Reduplication with Fixed Segmentism

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1. Introduction

Reduplicative morphemes copy the base to which they are attached, but perfect copying is not always achieved. Incomplete copying for templatic reasons — that is, partial reduplication — has received a great deal of theoretical attention. Much less has been said about cases where perfect copying is subordinated to *fixed segmentism*: invariant segments (or tones or features) that appear where copying might have been expected. Some typical examples are given in (1) and (2). The reduplicant, which is the surface exponent of the reduplicative morpheme, is underlined.

(1) Fixed Reduplicative Segmentism — "Phonological" Type

a. Yoruba (Akinlabi 1984, Pulleyblank 1988)

gbóná	gbí-gbóná	'be warm, hot'/'warmth, heat'
dára	dí-dára	'be good/'goodness'
gbé	gbí-gbé	'take'/'taking'
rí	rí-rí	'see'/'act of seeing'
mu	mí-mu	'drink'/'drinking'

b. Tübatulabal Telic Reduplication (Voegelin 1958)

piːbiːwin	ʔiː–biːbiːwin	'to play jew's harp'
ʃɨʔɨwɨ	ʔɨː–ʃɨʔɨwɨ	'it looks different'
ʔoːm	ʔoː–ʔom	'to string beads'
ʦama	ʔan–ʣama	'it's burning'

c. Lushootseed (Bates, Hess, & Hilbert 1994, Bates 1986, Urbanczyk 1996a)

təláw-il	tí-təlaw'-il	'run'/'jog'
s-duːk^w	s-dí-duːk^w	'knife'/'small knife'
č'ƛ'áʔ	č'í-č'ƛ'aʔ	'rock'/'little rock'

d. Nancowry (Radhakrishnan 1981)

cɯt	ʔit–cɯt	'to go, to come'/id.
cuac	ʔit–cuac	'to massage'/id.
rom	ʔum–rom	'flesh of fruit'/'to eat pandanus fruit'
ɲiak	ʔuk–ɲiak	'binding'/'to bind'

(2) Fixed Reduplicative Segmentism — "Morphological" Type

a. Kolami Echo Words (adds meaning of 'etc.') (Emeneau 1955)

pal	pal-gil	'tooth'/'tooth and the like'
kota	kota-gita	'bring it!'/'bring it or the like'
iir	iir-giir	'water'/'water and the like'
maasur	maasur-giisur	'men'/'men and the like'

b. English Echo Words

table-schmable	
electric-schmelectric	
gravity-schmavity	(Wonderbra advertisement)
networking-shmetworking	(http://www.creativelement.com/win95ann/win95ann5.html)
Oedipus-Schmoedipus	(*Time* magazine)

In Yoruba (1a), the reduplicant has the fixed vowel *i* (and fixed high tone), whatever the vowel of the base. The initial consonant of the base is copied normally, though. Lushootseed (1c) is similar, but only with roots meeting certain phonological conditions (cf. *čáləs*, <u>*čá*</u>-*čaləs* 'hand'/'little hand', with normal CV reduplication.) In Tübatulabal and Nancowry (1b, d), the reduplicant's initial consonant is fixed as ʔ; the vowel and any coda consonant show complex dependencies discussed below. In the Kolami echo-word formation (2a), the base is copied in toto, except that it receives a fixed initial string *gi*. The English case is similar (2b), with fixed initial *schm*.

The principal goal of this article is to argue for a comprehensive account of fixed reduplicative segmentism within the broader context of Optimality Theory (Prince & Smolensky 1993). Following McCarthy & Prince (1986: §3.2), we will show that (1) and (2) represent distinct types of fixed segmentism.

The type of fixed segmentism exemplified in (1) has a *phonological* basis. The fixed segments are typically unmarked on typological grounds and may show context-sensitivity. They come under the OT rubric of *emergence of the unmarked* (McCarthy & Prince 1994a), which provides a way to limit a domain like the reduplicant to some unmarked structure while permitting the language as a whole to have the corresponding marked structure too. The idea, then, is that non-copying of a base segment, with substitution of some fixed, default segment, decreases phonological markedness (as determined by some language-particular ranking of universal constraints). This proposal builds on ideas first implemented in underspecificational terms by Akinlabi (1984: 289f.) and McCarthy & Prince (1986: §3.2), which have been pursued within Optimality Theory by Yip (1993), McCarthy & Prince (1994ab), and Urbanczyk (1996a). It is also connected to proposals about markedness in reduplicative structure made by Shaw (1987) and Steriade (1988).

The type of fixed segmentism exemplified in (2), on the other hand, has a *morphological* basis. The fixed segments in this case, *gi*- or *schm*-, constitute an affix which is, for alignment reasons, realized simultaneously with the reduplicative copy. Hence, these fixed segments show affix-like properties: they may be relatively marked, they do not show context-sensitivity, and they are aligned at one edge of the copy. This is the type of fixed segmentism that McCarthy & Prince (1990) dub *melodic overwriting*. For precedents and additional discussion, see McCarthy 1979: 319, McCarthy & Prince 1986: §3.2, 1990: §3.2, Uhrbach 1987, Steriade 1988, Bao 1990, and Yip 1992ab.

In this article, we will present detailed analyses of both types of fixed segmentism in support of our claims. The two types are contrasted, with points of difference highlighted. Alternative approaches that do not distinguish the two are shown to be inadequate. To complete the typological picture, predictions about impossible types of fixed segmentism are also offered. We will not be addressing tonal phenomena here, but our results have direct parallels in the tonal domain — see Myers & Carleton 1996 and Akinlabi 1997.

