonority-based reduplication in Nakanai

/RED+taro/	→	[ta-taro]	'away'
/RED+mota/	→	[ma-mota]	'vines'
/RED-biso/	→	[bo-biso]	'two by two'

b. Sonority-based echo epenthesis: unattested

/tmeta/	→	[tameta]
/tmute/	→	[temute]

Third, in reduplication it is not uncommon for a long vowel to be copied as long, and a short vowel as short. This is exemplified by Kihehe reduplication: /mi-doodo+RED/ → [mi-doodo-doodo] 'fairly little' (Odden and Odden 1985), where length is faithfully transferred from the base to the reduplicant. The present survey has not found a case in which such length transfer occurs in echo epenthesis.

Finally, some echo epenthesis cases fail when certain types of segments intervene. In these cases, a default segment is inserted, as illustrated in (4) by Japanese loanword epenthesis.

(4) Japanese loanword echo epenthesis

a. Echo across [h]

/bax/	→	[bahha]	'Bach'
/gox/	→	[gohho]	'Gogh'

b. Default vowel [ɯ] inserted if a superlaryngeal consonant intervenes

/bʌs/	→	[basɯ]	'bus'
/kæp/	→	[k^{j}appɯ]	'cap'

Reduplication does not exhibit such behavior, except in very special circumstances (see footnote 14).

The differences between echo epenthesis and reduplication are summarized in (5):

(5) Differences between reduplicative copying and echo epenthesis

	Reduplication	Echo epenthesis	Discussed in
Long-distance consonant copy	Yes	No	§4
Copy of a distant target	Yes	No	§5
Length transfer	Yes	No	§6
Blockage by some intervening segments	No (but see §7)	Yes	§7

3. Background and proposal

To explain the differences between echo epenthesis and reduplication described in §2, I propose that echo epenthesis should be treated as spreading of V-Place with concomitant interpolation of a new root node, as depicted in (6)[1] (see, e.g., Clements 1991; Ní Chiosáin and Padgett 1993; Odden 1991; Padgett 1995 for V-Place in feature organization).

(6) Echo epenthesis as spreading of V-Place

```
 /μ/     →        [μ     μ]
  |                |     |
  Rt               Rt    Rt
  |                |____/
V-Place          V-Place
```

By contrast, in reduplication, copying by correspondence is mainly responsible for providing segmental material to a phonologically empty morpheme, RED (McCarthy and Prince 1993).[2] This, as I argue below, has different characteristics from the spreading in (6).

In this section, I first make explicit my assumptions about spreading, which allow an account of the characteristics of echo epenthesis. Then, I propose a restriction on correspondence that guarantees that echo epenthesis is always achieved by autosegmental spreading.

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[1] This proposal that echo epenthesis is spreading is a defense of a fairly traditional view. A spreading analysis of echo epenthesis has been proposed by various authors including Akinlabi (1993); Bugenhagen (1995); Clements (1987, 1991); Gafos and Lombardi (1999); Halle et al. (2000); Ka (1994); Ní Chiosáin (1995); Nichols (1994); Paradis (1996); Paradis and Prunet (1989); Shademan (2003); Uffmann (2001, 2003); and Zou (1991). A similar approach within the framework of Articulatory Phonology (Browman and Goldstein 1992) is found in Hall (2003) and Steriade (1990). An opposing view, which treats echo epenthesis as deriving from correspondence, is proposed by Kitto and de Lacy (1999).

[2] It is possible, however, that languages use epenthesis or spreading for assigning exponence to RED in particular contexts when forced to do so by high-ranked constraints. See Alderete et al. (1999) and Urbancyzk (1999) for discussion; see also footnote 14.

3.1 Background: spreading and correspondence-based copying

First of all, I assume that spreading is local: spreading cannot skip over a potential target.[3] A gapped configuration like (7), where spreading skips a potential anchor, is thus prohibited (Archangeli and Pulleyblank 1994; Gafos 1996, 1998; Gafos and Lombardi 1999; McCarthy 1994b, 1998; Ní Chiosáin and Padgett 1997, 2001; Padgett 1995; Shademan 2003; Walker 1998, 2000). It is irrelevant to the current proposal whether such locality is enforced at a strictly segmental level or on a relativized feature tier.

(7) Gapped spreading (prohibited)

X_1 X_2 X_3

Y

This means that if an autosegment Y spreads to X_1 from X_3, then it must also necessarily spread onto X_2, as X_2 is an intervening potential anchor for Y; in other words, if a feature (or a segment) spreads from one position to another, it necessarily affects any and all intervening segments. Locality of spreading also means that if Y cannot spread onto X_2, then it cannot spread onto X_1 either: spreading is affected (blocked) by intervening segments. I collectively refer to these characteristics of spreading as "sensitivity to intervening segments."

I will also make the uncontroversial assumption that copying does not have such sensitivity. That is, when a segment is copied by correspondence from one position to another, it neither affects intervening segments, nor is it blocked by intervening segments.

3.2 Formalization

To explain the differences between reduplication and echo epenthesis, I argue that echo epenthesis always involves spreading rather than correspondence-based copying. To guarantee this, phonological theory must be *un*able to achieve correspondence-based copying in the absence of a reduplicative morpheme (RED). I thus propose a restriction on non-morphological correspondence.

There are two mechanisms that can achieve copying by correspondence outside of reduplication in current formulations of correspondence theory. They are visually illustrated below in (8) ("S" stands for a segment; arrows stand for a correspondence relationship):

[3] Gafos (1996, 1998), McCarthy (1998), and Ní Chiosáin and Padgett (1997, 2001) derive this restriction on spreading by considering spreading to be an extension of articulatory gestures in the time domain. See also Browman and Goldstein (1992), Hall (2003), and Steriade (1990) for a related proposal.

(8) Two ways to achieve copying outside of reduplication

(a) $/\ldots S_u \ldots/$

$[\ldots S_1 \ldots S_2]_{morph}$

Surface-to-surface correspondence

(b) $/\ldots. S_u \ldots/$

$[S_1 \ldots S_2]_{morph}$

Multiple-IO mapping

(8a) achieves copying by way of surface-to-surface correspondence, as does reduplication, but (8a) does not involve any RED morpheme unlike reduplication (Goad 2001; Hall 2003; Hansson 2001; Kitto and de Lacy 1999; Krämer 1999; Pater 2003; Rose and Walker 2004; Yu 2003; Zuraw 2003). (8b) involves splitting, in which there are two output correspondents of one input segment (Gafos 2003; Kawu 2000; Nelson 2003; Struijke 2000; Urbanczyk 1998; Ussishkin 2000). I collectively refer to these mappings as "non-reduplicative copying," since both achieve correspondence-based copying without RED.

Allowing these types of mappings predicts that echo epenthesis can be achieved by non-reduplicative copying, and it predicts several unattested echo epenthesis patterns, as will be discussed in §4-7. I thus argue that these mappings should be rendered impossible. Meanwhile, copying must be possible for reduplication, i.e., where an independent morpheme, which is usually taken to be a phonologically empty morpheme RED (McCarthy and Prince 1993), is involved. Therefore, the correspondence relation depicted in (9) below should remain possible:

(9) Reduplicative copying

$/\ldots S_u \ldots + \text{RED}/$

$[\ldots S_1 \ldots]\ [\ldots S_2 \ldots]_{RED}$

The generalization is that there cannot be two output correspondents of one input segment in the same morpheme. Therefore, to rule out (8a) and (8b) while allowing (9), I propose to impose the restriction on correspondence in (10) and claim that candidates that violate (10) are not produced by GEN.

(10) A restriction on correspondence

i) Every output correspondent of an underlying segment must be licensed by a morpheme M.
ii) If a morpheme M licenses one output correspondent of an input segment S, M cannot license any other output correspondents of S.

(8b) is straightforwardly ruled out by (10) because with (8b), either S_1 or S_2 is unlicensed: a single morpheme cannot license two correspondents of one input segment. One might argue that in (8a), S_2 is not a direct correspondent of the underlying S_u, so it does not violate (10). However, we can assume that correspondence is transitive, that is, if S_u corresponds to S_1, and S_1 corresponds to S_2, then S_u and S_2 correspond to each other as well. A single morpheme, then, can only license either S_1 or S_2, and so (8a) is ruled out as well. Note that default segment epenthesis and echo epenthesis generated by (6) are *not* ruled out by (10) because in both cases, epenthetic segments do not have an input correspondent (in violation of DEP; see below).

The most crucial corollary of (10) is that one morpheme can contain only one output correspondent of an underlying segment. I refer to this consequence as the Principle of a Unique Correspondent (PUC):

(11) Principle of a Unique Correspondent (PUC)

> One morpheme can contain maximally one correspondent of one input segment.

As a consequence of (11), echo epenthesis, which is fundamentally phonotactically-driven and occurs within a single morpheme, can never be achieved by copying.[4] In other words, in order for copying to take place by way of multiple correspondence, there needs to be a support by a different morpheme i.e., RED. On the other hand, as illustrated in (6), since echo epenthesis by spreading does not involve correspondence—i.e., it involves a newly inserted root node just like default segment epenthesis—it does not violate the PUC. It thus follows that echo epenthesis must be achieved via spreading, not by copying. In the rest of this paper, I discuss in detail how this proposal explains the characteristics of echo epenthesis and how it avoids unwanted typological predictions of non-reduplicative copying.

4. Lack of long-distance consonant epenthesis

4.1 The observation and the problem

The first characteristic of echo epenthesis is that only vowels can be echoed. The Kolami example, repeated below as (
(12), involves echoing a vowel to break up triconsonantal clusters. This type of vowel echo is common-place cross-linguistically (see the Appendix).

(12) Kolami echo epenthesis (Zou 1991: 463)

/ayk+t/	→	[ayakt]	'swept away'	cf. /ayk/	→	[ayk]
/erk+t/	→	[erekt]	'lit (fire)'	cf. /erk/	→	[erk]
/kork+t/	→	[korokt]	'bit'	cf. /kork/	→	[kork]
/kink+t/	→	[kinikt]	'lit (fire)'	cf. /kink/	→	[kink]

[4] (11) entails that fission, in which one underlying segment breaks into two output segments, cannot be analyzed as involving a one-to-many correspondence relationship.

On the other hand, patterns that involve echoing consonants across vowels seem to be unattested. (13) and (15) are hypothetical patterns that would be expected if consonantal echo epenthesis across vowels is possible. (13) is a pattern in which underlyingly onsetless syllables are supplied with an onset consonant by long-distance consonantal echo epenthesis. In the typological studies of ONSET-driven consonantal epenthesis by de Lacy (2002) and Lombardi (2002), all cases involve insertion of a default (unmarked) consonant, usually a laryngeal or coronal consonant, but never a copy of an underlying consonant.[5]

(13) Unattested pattern I: ONSET satisfied via long-distance consonantal echo

/apa/	→	[p̲apa]
/ata/	→	[t̲ata]
/aka/	→	[k̲aka]

The lack of (13) is all the more striking given that in reduplication, a parallel pattern is found. Compare (13) with the Washo reduplication illustrated below in (14), where reduplicants consist of a single consonant, and when the bases are vowel-initial, it looks as if the reduplicants supply onsets to onsetless initial syllables.

(14) Washo reduplication (Bell 1983; Broselow and McCarthy 1983: 45-53)

/ámham/	[h̲ámham]	'light (in weight)'
/áŋkaʃ/	[k̲áŋkaʃ]	'hollow'

(15) illustrates a hypothetical language in which stressed syllables are made heavy (satisfying STRESS-TO-WEIGHT[6]) by way of long-distance consonantal echo. Although there are a number of cases in which stressed syllables are made heavy by gemination (e.g., Italian Raddoppiamento-sintattico (Nespor and Vogel 1986); Terena (Bendor-Samuel 1963)), no cases like (15) are documented. This typological gap is again mysterious, if echo epenthesis and reduplication are achieved by the same mechanism.

[5] Kawu (2000) argues that Yoruba gerundive formation constitutes an instance of long-distance consonantal echo epenthesis across a vowel, as in [ji-jɛ] 'act of eating,' derived from [jɛ] (see also Orie 2000). This is not an exception to the generalization made here because this mapping is crucially morphological (i.e., derives a gerundive form), and so it is likely to involve a RED morpheme: in fact, Marantz (1982) and Alderete et al. (1999) analyze this pattern as reduplication.

A crucially unattested pattern is one in which consonants are copied across a vowel *within* a morpheme in the absence of an additional morpheme: e.g., a pattern like /p+aka/ → [paka], /aka/ → [k̲aka], and /p+ata/ → [pata], /ata/ → [t̲ata].

[6] This constraint requires stressed syllables to be at least bimoraic ("if stressed, then heavy"). The name is due to Prince (1990), although he argues against the existence of such a constraint.