Apart from their relevance to the analysis of fixed-segmentism phenomena, our results bear on two wider fields. First, they support the OT conception of markedness with its concomitant claims about phonological inventories and emergence of the unmarked. In OT, a structure is marked if it violates some phonological constraint of UG. The ranking of the UG markedness constraints, among themselves and relative to faithfulness constraints, determines the structure of phonological inventories. The ranking for emergence of the unmarked can limit the force of a markedness constraint to some particular domain, like the reduplicant. In this way, the phonological inventory of the reduplicant is a subset of the inventory of the whole language in cases like (1).

Second, our results support the Prosodic Morphology program of seeking independent, general explanations for the properties of phenomena like reduplication (McCarthy & Prince 1994b). To the extent that fixed segmentism is attributed to special, otherwise unmotivated mechanisms like prespecification (Marantz 1982, Yip 1982, Kiparsky 1986, Lieber 1987, Clark 1990) or pre-templatic rewrite rules (Steriade 1988), explanation is impossible. Here, we argue that fixed segmentism of the type in (1) comes from the same source, modulo a difference in ranking, as restrictions on phonological inventories, and that fixed segmentism of the type in (2) comes from the same source, again modulo a difference in ranking, as morphological affixation. There is, then, no special apparatus to deal with fixed segmentism; it is merely a special kind of phonology or morphology, with the "special" part coming from the central element of OT, constraint ranking.

This article is organized as follows. In §2, we discuss the phonological type of fixed segmentism exemplified in (1), proposing a theory and providing numerous case studies. The morphological type of fixed segmentism (2) is treated in §3. Differences from the phonological type are noted and predictions about impossible patterns are highlighted. Finally, §4 sums up the results.

2. Fixed Segmentism as Phonology: Emergence of the Unmarked

In this section, we discuss the phonological type of fixed segmentism exemplified in (1). Our principal goal is to show how these phenomena can be understood in phonological terms, with significant connnections to the theory of inventory structure. To avoid cumbersome wording of conclusions or predictions, we disregard the possibility of the morphological type of fixed segmentism throughout this section. We will, however, discuss it in detail in §3, offering specific diagnostics for the two types and showing how our claims are maintained in this larger context.

We begin in §2.1 by introducing the essential theoretical prerequisites and by developing the results abstractly with a focus on predicted correlations of fixed segmentism with other aspects of phonology and phonological typology. We then turn to a series of case studies to illustrate the theory and confirm its predictions: Yoruba (§2.2), Lushootseed (§2.3), Tübatulabal (§2.4), and Nancowry (§2.5). Finally, §2.6 sums up the results and briefly discusses several additional case studies that support the overall approach.

2.1 A Theory of Emergent Fixed Segmentism

In Optimality Theory (Prince & Smolensky 1993), the grammar of a language is a ranking of universal constraints. One function of this ranking is to resolve the fundamental tension between markedness constraints and faithfulness constraints. Markedness constraints govern the form of linguistic structures; faithfulness constraints demand that the output exactly duplicate the input. When a given markedness constraint M crucially dominates an appropriate faithfulness constraint F (and no higher-ranking constraint vitiates the force of M), no M-offending structure will appear in the output, even at the expense of imperfect reproduction of the input. With the opposite ranking (F >> M), faithfulness takes precedence, and the M-offending structure is reproduced unaltered from the input.

Languages differ in how they rank constraints. Because differences in ranking can account for differences in activity of markedness constraints, it is possible to say that all markedness constraints are universal. Then, the grammar of a language is a ranking of the constraints of Universal Grammar. There is no parametrization of constraints; every constraint is present in the grammar of every language, though if it is crucially dominated, its activity may be limited or non-existent. The limited but nonetheless visible activity of dominated constraints plays a crucial role in the account developed here.

OT's use of the term "markedness" might seem to recall Praguian statements like "voiced obstruents are marked/voiceless obstruents are unmarked" or "if a language has voiced obstruents, it also has voiceless obstruents". (For a particularly lucid description of a modern version of the Praguian view, see Kenstowicz (1994a: 61f.).) Though there are occasional points of contact between the two views of markedness, there are also important differences, and it is an error to think of them as too similar:

•Praguian markedness classifies entities as marked or unmarked, or it contains overt implicational statements, as in the examples immediately above. In OT, a structure is marked with respect to some particular constraint if it receives violation-marks from that constraint (Smolensky 1993). Implicational statements are never made overtly in OT; they must instead be deducible as theorems from the constraints themselves and the properties of constraint ranking.

•Praguian markedness typically refers to single segments without their surrounding prosodic or segmental context, like "voiced obstruents are marked". OT also contains markedness constraints that are context-sensitive or that refer to structures or strings larger than a single segment (e.g., "word-final feet are prohibited").[1]

•In the familiar Praguian view, markedness is a unidimensional scale, so one can confidently assert that there is some least-marked segment, once and for all. But the notion of markedness in OT includes conflicting constraints which together define a multi-dimensional space. Conflict among markedness constraints is resolved in the same way as markedness/faithfulness conflict: by language-particular ranking.

•It is often assumed that Praguian markedness has an articulatory basis, emerging from some kind of least-effort principle. The markedness constraints of OT have no necessary connection with articulation, perception, or any other extra-linguistic domain, though of course they *may* have such a connection (see, e.g., Archangeli & Pulleyblank 1994 or Flemming 1995 for relevant discussion).

These remarks should clarify what is meant by markedness in an OT context, distinguishing it clearly from other views.

Markedness constraints have many important functions in OT. Given the appropriate ranking, they can compel unfaithfulness to a lexical form, thereby leading to phonological alternations. In the same way, they are responsible for defining the structure of phonological inventories and for characterizing the notion of a default segment. Since inventories and defaults are particularly important in the current context, we will focus on them here.

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[1]Confusingly, the term "context-sensitive/free" is used ambiguously in the markedness and underspecification literature. For Archangeli & Pulleyblank (1994), a redundancy rule is context-free only if it has the form "[ ] → [F]" — i.e., it places no conditions on its target whatsoever. For Cairns (1969) or Kiparsky (1995: 646), a rule is context-free as long as it does not impose conditions beyond the single segment affected by it. We use the latter sense throughout.

For approaches with context-sensitive marking conventions or redundancy rules, see Cairns, Kiparsky, and Chomsky & Halle 1968: 404–6, rules (6.II, 6.III, 6.XXIV).

The phonological inventory of a language L is the set of all structures permitted in L. This extended notion of an inventory includes not only the segmental or phonemic inventory, but also the linguistically significant generalizations about the distribution of segments and the inventory of prosodic structures like syllables or feet. Though some theories derive inventory restrictions from combinations of constraints on inputs and outputs, OT claims that inventories emerge from the interaction of (output) markedness constraints with faithfulness constraints operating on a universal set of inputs (Prince & Smolensky 1993: Chapter 9; see also Itô, Mester, & Padgett 1995, Kirchner 1995, McCarthy & Prince 1995). That is, there are no language-particular restrictions on inputs — no morpheme-structure constraints, language-particular underspecification, or similar devices.

Specifically, if some structure ς occurs in the inventory of a language, then some input-output faithfulness constraint F_{IO}(ς) demanding faithfulness to ς must outrank any markedness constraints M(ς) that ς violates. Conversely, if the structure ς does not occur in the inventory of some language, then some markedness constraint M(ς) that ς violates must dominate some faithfulness constraint F_{IO}(ς) demanding faithfulness to ς. Any gap in an inventory that cannot be accounted for in terms of some markedness constraint of UG must, as a matter of principle, be accidental. (In practice, of course, the process of discovering the markedness constraints is a subtle matter of weighing various evidence, little different from equivalent problems elsewhere.)

This OT conception of inventories has important implications for the structure of reduplicant, once we combine it with an explicit theory of faithfulness. Faithfulness is a relation of representational matching or exactness. In its original form, it is a relation between an underlying form and a surface form (Prince & Smolensky 1991, 1993), but similar relations can be found in reduplicant/base pairings (McCarthy & Prince 1993a, 1994ab) and between morphologically related surface words (Benua 1995, 1997). Correspondence Theory (McCarthy & Prince 1995) generalizes over these various types of faithfulness, seeing them in terms of a general relation between linguistic forms:

(3) Correspondence

> Given two linguistically related strings S_1 and S_2, **correspondence** is a relation $\Re$ between the elements of S_1 and those of S_2. Elements $\alpha \in S_1$ and $\beta \in S_2$ are referred to as **correspondents** of one another when $\alpha \Re \beta$.

The correspondence constraints include, among others, MAX (complete correspondence from S_1 to S_2), DEP (complete correspondence from S_2 to S_1), and IDENT(F) (corresponding segments must agree in the feature F).

There are separate, and therefore separately rankable, correspondence relations depending on how S_1 and S_2 are related to one another. In classic faithfulness, S_1 and S_2 stand to each other as underlying input and surface output; this is called IO correspondence, and constraints regulating it are called MAX_{IO} (no deletion), DEP_{IO} (no epenthesis), and so on. In base-reduplicant or BR correspondence, S_2 is a Gen-supplied reduplicant and S_1 is the string immediately preceding or following it, called the base.[2] The BR correspondence constraints include MAX_{BR} (copying is complete), DEP_{BR} (the reduplicant contains only copied material), etc.

Assume that some markedness constraint M is crucially dominated by all relevant I-O faithfulness constraints F_{IO}. Then satisfaction of M cannot compel unfaithfulness in the I-O mapping, and M-violating outputs will therefore be observed. But if the same M crucially dominates a faithfulness constraint, F_{BR}, which is proper to the B-R correspondence relation, then M will be obeyed in the reduplicant, at the expense of inexactly copying the base. This is known as the emergence of the unmarked (acronymically TETU): the normally inactive markedness constraint M reveals itself in base-reduplicant situations where I-O faithfulness is not relevant. The following is a general schema for reduplicative TETU, according to the ranking logic just presented:

(4) Ranking Schema for Reduplicative TETU (McCarthy & Prince 1994a)

$\text{Faith}_{IO} >> M >> \text{Faith}_{BR}$

TETU is also important in morphological domains other than reduplication, such as morphological truncation (Benua 1995, forthcoming) or the Japanese *zuuja-go* argot (Itô, Kitagawa, & Mester 1992, 1996), but here our focus is exclusively on reduplication, and so we show the schema with $\text{Faith}_{\mathbf{BR}}$ as low-ranking.

Consider what happens when a markedness constraint that governs prosodic structure (e.g., NO-CODA) is substituted for M in the TETU schema (4). Ranked like this, the markedness cosntraint will define the structural characteristics of systems of partial reduplication (McCarthy & Prince 1994ab, to appear). This Generalized Template Theory of Prosodic Morphology captures the important insight of Shaw (1987) and Steriade (1988) that templates implement markedness restrictions, but it does so with literally the same constraints that determine markedness elsewhere in phonology, rather than with a special template-specific apparatus of markedness parameters or the

[2] The base, then, is always defined relative to the reduplicant. It is a string adjacent to the reduplicant, on the "inside" — immediately preceding a suffixed reduplicant or immediately following a prefixed reduplicant. For discussion, see McCarthy & Prince (1993a: Chapt. 5), Urbanczyk (1996a), and Carlson (1996).

like.[3]

If instead M in (4) is a segmental-featural constraint, then it will limit the *segmental* rather than the prosodic characteristics of the reduplicant. This is the source of fixed default segmentism: it is emergence of the unmarked when the emergent constraint governs segmental rather than prosodic structure. McCarthy & Prince (1994a: 366) and Urbanczyk (1996a) analyze Tübatulabal and Lushootseed, respectively, in these terms. From this perspective, fixed default segmentism and templatic restrictions in partial reduplication have exactly the same analytic basis: they both arise from rankings like (4), differing only in the kinds of markedness constraints that are involved.