(15) Unattested pattern II

/mapa/	→	[má<u>m</u>pa]	cf. [má<u>p</u>pa]
/rata/	→	[rá<u>r</u>ta]	cf. [rátta]
/laka/	→	[lá<u>l</u>ka]	cf. [lá<u>k</u>ka]

Patterns resembling (15) do exist in reduplication. For example, in the West Tarangan examples given in (16), a reduplicative copy of a consonant is prefixed to stressed syllables:

(16) West Tarangan (Spaelti 1997)

/RED+gasira/	→	[ga<u>r</u>síra]	'old'
/RED+ɛlajir/	→	[ɛla<u>r</u>jír]	'3s-white'

Thus, it is not the case that copying a consonant across vowels is entirely impossible in natural language. Rather, the generalization is that phonological requirements like ONSET or STRESS-TO-WEIGHT are never satisfied by long-distance consonantal echo epenthesis, while reduplication does seem to freely copy consonants at a distance.[7]

The absence of patterns like (13) and (15) poses a problem for a theory that imposes no restrictions on correspondence: under certain ranking permutations, the unattested patterns are predicted to occur. For the sake of illustration, suppose that the long-distance splitting in (8b) violates INTEGRITY (Kawu 2000; Nelson 2003; Ussishkin 2000; the original formulation of INTEGRITY is due to McCarthy and Prince 1995), which prohibits two output correspondents of one input segment. If ONSET and DEP are ranked above INTEGRITY, (13) is predicted to occur, as illustrated below in (18):

(17)
INTEGRITY: There cannot be two output correspondents for one input segment (no splitting).
DEP: Every output segment has an input correspondent (no epenthesis).
ONSET: No syllables without an onset consonant are allowed.

(18)

/ap$_i$a/	ONSET	DEP	INTEGRITY
a. a.p$_i$a	*!		
b. ʔ$_j$a.p$_i$a		*!	
c. ☞ p$_i$a.p$_i$a			*

[7] Semitic biliteral roots are arguably a counterexample to this generalization, as a template-driven mapping with long-distance consonantal epenthesis seems to be involved, as in /sm/ → [samam] (Rose 1997; Ussishkin 2000). Though see Gafos (1998) for an argument that this mapping involves a RED morpheme; see also Gafos (2003) for a view that biliteral roots undergo default consonant epenthesis, not long-distance consonant copy.

The candidate in (18c) is supplied with an onset by long-distance splitting. In this candidate, the inserted epenthetic [p] has an underlying correspondent, so it does not violate DEP. Therefore, if DEP » INTEGRITY holds, the unwanted candidate (18c) mistakenly wins.

There is another way in which a theory that admits non-reduplicative copying has trouble ruling out the unattested echo epenthesis patterns. If a theory allows an epenthetic segment to stand in correspondence with a segment in the base (Kitto and de Lacy 1999) by surface-to-surface correspondence as in (8a), then the unwanted pattern emerges. Zuraw (2003) argues that there is a requirement that surface segments stand in correspondence with other segments as much as possible, which she calls REDUP (see also Kitto and de Lacy 1999). For the sake of illustration, let us say that this constraint requires an epenthetic segment to correspond with some segment in the root. Let FAITH-CC stands for a set of faithfulness constraints that requires two corresponding consonants to be identical, following Rose and Walker (2004). With these constraints, the unwanted pattern in (13) emerges again:

(19)

/ap$_i$a/	ONSET	REDUP	FAITH-CC
a. a.p$_i$a	*!		
b. ʔ$_j$a.p$_i$a		*!	
c. ʔ$_i$a.p$_i$a			*!
d. ☞ p$_i$a.p$_i$a			

The candidate in (19d) undergoes reduplicative copying by the surface-to-surface correspondence mechanism shown in (8a). The problem illustrated in (19) is a serious one, because an oft-attested candidate (19b) (see de Lacy 2002; Lombardi 2002 for a host of cases) is harmonically bounded by the unwanted candidate (19d). This is because REDUP not only allows but also requires non-reduplicative copying.

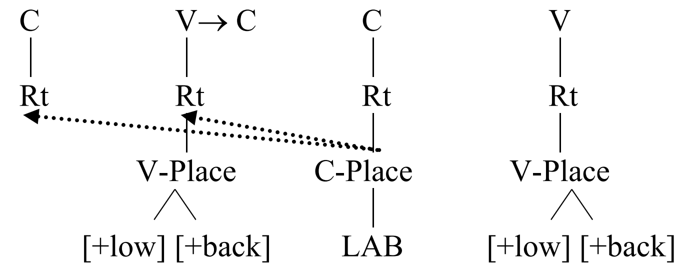
4.2 Solution

The preceding discussion shows that a theory that admits non-reduplicative copying misses the generalization that only vowels can be echoed for the purpose of epenthesis, and therefore such a theory overgenerates unattested patterns. The Principle of a Unique Correspondent (PUC) in (11) solves these problems. Because no two surface segments are allowed to (directly or indirectly) stand in correspondence with one underlying segment within a morpheme, no non-reduplicative copying can be used for epenthesis. Specifically, problematic candidates like (18c) and (19c, d) are never emitted by GEN.

In order to make long-distance consonant echo epenthesis impossible, we also need to make sure that spreading cannot achieve such a mapping. This does not require an additional stipulation, however, since the impossibility of spreading of major C-Place across vowels is independently motivated. Descriptively, assimilation in vocalic features across consonants is common; but major C-Place features do not assimilate across vowels (Clements 1985a (citing personal communication with Morris Halle), 1991; Clements and Hume 1995; Gafos 1996, 1998; Ní Chiosáin and Padgett 1997, 2001; Shaw 1991, among others). [8]

There are two major explanations for this C-V asymmetry in current phonological theory, which I will briefly sketch here without taking a position. The first explanation is the theory of absolute strict locality, pursued mainly in Gafos (1996, 1998) and Ní Chiosáin and Padgett (1997, 2001). In this view, locality of spreading is imposed at the segmental level, so if a C-Place node spreads across a vowel, the C-Place must be imposed on that vowel as well. Take the unattested /apa/ → [papa] in (13) as an example. To achieve long-distance spreading of /p/, its C-Place must be imposed on the intervening vowel [a], as in (20). Then the intervening vowel is associated with the spread C-Place as well as its original V-Place. Since stricture is defined in terms of a segment's most constricted place, the intervening vowel is no longer a vowel, as it is associated with a consonantal stricture. (20) is therefore something like [pppa], an extremely marked structure in terms of syllable wellformedness, and is presumably universally impossible (Ní Chiosáin and Padgett 1997).[9]

(20) C-Place spreads onto intervening vowels: /apa/ → *[pppa]

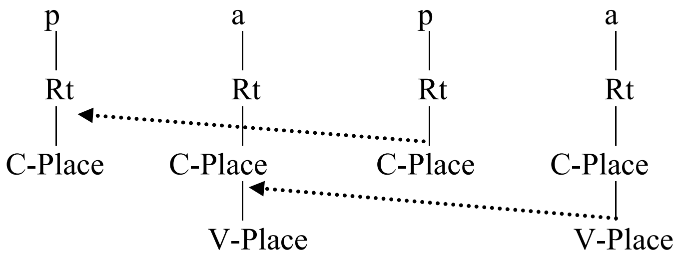


Another explanation for the C-V asymmetry is the model of feature geometry (Clements 1985a et seq.) formalized in Clements (1991) and Clements and Hume (1995). They claim that V-Place is dominated by a C-Place node, and that every segment has C-Place.

[8] This C-V asymmetry is not observed in child phonology. Assimilation of major C-Place features across vowels, as in [gɔg] for *dog*, is observed; so is long-distance consonantal echo epenthesis, as in [p̠ɛr plɛɪn] for *air plane*. See Pater and Werle (2003) for relevant discussion and references to earlier work.

[9] This proposal predicts that consonantal spreading is possible across consonantal nuclei, e.g., /n̩t/ → [tn̩t] (John McCarthy p.c.). Whether such a pattern is possible, and if not, how the theory of strict locality accounts for the lack of it, are interesting topics but not directly relevant to the present proposal, and therefore not discussed here.

(21) C-Place spreading blocked by intervening vowels: /apa/ → *[papa]



Given this feature geometry, spreading C-Place across any segment necessarily results in a violation of the Line Crossing Principle (Goldsmith 1976), as shown in (21). On the other hand, V-Place can spread across an intervening consonant unless the consonant bears an incompatible V-Place feature. This theory also assumes locality that is relativized for feature tiers; that is, in (21) [p]'s C-Place cannot spread through the existing C-Place of the intervening [a].

In both of the theories, spreading is sensitive to intervening segments. In the first theory, spreading of C-Place changes all intervening segments into consonants; in the second theory, spreading of C-Place is blocked by an intervening vowel by virtue of the Line Crossing Principle (Goldsmith 1976). In both theories, this property of locality is fundamental to the explanation of why consonants cannot spread across vowels. We will see in the following sections that such locality of spreading is also key to explaining other properties of echo epenthesis.

Before closing this section, a few remarks on reduplication and correspondence-based copying are in order. Unlike echo epenthesis, reduplication can rather freely copy a consonant across vowels (see (14) and (16)). This fact follows because reduplication can be achieved by copying via correspondence. That correspondence-based copying can copy a consonant across vowels is a consequence of the assumption that correspondence-based copying does not affect (and is not affected by) intervening segments: copying a consonant across a vowel does not change the vowel into a consonant, nor does it result in line-crossing. This property of copying also plays a fundamental role in explaining the other aspects of reduplication, which are discussed in the following sections.

5. No skipping of potential targets

5.1 The observation

The second difference between echo epenthesis and reduplication is that the former is subject to a more stringent locality requirement than reduplication (Kawahara 2004). Specifically, echo epenthesis can never target a distant vowel, whereas reduplication can skip a closer potential target in order to satisfy high-ranked constraints.

An echo epenthesis pattern like the one in (22), where the most sonorous vowel is echoed regardless of the distance, is unattested:

(22) Sonority-based echo epenthesis: unattested

/tametk/ → [tametak]
/temitk/ → [temitek]

In the first form given in (22), the potential local target [e] is ignored and the more distant [a] is echoed, as [a] makes a better nucleus than [e]. Similarly, in the second form, [e] is copied across the local but less sonorous [i].

The lack of such a pattern is all the more striking given that exactly parallel patterns are found in reduplication. An illustrative case is found in Nakanai, where the most sonorous vowel in the base is reduplicated across a less sonorous vowel:

(23) Sonority-based reduplication in Nakanai (Johnston 1980; Spaelti 1997)

a.	/RED-taro/	→	[ta-taro]	'away'
	/RED-buli/	→	[bu-buli]	'roll'
b.	/RED-mota/	→	[ma-mota]	'vines'
	/RED-kusa/	→	[ka-kusa]	'wet'
	/RED-biso/	→	[bo-biso]	'two by two'

Given the standard sonority hierarchy among vowels (low > mid > high), when V_1 is more sonorous than or equally sonorous to V_2, V_1 is copied as in (23a). However, as seen in (23b), when V_2 is more sonorous than V_1, V_2 is reduplicated. A similar example is found in Tawala, where a CV_1V_2 base reduplicates as CV_2-CV_1V_2, as in *ge-gae* 'go up' (Ezard 1997: 43) in which V_1 is systematically skipped for reduplicative copying.[10] Efik (Cook 1987) provides yet another example, where, if the base has a [+ATR] vowel followed by a [-ATR] vowel, the second vowel is copied: /RED+tika/ → [a-tika] 'kick' and /RED+fidɔ/ → [ɔ-fidɔ] 'jump'. See Kawahara (2004) for more examples of this kind.

Such examples show that the locality requirement for reduplication is violable—i.e., under the pressure of higher-ranked constraints, reduplication can skip local targets. This is in line with a number of recent proposals that the distance between corresponding segments is governed by a violable constraint (Hogoboom 2003; Kitto and de Lacy 1999; Nelson 2003; Riggle 2004; Rose 1997).

However, if this is the case, allowing non-reduplicative copying to achieve echo epenthesis predicts the unattested pattern in (22). Let *MID/NUC and *HIGH/NUC be constraints that prohibit mid and high vowels in syllable nuclei (Prince and Smolensky 1993), and LOCALITY be a constraint that requires that corresponding segments be as close as possible, assigning one violation mark for each intervening segment (Kitto and de Lacy 1999). Ranking *HIGH/NUC (») *MID/NUC » LOCALITY predicts that the unattested pattern in (22) is possible. The following tableau illustrates this (cancelled violation marks not shown):

[10] Given that V_2 is always less sonorous than V_1, it might be that reduplicative vowels are required to be as short as possible (see Kirchner 1996; Alderete et al. 1999).

(24)

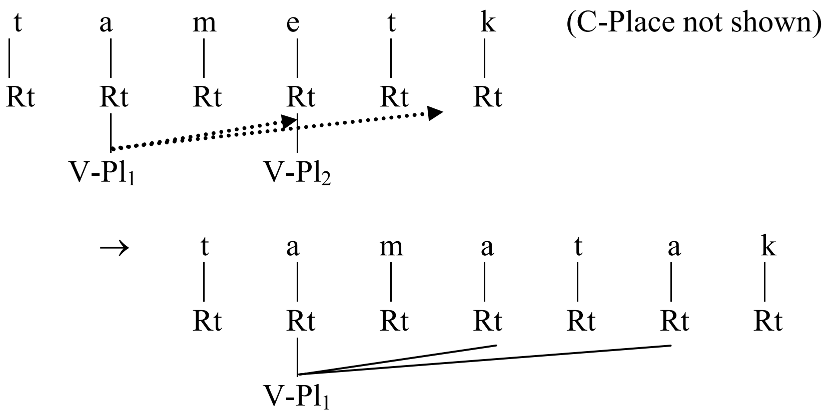
/tametk/	*COMPLEX	*MID/NUC	LOCALITY
a. tametk	*!		
b. tame$_i$te$_i$k		*!	*
c. ☞ ta$_i$meta$_i$k			***

5.2 Solution

As illustrated in (24), allowing correspondence-based echo epenthesis predicts an unattested pattern. This overgeneralization problem does not arise if echo epenthesis is exclusively achieved by spreading, due to the PUC in (11). If echo epenthesis is invariably derived from spreading, as I claim throughout this paper, the absence of the unattested pattern in (22) again follows from the fact that spreading affects intervening segments.