We can now return to the theory of inventories. As we noted previously, the structure ς will be barred from the inventory of the whole language if some constraint M(ς) dominates some constraint demanding input-output faithfulness to ς, F_{IO}(ς), as in (5a). Similarly, the TETU ranking (5b) bars ς from the inventory of the reduplicant, although it appears elsewhere in the language. Finally, the ranking in (5c) permits ς to occur in the inventory of reduplicants and non-reduplicants alike:

(5) Inventory Consequences of Ranking

a. Barring ς from Inventory of Whole Language (Including Reduplicant)

M(ς) >> F_{IO}(ς) (ranking of F_{BR}(ς) irrelevant)

b. Barring ς from Inventory of Reduplicant Only

F_{IO}(ς) >> M(ς) >> F_{BR}(ς)

c. Permitting ς in Inventory of Whole Language (Including Reduplicant)

F_{IO}(ς), F_{BR}(ς) >> M(ς)

In this way, the same theory, with the same constraints and rankings, yields both the inventory of the whole language and the restricted, reduplicant-specific inventory.[4]

From this result we derive the following predictions:

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[3] On markedness in reduplicative structure, also see McCarthy & Prince 1986 for the "core syllable" template. On Generalized Template Theory, see McCarthy & Prince 1994ab, to appear; Carlson 1997; Colina 1996; Downing 1994, 1996ab, to appear; Futagi 1997; Gafos 1995, 1996; Itô, Kitagawa, & Mester 1996; Moore 1996; Spaelti 1997; Urbanczyk 1995, 1996ab.

[4] Segmental inventories which are reduced in size and relative markedness are not limited to the reduplicative domain; restrictions of this type are characteristic of unstressed or non-initial syllables (Steriade 1993, 1995), syllable codas, and affixes as opposed to roots (McCarthy & Prince 1994b, 1995). The ranking schema in (10) generalizes to these cases of positional neutralization as well. For example, the ranking F_{ROOT} >> M >> F_{AFFIX} yields emergent unmarkedness in affixes. For development of this approach to positional neutralization, see Alderete 1995, Beckman 1995, 1997, Casali 1997, Lombardi 1995, 1997, Padgett 1995ab.

(6) Reduplicant/Inventory Connection I

The reduplicant's inventory is a (possibly improper) subset of the whole language's. The reduplicant can never have a less restricted (therefore more marked) inventory than the language as a whole. The reduplicant can either copy its base (5a, c) or be less marked than it (5b).

(7) Reduplicant/Inventory Connection II

Reduplicant inventories are like language inventories. Any linguistically significant restriction on the inventory of one language should be paralleled by a restriction on the reduplicant of another language.

(8) Reduplicant/Inventory Connection III

Language inventories are like reduplicant inventories. Conversely, any restriction on the reduplicant of one language should be paralleled by a restriction on the inventory of another language.

The claims in (7) and (8) follow from the core premises of OT: universality of constraints and particularity of ranking. If M(ς) is in the grammar of some language, it is in the grammar of all languages. Thus, if it has an inventory-defining role in some language, it may define the structure of the reduplicant in another through the ranking in (5b). Likewise, if M(ς) defines the structure of the reduplicant in some language, it is ranked somewhere in the grammars of all languages, and it may limit the inventory of some of them through the ranking in (5a). Below, we will seek to support these claims, presenting evidence in the context of analyses of Lushootseed, Tübatulabal, Nancowry, Igbo, Nuxalk, and Nisgha. We will also suggest some functional considerations that, weighed against these formal consequences of the theory, might sometimes blunt their force.

Classically, another important role for markedness has been in characterizing *default* segments, which emerge most typically in circumstances of epenthesis. Default segments have been particularly important in the development of theories of underspecification, which analyze defaults as the result of spelling-out the featural contents of incomplete segments (Archangeli 1984: 36, 1988; Broselow 1984; Herzallah 1990; Paradis and Prunet 1991; Pulleyblank 1988). Here, we generalize the notion of a default from a segment to any structure, and we include the effects of context on defaults as well. Default segments or structures are determined by the same markedness constraints that characterize inventories (Prince & Smolensky 1993: Chapt. 9; Smolensky 1993). In determining what is the default, the *interaction* of markedness constraints, through ranking, is what's important:

(9) Defn.: *Default*

A set of segments or structures α is the *default* relative to the set S in context K in a language L iff

(i) $\alpha \subset S$; α, $\bar{\alpha}$ (the complement of α in S) $\neq \emptyset$,

(ii) all elements of α obey some markedness constraint(s) M in context K, and all elements of $\bar{\alpha}$ violate M in context K, and

(iii) there is no markedness constraint C such that C >> M in L, some element of α violates C, and some element of $\bar{\alpha}$ obeys C.

The clauses of this definition mostly reflect familiar assumptions about defaults, though without the underspecificational orientation that is common to most pre-OT treatments.

(i) A segment or other structure is a default relative to some larger set of which it is a member; hence, we see informal statements like "voiceless is the default for obstruents" or "ʔ is the default consonant". (As in the latter case, α can be a singleton set.)