Schematically, suppose that underlying /$C_1V_1C_2V_2C_3C_4$/ attempts to resolve the word-final cluster via spreading of V_1. In order for V_1 to be realized between C_3 and C_4, the V-Place of V_1 must spread onto V_2. The total spreading of V_1 changes V_2 into V_1, since one vowel cannot simultaneously bear two V-Place features. This is illustrated in (25) where /tametk/ is necessarily mapped onto [tamatak], not *[tametak].

(25) Locality enforced in spreading



This explains why echo epenthesis cannot map underlying /tametk/ onto [tametak]: given locality of spreading, spreading of [a] must result in [tamatak].[11]

To complete the discussion for locality of echo epenthesis, there is one more point to address. Although echo epenthesis is subject to a very strict locality restriction, there is one case where we find variation in terms of which segment is targeted for echo

[11] The issue of transparency in vowel harmony remains as a problem for a theory that assumes locality of spreading. The question of why spreading the entire V-Place (in echo epenthesis) does not exhibit transparency is an interesting question, but to solve this problem is beyond the scope of this paper. Bakovic (2000: 263-268) provides an overview of several recent approaches to related problems.

epenthesis, as pointed out by Kitto and de Lacy (1999).[12] The variation arises in cases in which a glide is closer to the target position than a vowel (see also Uffman 2000). In such a configuration, some languages choose the intervening glide as the echoed segment, but other languages allow intervening glides to be transparent. For example, given an input like /twa/, two outputs are possible cross-linguistically: [tuwa] and [tawa]. The former strategy is taken by Fula (Paradis 1996) and the latter by Winnebago (Miner 1992).

In other words, glides in Winnebago are transparent to echo epenthesis, while glides in Fula are opaque. Following Herman (1994), Hume (1995) and Levi (2004), this ambiguous behavior of glides can be captured by saying that some glides are consonantal, having C-Place specifications, while other glides are vocalic and therefore have V-Place specifications. Vocalic glides are opaque to V-Place spreading while consonantal glides are transparent. This explains not only variation in spreading behavior in echo epenthesis, but also why some glides are transparent to vowel harmony while other glides are opaque, as vowel harmony is arguably another kind of operation that spreads vocalic features (Clements 1977 et seq.).

6. No length transfer

6.1 The observation and the problem

The third difference between echo epenthesis and reduplication is the impossibility of length transfer (or quantity transfer; Clements 1985b; McCarthy and Prince 1990). In my typological survey of echo epenthesis, I have not found any cases in which long vowels echo as long, and short vowels as short, as in (26):

(26) Length transfer in echo epenthesis: unattested

/takt/	→	[tak<u>a</u>t]
/taakt/	→	[taak<u>aa</u>t]

The result of echo epenthesis is always short, just as default epenthetic vowels are always short (unless a language imposes a metrical restriction that stressed vowels must be long, and epenthetic vowels happen to be stressed).

In reduplication, on the other hand, length can be transferred: an example like /mi-doodo+RED/ → [mi-doodo-<u>doodo</u>] 'fairly little' in Kihehe (Odden and Odden 1985) suffices to illustrate this point: the long vowel reduplicates as long and the short vowel as short. To account for this length transfer in reduplication, some recent proposals postulate a faithfulness constraint that requires identity in weight (or mora count) between corresponding segments (e.g., Crosswhite 1998; Katayama 1998; Urbancyzk 1999; McCarthy 2000):

(27) IDENT(WEIGHT): Corresponding segments agree in weight.

[12] Their observation is based on morphemes with unspecified timing slots.

In Kihehe reduplication, the BR version of this faithfulness constraint is ranked above constraints that would potentially restrict the prosodic shape of reduplicants. Therefore, the length of base vowels is faithfully copied, as illustrated in (28).

(28)

/mi-doodo-RED/	*IDENT(WEIGHT)-BR	*LONGVOWEL
a. mi-do$_i$do-doo$_i$do	*!	*
b. ☞ mi-doo$_i$do-doo$_i$do		**

With this kind of faithfulness constraint, however, a theory that employs non-reduplicative surface-to-surface correspondence predicts that there can be long epenthetic vowels. If, for example, an epenthetic vowel is created by surface-to-surface correspondence, the ranking IDENT(WEIGHT) » *LONGVOWEL predicts that the epenthetic vowel is long when the trigger is long, as in (29):

(29)

/taakt/	*COMPLEX	IDENT(WEIGHT)	*LONGVOWEL
a. taakt	*!		*
b. taa$_i$ka$_i$t		*!	*
c. ☞ taa$_i$kaa$_i$t			**

The approach that makes use of long-distance splitting predicts the same outcome; when IDENT-IO(WEIGHT) dominates *LONGVOWEL, as it should in a language that permits long vowels in its inventory, the echo of a long vowel should also be long.

6.2 Solution

If echo epenthesis cannot be achieved by copying, as the PUC requires, the lack of length transfer in echo epenthesis is predicted. Because length is not a property of segments, it cannot be transmitted when a segment (or a feature) spreads (an unambiguous case of "length harmony" is not attested; see Hyman and Udoh 2002 for recent discussion). Put differently, since length is not dominated by V-Place, spreading V-Place does not result in length transfer. Epenthetic vowels are thus predicted to always be short due to the effect of the markedness constraint *LONGVOWEL, unless the epenthetic vowels are required to be long by a higher-ranked metrical constraint. This is shown in (30):

(30)

/taakt/	*COMPLEX	*LONGVOWEL
a. taakt	*!	*
b. ☞ taa kat \ / a		*
c. taakaat \ / a		**!

In (30), candidate (c) transfers the length of an underlying long vowel to the epenthetic vowel, but the long echo vowel gratuitously adds a violation of *LONGVOWEL. This candidate, as a result, is harmonically bounded by the actual winner, candidate (b). This is a clear case of the Emergence of the Unmarked (McCarthy and Prince 1994): since epenthetic vowels have nothing to be faithful to in terms of length, the unmarked shape (short vowel) emerges.

7. Blockage by intervening segments

7.1 The observation and the problem

As I have argued so far, the PUC requires echo epenthesis to be achieved by spreading of V-Place. Given this, it is expected that some set of intervening segments can block echo epenthesis, as spreading is sensitive to intervening segments. This section shows that this prediction is borne out. This provides further support for treating echo epenthesis as spreading.

One illustrative case where echo epenthesis is blocked by some intervening sounds is Japanese loanword epenthesis. The quality of the epenthetic vowels is of interest here. First, after [h] (allophones of /h/), vowel echo takes place, as illustrated by the examples in (31a).[13] When the echoed epenthetic vowels are [i] and [ɯ] as in (31bc), the preceding consonants become [ç] and [ɸ], respectively, by allophonic alternations which is independently motivated in Japanese phonology. These echo epenthesis patterns have not been discussed in the past phonological literature; the examples are thus collected by the author and checked by multiple native speakers:

[13] This echo epenthesis pattern cannot be analyzed as a case of vowel intrusion, a percept of a copied vowel across a neighboring consonant, due to extensive gestural overlap of a vowel with the consonant (Hall 2003). This is because, as Hall argues, such intrusive vowels do not project a syllable, and hence this view is not consistent with the fact that epenthetic vowels are inserted to support unsyllabifiable consonants in the case of Japanese, i.e., to satisfy CODACONDITION (Itô 1986), which prohibits a coda consonant with an independent place node.

(31) Japanese loanword echo epenthesis

a. Across [h]

[bahha]	'Bach'	[ʃɯ:mahha]	'Schumacher'
[mahha]	'Mach number'	[ɸoierɯbahha]	'Feuerbach'
[rɯ:bahha]	'Rubach'		
[gohho]	'Gogh'	[kohho]	'Koch'
[dohho]	'doch (German)'	[mazohho]	'Masoch'
[bɯrohho]	'Bloch'		

b. Across [ç]

[iççi]	'ich (German)'	[tʃuuriççi]	'Zurich'
[diççi]	'dich (German)'	[ɸuriidoriççi]	'Friedrich'
[m^{j}ɯ:niççi]	'Münich'		

c. Across [ɸ]

[bɯ:ɸɯ]	'Buch (German)'
[raatobɯ:ɸɯ]	'Radbruch'

When consonants with superlaryngeal constriction intervene, the default vowel [ɯ] is inserted (see e.g., Katayama 1998). After coronal stops the vowel is [o], since Japanese does not allow coronal stops followed by high vowels (i.e., *[tɯ], *[dɯ]).

(32) Japanese default vowel epenthesis

bazɯ	'buzz'	sɯtoraikɯ	'strike'
sɯpɯraito	'Sprite	opɯtimarɯ	'optimal'
kɯrisɯmasɯ	'Christmas'	toripɯrɯ	'triple'

The generalization is that echo epenthesis takes place only across segments that lack superlaryngeal consonantal constriction, i.e., allophones of /h/. I assume that [ç] and [ɸ], the allophones of /h/ before [i] and [ɯ], respectively, have only V-Place acquired from the following vowels.

This is a typical case of laryngeal transparency (Aoki 1968; Gafos and Lombardi 1999; McCarthy 1994b, 1998; Padgett 1995; Stemberger 1993; Steriade 1987) where assimilation takes place only across laryngeal consonants. Another case of echo epenthesis that exhibits laryngeal transparency is found in Mohawk, as in (33):

(33) Epenthesis in Mohawk (from Postal 1969)

a. Leftward echo epenthesis across [ʔ]

/ʌ+wa+atunisʔa+s+hek+ʔ/ → [ɔwadunizaʔashegeʔ]
'it will be ripening repeatedly'
/ʌ+wa+o+atinisʔa+u+hak+ʔ/ → [ɔyodinizuʔuhageʔ]
'it will have been ripening'

b. Default [e] epenthesis if a superlaryngeal consonant intervenes

/ya+k+ni+rʌn+ot+ʔ/ → [yageniro:nodeʔ]
'we two (exclusive) are singing'
/wa+o+arʔsʌ+ʔ/→ [yoreʔzʌʔ] 'she is fat'

As seen in (33a), the cluster [zʔ] is broken up by leftward echo epenthesis of the following vowel (which Postal refers to as the "VOWEL TWIN"). Across a non-glottal consonant, echo epenthesis seems impossible; instead default [e] is epenthesized.

Similar patterns are not uncommon. Some other cross-linguistic examples that exhibit "echo only across X (or blocked by Y)" patterns are listed below:

(34) Cases of "echo only across X"

Barra Gaelic:	Echo of [back] blocked by some set of consonants (Halle et al. 2000; Clements 1987; Ní Chiosáin 1995)
Iraqw:	Across laryngeal consonants (Rose 1996: 77)
Ancient Hebrew:	Across guttural consonants (McCarthy 1994b: 215)
Kinyarwanda:	Across [l] (Uffmann 2003)
Yoruba:	Across [r] (Akinlabi 1993)
Maori:	Across [r] (Kitto 1997: 57; Kitto and de Lacy 1999)

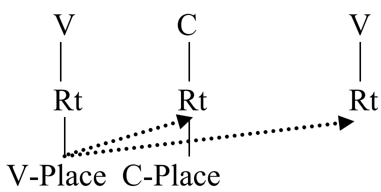
In fact, several authors argue for a spreading analysis of echo epenthesis on the basis of the effect of intervening segments. Nichols (1994) observes that in Northern Tiwa, the tonal quality of an echoed vowel is lost *only* when a laryngeal consonant intervenes. On the basis of this, Nichols argues that what is involved is spreading rather than copying: spreading of a tone is blocked by intervening laryngeal consonants. Similarly, Shademan (2003) makes a parallel claim that echo epenthesis is spreading on the basis of the intricate blockage patterns of echo epenthesis found in Farsi. Gafos and Lombardi (1999) assume that vowel echo is achieved by spreading and explain blockage patterns by anti-coarticulation constraints (see below). Pater (2003) is yet another work that argues for a spreading analysis based on the effect of intervening segments.

Given the uncontroversial assumption that reduplicative copying does not show sensitivity to intervening segments,[14] the fact that the effects of intervening segments on echo epenthesis are common-place provides further support for the view that echo epenthesis is spreading, at least for cases that exhibit blockage. If echo epenthesis were achieved by solely correspondence copying, such blockage would not be expected.

7.2 Analysis

Given that echo epenthesis is spreading, the next question is how to formally capture blockage of spreading by intervening consonants. One approach is to assume that intervening segments participate in "long-distance" spreading. In this view, as depicted in (35), the intervening segments actually participate in spreading, and spreading is blocked when the intervening segment is incompatible with the spread feature.

(35) Intervening segments participate in spreading



Another approach uses a theory of underspecification that does not necessarily assume absolute strict locality: consonants that block V-Place spreading bear their own specifications on the V-Place tier, while consonants that do not block do not project V-Place. Such an underspecification approach, however, seems unmotivated in the current context of Optimality Theory (Prince and Smolensky 1993), so I do not go into the details of this approach (see, e.g., Gafos and Lombardi 1999; McCarthy 1994a; Steriade 1995 for criticisms against underspecification). Instead, I illustrate an analysis that assumes that intervening segments participate in apparent long-distance assimilation, at least in cases where blockage takes place.