(ii) Defaults may be contextually determined, because UG includes markedness constraints that are context-sensitive as well as context-free; hence, we find informal statements like "vowels are oral by default" modified by "vowels are nasal by default next to a nasal consonant".

(iii) Because markedness constraints conflict, language-particular ranking of markedness constraints can lead to differences in what the default is. For example, the default syllable is normally open, as syllabic augmentation in Lardil or Axininca Campa demonstrates, but it is closed word-finally in Makassarese (McCarthy & Prince 1994a).

Finally, observe that this definition does not mention faithfulness constraints, because faithfulness is irrelevant to the characterization of default status. In the most typical default case, epenthesis, the choice of whether to epenthesize or not is a matter of faithfulness, but the choice of which segment to epenthesize calls on the notion of a default, which does not consider faithfulness.

Defaults are also important in reduplication, including fixed segmentism. As we noted previously, because of the logic of TETU the reduplicant can either be identical to its base or it can improve on the base in markedness. Improvement in markedness is always relative to some language-particular constraint hierarchy (see (9iii) above), because languages differ in constraint ranking and markedness constraints may be in conflict with one another. A grammar of a language is a ranking of constraints, and a single ranking must be capable of characterizing fixed-segmentism phenomena in terms of the TETU ranking (5b) and default segments in terms of the definition (9). We therefore obtain a concrete prediction from these abstract considerations:

(10) Reduplication/Default Connection

When not copied, reduplicants are like defaults. Markedness effects shown by fixed-segmentism phenomena must be consistent with markedness effects shown by classic evidence of default status, like epenthesis. Where reduplicative TETU and default phenomena are co-existent in a language, they cannot show attraction to inconsistent targets (assuming that all relevant properties, such as context and class of affected segments, are the same).

This means that the same segment will appear in epenthesis and in fixed-segment reduplication. Concrete evidence of this prediction will be given in below in the analyses of Yoruba, Lushootseed, Tübatulabal, Nancowry, and Makassarese.

This brings us to a final prediction derived from the TETU ranking (5b): fixed segmentism need not be "fixed" at all, but may in fact vary depending on details of the form under evaluation and the rest of the language's constraint hierarchy. This lack of invariance can be made manifest in any of the following situations:

(11) Potential Variability of Fixed Segmentism

Fixed reduplicative segmentism may alternate across different realizations of the reduplicative morpheme if higher-ranking constraints demand alternation.

Some concrete examples:

•Suppose the emergent markedness constraint M(ς) in (5b) evaluates segments relative to some context or its activity is impinged on by some higher-ranking context-sensitive constraint. In such a case, the particular context obtaining in each form will determine what the "fixed" segmentism is, and it may in fact be observed to vary from one form to another. This is the situation in Nancowry, Igbo, Nuxalk, and Nisgha.

•Suppose we have a ranking like (5b) and ς occurs in an optional prosodic position like the coda. In that case, M(ς) will function like a classical template — it will simply prevent copying of non-ς material (and no fixed-segmentism substitute will be provided). This observation reinforces the connection made earlier between fixed segmentism and Generalized Template Theory. This is the situation in Tübatulabal.

• Suppose M(ς) is ranked above the general BR faithfulness constraints MAX and DEP, but below other more specific BR faithfulness constraints (such as ANCHOR, the edge-specific version of MAX). Then the force of M(ς) will be felt only as a default relative to failure to satisfy the higher-ranking BR constraints ("copy this way, else substitute fixed segmentism"). This is the situation in Lushootseed and Makassarese.

Of course, true invariance of fixed segmentism is also possible, when none of these circumstances holds. But the conditions leading to variance are of particular interest, and we call attention to them below.

To sum up, in this section we have shown how certain elementary assumptions about markedness, faithfulness, and their interaction lead to specific predictions about the nature of fixed segmentism in reduplication. Fixed reduplicative segmentism is obtained by deploying a markedness constraint in the TETU ranking (5b). Since markedness constraints are universal, any constraint of UG can potentially be responsible for fixed segmentism and, conversely, any fixed segmentism may be the product of (a congeries of) universal markedness constraints. Markedness constraints define the shape of phonological inventories, and therefore any observed inventory restriction could in principle be paralleled by a fixed-segmentism phenomenon, and conversely. A language-particular ranking of markedness constraints defines various default segments or structures, and any fixed-segmentism phenomenon in that language must be consistent with that ranking. Finally, fixed segmentism need not be "fixed" at all; contextual markedness effects are always possible and, through constraint interaction, the same constraints that define fixed segmentism in one language can define what is able to be copied in another or what to do in case of failure to copy in a third.

2.2 Case Study: Yoruba

From these abstract considerations, we turn to the concrete case of Yoruba, which clearly exemplifies the predicted correlation between fixed reduplicative segmentism and the default segment in the language at large. The data are repeated here from (1a) above:

(12) Deverbal Reduplication in Yoruba (Akinlabi 1984, Pulleyblank 1988, Ola 1995: 86f.)

gbóná	gbí-gbóná	'be warm, hot; warmth, heat'
jɛ	jí-jɛ	'eat; act of eating'
dára	dí-dára	'be good; goodness'
gbé	gbí-gbé	'take; taking'
rí	rí-rí	'see; act of seeing'
mu	mí-mu	'drink; drinking'
wɔ́n	wí-wɔ́n	'be expensive; dearness'

Descriptively, the reduplicant copies the initial consonant of the base and combines it with the fixed vowel *i* and fixed high tone. We will argue that the fixed vowel *i* is a consequence of reduplicative

TETU and that it accords with the default structure of the language.[5] (More tentatively, we will suggest that the tone is also a TETU default.)