It has been argued that the degree of (in)compatibility between spreading and intervening consonants varies depending on which consonant is articulated with which vowel; there are a set of constraints against coarticulation of V-Place with several types

[14] The exponence of reduplicants is usually assigned by reduplicative copying, but it can also be assigned by epenthesis or spreading, if markedness and BR-faith requirements prohibit copying. In other words, when base materials are marked, faithfully copying the base materials incurs additional violations of markedness constraints, which can be avoided in some languages. In such cases, other strategies (e.g., epenthesis and spreading) can be used to fulfill reduplicative templates.

Concretely, epenthesis is found for example in Igbo (Alderete et al. 1999) and Lushootseed (Urbanczyk 1999). Spreading is used in FeʔFeʔ Bamileke reduplication (Hyman 1972; Cole and Kuo 1991). In this language, when the base vowels are high, reduplicative copying takes place; this copying does not exhibit sensitivity to intervening segments at all. When the base vowels are non-high, reduplicative vowels are still high, and color features are filled in by spreading, which does exhibit sensitivity to intervening segments. This spreading is blocked by a set of consonants (front vowels by grave consonants, and back vowels by acute consonants), in which case a default vowel is inserted.

of consonants (Gafos and Lombardi 1999; Hall 2003; McCarthy 1994a, 1998; Ní Chiosáin and Padgett 1997, 2001; Padgett 1995; Pater 2003; Shademan 2003).

By way of illustration, I provide an analysis of Japanese foreign word epenthesis, which can be easily extended to Mohawk and other patterns. To account for the pattern, I posit an anti-coarticulation constraint, *SPLYCWITHV-PLACE, that militates against a superlaryngeal consonant coarticulated with V-Place. "Superlaryngeal consonant" is a cover term that includes labial, coronal and dorsal consonants. It might be necessary to further decompose this constraint into more fine-grained constraints, as coronals are cross-linguistically more likely to be transparent to vocalic spreading (Paradis and Prunet 1989) than labials and dorsals, but this constraint alone suffices for the present purpose (see Gafos and Lombardi 1999; McCarthy 1998 for discussion).

(36) *SPLYCWITHV-PLACE: V-Place is not associated with superlaryngeal consonants.

To distinguish echo epenthesis from default vowel epenthesis, I posit two more constraints. The first constraint, *V-PLACE, penalizes each autosegmental token of V-Place,[15] favoring echo epenthesis over default vowel epenthesis. The second constraint *SPREAD(V-PL, μ) requires that any V-Place-to-mora association in the output be present in the input, which thus prohibits spreading of V-Place.[16] The formulation of *SPREAD(V-PL, μ), based on McCarthy (2000), is given in (37b):

(37)
a. *V-PLACE: Assign one violation mark for each token of autosegmental V-Pl.

b. *SPREAD(V-PL, μ):

Let V-pl and μ be elements in the Input and Output where

$V\text{-}pl_I$ and $\mu_I \in$ Input

$V\text{-}pl_O$ and $\mu_O \in$ Output

$V\text{-}pl_I \Re V\text{-}pl_O$

For each μ_O that is associated with $V\text{-}pl_O$, there should be a μ_I such that $\mu_I \Re \mu_O$, and μ_I is associated with $V\text{-}pl_I$

In addition to these constraints, I take CODACONDITION to be the trigger of epenthesis; this prohibits a coda consonant that is not a first half of a geminate (Itô 1986). This constraint is undominated in Japanese, and since no candidate that violates this constraint survives in the output, only candidates that obey it are considered below.

*SPLYCWITHV-PLACE, *V-PLACE, and *SPREAD(V-PL, μ) interact as in the following two tableaux, where a consonant with a superscript vowel indicates that the consonant and the vowel are coarticulated: [h^a] = [h] coarticulated with [a].

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[15] Here I follow Beckman's (1998) proposal to assess violation marks in terms of autosegments. See Bakovic (2000) for a different view.

[16] It might be necessary to relativize this constraint for directionality, because for example in Mohawk only leftward echo epenthesis is observed. This means that *SPREAD(V-PLACE, μ)-RIGHT is undominated in Mohawk, in contrast to *SPREAD(V-PLACE, μ)-LEFT.

(38)[17] *V-PLACE » *SPREAD(V-PL, μ)

/bah/ | V-Pl [+lo] [+bk]		*SPLYCWITH V-PLACE	*V-PLACE	*SPREAD
a.☞ b a h a V-Pl [+lo] [+bk]	= [bah^{a}a]		*	*
b. b a h ɯ | | V-Pl V-Pl [+lo][+bk] [+hi][+bk]	= [bahɯ]		**!	

First, as illustrated in (38), *V-PLACE » *SPREAD(V-PL, μ) favors echo epenthesis over default vowel insertion, when the markedness constraint *SPLYCWITHV-PLACE is irrelevant. Next, consider the following tableau:

(39) *SPLYCWITHV-PLACE » *V-PLACE

/bas/ | V-Pl [+lo] [+bk]		*SPLYCWITH V-PLACE	*V-PLACE	*SPREAD
a. b a z a V-Pl [+lo] [+bk]	= [bas^{a}a]	*!	*	*
b.☞ b a z ɯ | | V-Pl V-Pl [+lo][+bk][+hi][+bk]	= [basɯ]		**	

Since *SPLYCWITHV-PLACE is undominated, spreading across a superlaryngeal consonant, [z] in the case above, is impossible. Instead, a default vowel is inserted. In this way, blockage of spreading can be analyzed in terms of anti-coarticulation constraints.

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[17] Gemination which occurs in the process of adaptation is ignored (see, e.g., Katayama 1998).

We have now dealt with blockage of echo epenthesis. There are, however, cases of echo epenthesis that may cross any intervening segments. This is illustrated by the data from Kolami, repeated below in (40), in which echo epenthesis even permeates oral stops (Clements 1991: 104-106; Zou 1991: 463). Other examples in which echo epenthesis applies even across oral stops include Kalinga (Gieser 1969: 67) and Welsh (Awbery 1984: 88).

(40) Kolami echo epenthesis

/ayk+t/	→	[aya̲kt]	'swept away'
/erk+t/	→	[ere̲kt]	'lit (fire)'
/puḍk+t/	→	[puḍu̲kt]	'touched'
/daṭp+t/	→	[daṭa̲pt]	'drove (horse)'

In such cases, *V-PLACE is ranked above both *SPREAD(V-PL, μ) and *SPLYCWITHV-PLACE, prohibiting default vowel epenthesis entirely. This scenario is illustrated by the following tableau:

(41) *V-PLACE » *SPREAD(V-PL, μ), *SPLYCWITHV-PLACE

/d a ṭ p + t / V-Pl [+low] [+back]		*V-PLACE	*SPLYCWITH V-PLACE	*SPREAD
a. ☞ d a ṭ a pt V-Pl [+low] [+back]	= [daṭ^{a}apt]	*	*	*
b. d a ṭ i pt V-Pl V-Pl [+lo] [+bk] [+hi] [-bk]	= [daṭipt]	**!		

The tableau (41) shows that echo epenthesis can be analyzed as spreading even when it is insensitive to the quality of intervening segments.

8. Concluding remarks

8.1 Summary

I have identified four properties of echo epenthesis in comparison with reduplication:

(42) Properties of echo epenthesis

(i) Consonants cannot be echoed across vowels.
(ii) An intervening vowel is never skipped.
(iii) Length is not transferred.
(iv) Echo epenthesis can be blocked by some set of intervening segments.

I argued that echo epenthesis invariably involves spreading, never copying; and that all four properties follow from independently motivated properties of spreading. As C-Place cannot spread across vowels, the first property of echo epenthesis follows as a natural consequence. Sensitivity of spreading to intervening segments accounts for the second and the fourth properties. Finally, length is not transferred concomitant with spreading because length is not a property of a segment and is not dominated by V-Place, which explains the third property of echo epenthesis.

Since reduplication exhibits distinct behavior from echo epenthesis in terms of (i)-(iv) above, if spreading and copying were one unified mechanism, then these empirical differences would be hard to account for. On the other hand, the division of labor between spreading and correspondence-based copying—that echo epenthesis can only be achieved by spreading, not by copying—allows us to account for the differences in a natural way. Concretely, I argued that copying is strictly limited to cases in which morphology is involved, from which this division of labor naturally follows. To achieve this, I have proposed a modification of Correspondence Theory (McCarthy and Prince 1995) that prohibits two output correspondents of a single underlying segment within a morpheme (Principle of a Unique Correspondent).

8.2 Theoretical consequences

There are two major theoretical implications of the proposal advanced in this paper. First, the current proposal stands at odds with several recent proposals in OT that make use of non-reduplicative copying. As reviewed in §3, a number of recent proposals argue for correspondence-based copying outside of reduplication (Gafos 2003; Goad 2001; Hall 2003; Hansson 2001; Kawu 2000; Kitto and de Lacy 1999; Krämer 1999; Nelson 2003; Pater 2003; Rose 1997; Rose and Walker 2004; Urbanczyk 1998; Ussishkin 2000; Struijke 2000; Yu 2003; Zuraw 2003). Some cases simply involve morphology, which are therefore not inherently incompatible with the current proposal (some cases discussed in Kawu 2000; Nelson 2003; Pater 2003; Urbanczyk 1998 are morphological). Other cases are incompatible with my proposal: in particular, my results and those of Rose and Walker (2004) and Zuraw (2002) which deal with long-distance assimilation seem as yet difficult to reconcile.

Second, despite some recent works that cast doubt on the role of autosegmental spreading in Optimality Theory (Bakovic 2000; Cassimjee and Kisseberth 1998; Kitto and de Lacy 1999; Krämer 1999), this paper has shown that spreading is indeed necessary to explain the differences between echo epenthesis and reduplication. A simple theory with only correspondence-based copying would fail to capture the characteristics of echo epenthesis.

Appendix: List of languages that exhibit echo epenthesis

The following languages were surveyed to produce the typological patterns discussed in this paper.

Synchronic patterns

Bardi (Metcalfe 1975: 149-152)
Barra Gaelic (Clements 1987; Ní Chiosáin 1995; Halle et al. 2000)
Bedouin Arabic (McCarthy 1994b: 214)
Capanahua (Safir 1979: 97)
Chamicuro (Parker 2001: 367): echo epenthesis occurs only through [ʔ]
Desano (Miller 1999: 12): echo epenthesis only across glottal consonants
Farsi (Shademan 2003)
Fula (Paradis and Prunet 1989: 335; Paradis 1996: 516)
Futankoore (Paradis and Prunet 1989: 338)
Gadaba (Bhaskararao 1998: 331-332)
Hebrew (Ancient and Modern) (McCarthy 1994b: 210, 215; Gafos and Lombardi 1999)
Hawaiian (Kitto 1997; Kitto and de Lacy 1999)
Iraqw (Rose 1996: 77)
Japanese (§7 of this paper)
Kalinga (Gieser 1970: 67)
Kekchi (Campbell 1974; Hall 2003)
Kinyarwanda (Uffmann 2003): echo epenthesis only across [l]
Kolami (Clements 1991: 104-106; Zou 1991: 463)
Lenakel (Lynch 1978: 17)
Mangap-Mbula (Bugenhagen 1995: 31-37)
Maga Rukai (de Lacy 2002: 150-151)
Makah (Werle 2002)
Makassarese (McCarthy and Prince 1994; McCarthy 1998; Kawu 2000: 384)
Maori (Kitto 1997; Kitto and de Lacy 1999)
Marshallese (Bender 1968: 25, 33-34)
Mawu (Kenstowicz 2001)
Mohawk (Postal 1969: 293-295)
Mono (Olson 2003; Olson and Schrag 2000)
Northern Tiwa (Picurís and Taos) (Nichols 1994)

Ponapean (Rehg and Sohl 1981: 91-94)
Rennallese (Brasington 1978: 43-45)
Selayarese (Mithun and Basri 1986: 236-240)
Shona (Uffmann 2001)
Samoan (Uffmann 2003)
Somali (Kenstowicz 1994: 128-129)
Sranan (Uffmann 2001, 2003)
Swahili (Batibo 1995)
Tigre (McCarthy 1994b: 216; Rose 1996: 95)
Tojolabal (Furbee 1974: 77; Steriade 1987: 603)
Tunica (Haas 1940)
Tswana (Batibo 1995)
Welsh (Awbery 1984: 88-89)
Winnebago (Dorsey's Law: Miner 1992; Steriade 1990)
Wolof (Ka 1994: 107)
Yapese (Jensen 1977: 81-85)
Yoruba (Akinlabi 1993: 152-156; Nelson 2003)
Yuhup (Lopes and Parker 1999: 341)

Historical changes[18]

East Cushitic languages from Proto-East Cushitic (Blevins 2003)
Eastern dialect of Finnish (Campbell 1998: 34)
Lettinese and Moa from Proto-Austronesian (Mills and Grima 1979)
Late Latin (Steriade 1990: 390)
Sardinian (Steriade 1990: 390)
Eastern Slavic (Steriade 1990: 393)
Several Creoles cited in Alber and Plag (2001: 812-813)

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[18] Arguably, historical processes are once productive synchronic phonological processes (Weinreich et al. 1968).

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