Marantz (1982) analyzes Yoruba with prespecification on a CV template:

(13) Yoruba Reduplicative Template Under Prespecification Theory

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 H
 |
CV
 |
 i
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The prespecified vowel and tone take precedence over copying, fixing them as invariant no matter what the base looks like. Though Pulleylbank (1988) accepts the tonal part of this analysis, he argues instead that *i* is a default, an underspecified V slot that is left empty by reduplication, only to be filled in later by the default rules of the language. Evidence for *i*'s default status comes, *inter alia*, from the phonology of loan words, which usually resolve unsyllabifiable sequences by epenthesizing *i*: *gírámà* 'grammar', *dírɛ́bà* 'driver', *sílípáàsì* 'slippers'.[6]

The essence of Pulleyblank's proposal carries over into OT, though without his underspecificational and derivational assumptions. To simplify the discussion, let us assume the existence of some hierarchy H(*i*), a language-particular ranking of markedness constraints that favors *i* over all other vowels.[7] To say that *i* is the default vowel in Yoruba is to say that the grammar of Yoruba contains this ranking (cf. (9)). Then H(*i*), however it is disposed relative to other constraints in the grammar, will favor epenthesis of *i* over epenthesis of any other vowel, where epenthesis is compelled by syllabic considerations (i.e., the ranking *COMPLEX >> DEP$_{IO}$):[8]

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[5] Oduntan (1996) reports variation with base *u* copying as *u*: *mí-mu* ~ *mú-mu* 'drinkable', *lí-lù* ~ *lú-lù* 'act of striking'. He reports that some speakers find both variants equally good, some accept both but prefer *i*, and some find *u* "mildly unacceptable". We do not address this variation here, but discuss a similar situation in Igbo below in §2.6.

[6] Some loans epenthesize *u* under conditions of back harmony or labial attraction. But many loans epenthesize only *i*, and the reduplicant conforms to that pattern. See Pulleyblank 1988: 247f. for discussion.

[7] It doesn't matter whether *i* incurs some violations H(*i*) or not, so long as *i*'s violations are less severe than those of any other vowel.

[8] The constraint *COMPLEX-ONSET militates against biconsonantal or longer onsets. DEP$_{IO}$ is the correspondence-theoretic version of the anti-epenthesis constraint FILL, here limited to the IO mapping.

(14) Default Epenthesis in Yoruba

/grama/	*COMPLEX-ONSET	DEP$_{IO}$	H(*i*)
a. ☞ girama		*	*a*, *a*
b. gurama		*	*u*!, *a*, *a*
c. gɛrama		*	ɛ!, *a*, *a*
d. grama	* !		*a*, *a*

To aid the reader in determining the locus of constraint violation, we have sometimes noted the offending segment(s) in the tableau; each segment translates into a single "*". All candidates equally share the markedness violations incurred by the two *a* vowels. Thus, the decision falls to other considerations. Form (14e), though fully faithful to the input, violates top-ranked *COMPLEX; epenthesis is unavoidable, then. The choice of which vowel to epenthesize falls to markedness considerations. The optimal candidate is (14a), with epenthetic *i*, this candidate best satisfies H(*i*) without violating *COMPLEX-ONSET. The default status of *i* is a matter of obedience to a hierarchy of markedness constraints, just as in the definition (9).

Though H(*i*) is default-defining in Yoruba, it is not inventory-defining; the language as a whole has other vowels. This shows that H(*i*) is crucially dominated by I-O faithfulness requirements, such as MAX$_{IO}$ and IDENT$_{IO}$, so its its force emerges only in situations where I-O faithfulness is not directly relevant, like epenthesis. In this way, input vowels like /e/ or /o/ are reproduced faithfully in the output, and not simply deleted or replaced to suit the exigencies of markedness. In contrast, other markedness constraints — the inventory-defining ones — must dominate MAX$_{IO}$ or other I-O faithfulness requirements. Such undominated constraints define the invariant properties of the Yoruba inventory, such as the prohibition on front rounded vowels. The undominated and the emergent constraints are formally indistinguishable from one another, since both come from the broad family of markedness constraints. But they differ in ranking with respect to I-O faithfulness.

Now we come to reduplication. In the reduplicant, H(*i*) is *inventory-defining*. This shows that it crucially dominates some B-R identity constraint(s), by assumption the anti-deletion and anti-epenthesis constraints MAX$_{BR}$ and DEP$_{BR}$, in a TETU ranking:

Note to readers: Differences in degree of shading in tableaux have no significance; they reflect a bug in WordPerfect.

(15) Tableau for TETU in Yoruba

/RED+ j^a $ɛ^b$ /	MAX$_{IO}$	H(*i*)	MAX$_{BR}$	DEP$_{BR}$
a. ☞ j_1í- $j_1^a ɛ_2^b$		ɛ	ɛ	*i*
b. j_1ɛ́$_2$ - $j_1^a ɛ_2^b$		ɛ, ɛ !		
c. j_1í$_2$ - $j_1^a i_2$	ɛ !			

Correspondence mappings on the I-O relation are indicated here by alphabetic superscripts, and correspondence mappings on the B-R relation are shown by numeric subscripts. (This notation, though somewhat cumbersome, is necessary because we are dealing with separate relations of correspondence.) In the actual output form (15a), a vowel of the base is not copied, violating MAX$_{BR}$, and a non-copied vowel appears in the reduplicant, violating DEP$_{BR}$. Nonetheless, its expected syllabic role, as nucleus in the reduplicant, is indispensable. A vocalic nucleus is required by an undominated constraint, and one is supplied, in accordance with minimization of markedness violation. In this latter respect, reduplication is no different from ordinary epenthesis, as seen in (14).

Following McCarthy & Prince (1994a), we propose that the non-copying of the vowel in Yoruba reduplication — i.e., the MAX$_{BR}$ violation — is motivated by exactly the same markedness constraints, H(*i*), that determine the choice of the epenthetic vowel in *gírámà*.[9] Non-copying arises because MAX$_{BR}$ is ranked below H(*i*), so the candidate with exact copying, (15b), fatally violates H(*i*). That violation *can* be avoided by inexact copying, as (15a) shows, and it *must* be avoided, because H(*i*) dominates MAX$_{BR}$ and DEP$_{BR}$. The same reasoning applies with equal force to all the other vowels of Yoruba, except of course for *i* itself.

The candidate in (15c) exhibits a different kind of behavior, a kind of *back-copying*, in which a derived property of the reduplicant is copied back into the base, thereby maintaining perfect B-R identity while simultaneously achieving markedness improvements. Back-copying is in general possible in reduplication (McCarthy & Prince 1995), but it can never be obtained in TETU situations like this one, because the logic of constraint ranking forbids it (McCarthy & Prince, to appear). Form (15c) improves on even the actual output in H(*i*) performance, and it achieves perfect performance on MAX$_{BR}$, but it does so at too high a price: violation of top-ranked MAX$_{IO}$. This fault in (15c) is the

[9]Compare earlier rule-based approaches to Yoruba, which offer much more arbitrary reasons for non-copying. McCarthy & Prince 1986 stipulate that the V tier is not copied; Pulleyblank 1988 stipulates that the root-initial C spreads instead of copying, so the vowel cannot copy due to the line-crossing prohibition (cf. Steriade 1982).

same that we would find in any example, reduplicated or not, where an input vowel is replaced by output *i*. This is what it means to say that the unmarked *i* of the reduplicant is an *emergent* property of Yoruba phonology. The vowel *i* is not a target to which all input vowels are mappable, because I-O faithfulness crucially dominates the constraints in H(*i*).

This, in brief, is the account of fixed segmentism as TETU, under the ranking schema (4) and the Non-Copying Model. The vowel *i* is the default because it performs best on the markedness hierarchy H(*i*). This default vowel emerges in epenthesis because there is nothing better to epenthesize, with respect to H(*i*); it emerges in reduplication because H(*i*) is favored over accuracy of copying. In that way, H(*i*) defines the vocalic inventory of the reduplicant. It therefore exemplifies the predicted correlation between fixed and default segmentism (10). It also exemplifies the prediction that the reduplicant's inventory can be a proper subset of the whole language's (6).

Some questions naturally arise, however, and we will try to address them before going on to present our other case studies:

▫In Yoruba, the vowel inventory of the reduplicant is just *i* — much more restricted than the inventory of the rest of the language. Could the reduplicant have a *richer* or *different* inventory than the rest of the language?

▪The answer is no. As we emphasized earlier (and see Prince & Smolensky 1993: Chapt. 9), the vowel inventory is itself defined by M >> F_{IO} constraint interactions. Therefore, by transitivity of the domination relation, given that F_{IO} >> H(*i*), any inventory-defining markedness constraint must dominate any default-defining markedness constraint in H(*i*). Introducing a non-inventory vowel in the reduplicant is thus even worse, markedness-wise, than copying the base vowel. For this reason, TETU can never yield fixed segmentism in the reduplicant that goes outside the independently attested segmental inventory.

▫Is the *i* of the reduplicant epenthetic or just an inaccurate copy? In Correspondence terms, is the actual output form j_1 *í* - $j_1\varepsilon_2$, with MAX$_{BR}$ and DEP$_{BR}$ violations, or is it j_1 $í_2$ - $j_1\varepsilon_2$, with violations of various IDENT$_{BR}$ constraints (which require corresponding segments to match featurally)?

▪Either approach is entirely consistent with all known data in Yoruba, and so either one would be satisfactory and would support our overall claims. Other examples discussed below appear to require one approach or the other, indicating that both are attested. This is what we would expect, since both approaches reflect different possibilities afforded by ranking permutation. For discussion, see Schachter & Fromkin 1968, Hyman 1972, Faraclas & Williamson 1984, Clements 1989, McCarthy

& Prince 1994b, and Padgett & Ní Chiosáin 1995..

▫What if the vowel of the base is *i*, as in *rí*?

▪In that case, there is no conflict between MAX$_{BR}$ and H(*i*), so the reduplicant will contain a copied (rather than epenthetic) *i*: $r_1í_2$-$r_1í_2$. There is a general result here: "accidental" resemblance between the default segment and the base leads to copying rather than epenthesis (cf. the notion of vacuous application in rule-based phonology (Mascaró 1976) or vacuous coalescence in Correspondence Theory (Gnanadesikan 1995)). Direct evidence for copying in such situations comes from Igbo (§2.6).

▫In Yoruba, H(*i*) is inventory-defining for just the reduplicant, but can it ever be inventory-defining for a whole-language, by domination of IO faithfulness?

▪Though the individual constraints of H(*i*) might be observed to define inventories, the full hierarchy does not, since no language has a vowel inventory consisting of just *i*. This is an instance of a classic problem in markedness and underspecification theory: the best inventories are small ones, but not *too* small. This problem has not been addressed in the underspecification literature, but markedness theories of the *SPE* type take special precautions to force a lower bound on inventory size or complexity (Kean 1975: 52f.; cf Chomsky & Halle 1968: 409f.).

A better idea is to admit, say, {ʔ , *i*} as a possible segmental inventory of human language and then consider the many functional reasons why no actual human language has it. A vocabulary consisting of just the lexical items ʔ*i*, ʔ*i*ʔ*i*, ʔ*i*ʔ*i*ʔ*i*, ... presents obvious difficulties in actual use: it must be either very small or involve very long words; the human perceptual system is ill-equipped to distinguish among, say, 5, 6, or 7 repetitions of identical or even similar syllables.[10]

▫What precisely are the constraints in H(*i*)?

▪This question is roughly equivalent to asking for a comprehensive theory of the phonology of vowel systems, something neither we nor anyone else is prepared to offer. Our purpose in presenting Yoruba is to give a relatively simple illustration of the ranking logic of TETU and the correlation of fixed segmentism and default status. Of course, cross-linguistically, *i* is a common epenthetic vowel (Steriade 1995: 140), so we are amply justified in assuming the existence of H(*i*), but whether H(*i*) is representational (as in the underspecificational account of Pulleyblank 1988) or substantive (as in the account of Pulleyblank 1996) is not something we will address here. Ultimately, of course, we have a responsibility to make contact between fixed segmentism phenomena and specific proposals

[10]This argument has clear relevance to acquisition; see Gnanadesikan 1996.

about the make-up of the markedness constraints of UG. We do that below, particularly in §2.4, §2.5, and §2.6.[11]

□The Yoruba reduplicant has a high tone, but Pulleyblank (1984) has argued that the default tone in Yoruba is mid. So, even if the vowel is emergent, isn't prespecification of tone necessary, as in Pulleyblank 1988?

■The essence of Pulleyblank's (1984) argument is that, in encounters where a mid tone contends with a high or low tone for the same vowel (e.g., in hiatus resolution), the mid tone always loses. From this fact, he concludes that the mid tone is not present at all when the relevant phonology takes place, and therefore that the mid tone is the default.

An alternative is possible, building on a suggestion that Pulleyblank (1984: 121) attributes to G. N. Clements. The core observation is that potential contour tones that combine high or low with mid in any order are always resolved by deleting the mid tone. Both aspects of this observation make sense under Dispersion Theory (Liljencrants & Lindblom 1972; Lindblom 1986, 1990; Flemming 1995), which favors maintaining maximal perceptual distance between distinct objects. Thus, it is plausible for a language to permit HL or LH contour tones while prohibiting the less dispersed contours HM, MH, LM, and ML. Furthermore, in a three-tone system, the middle tone is most marked, dispersion-wise (see also Gnanadesikan 1997), and so markedness considerations would favor deleting the M from any of these contour tones. From this perspective, then, M is the most marked rather than the default tone of Yoruba, and the H of the reduplicant may indeed be a default, like the vowel *i*. (To complete the picture, it must be shown that H is the default relative to L as well.)

2.3 Case Study: Lushootseed

In the Salish language Lushootseed, there is an alternation between CV reduplication and fixed segmentism C*i* reduplication. According to Bates (1986), the choice of CV versus C*i* reduplication is predictable on the basis of the phonology of the root: "[f]orms take Ci if CV-prefixation is prevented by independent principles" (Bates 1986: 11). Following Urbanczyk (1996a), we will show how these independent principles — that is, rankd constraints — interact with the TETU system to produce the pattern Bates discovered.

The determinants of CV versus C*i* are these:

[11] Faraclas & Williamson (1984) make the interesting proposal that the reduplicative vowel is high because of stricture assimilation to the consonantal context.

(16) Lushootseed Diminutive Reduplication (Bates, Hess, & Hilbert 1994, Urbanczyk 1996a)[12]

a. CV Reduplication			
čáləs	'hand'	čá-čaləs	'little hand'
hiw-il	'go ahead'	hi-hiwil	'go ahead a bit'
s-duk^{w}	'bad'	s-dú-ʔ-duk^{w}	'riff-raff'
súq^{w}aʔ	'younger sibling'	sú-ʔ-suq^{w}aʔ	'little younger sibling'
b. C*i* Reduplication			
i. With Cə Roots			
təláw-il	'run'	tí-təlaw'-il	'jog'
x̌əc-bid	'afraid'	x̌í-ʔ-x̌əc-bid	'a little afraid of it'
g^{w}ədíl	'sit down'	g^{w}í-g^{w}ədil	'sit down briefly'
ii. With CVː Roots[13]			
s-duːk^{w}	'knife'	s-dí-duːk^{w}	'small knife'
buːs	'four'	bí-ʔ-buːs	'four little items'
luː-d	'hear something'	lí-ʔ-luːd	'hear something a little'
iii. With CCV Roots			
č'ƛ'áʔ	'rock'	č'í-č'ƛ'aʔ	'little rock'
c'k^{w}'usəd	'cane, walking stick'	c'í-c'k^{w}'usəd	'little walking stick'
ɬč-il	'arrive, get there'	ɬí-ɬč-il	'arrive occasionally'

The Lushootseed diminutive reduplicant is a core CV syllable, with a simple onset and a short vowel. Furthermore, it is always stressed, indicating that it is a member of the broader class of dominant or stress-attracting affixes in this language. For expositional economy, we will simply assume that these properties of the reduplicant are enforced by undominated constraints (on which see Urbanczyk 1996a).

From these restrictions on the reduplicant, we can derive the difference between the CV-reduplicating roots in (16a) and the C*i*-reduplicating roots in (16b). In (16a), it is possible to copy the initial CV sequence of the root exactly and still have a satisfactory reduplicant. But in (16b), either exactness of copying or restrictions on the reduplicant must suffer:

- Cə roots (16b.i). Exact copying of the initial Cə sequence would produce a stressed schwa: **g^{w}ə́-g^{w}ədil*. This configuration is strongly disfavored in Lushootseed and cross-linguistically (see below). The fixed *i*, then, is a stressable substitute for the preferentially unstressed ə. An alternative candidate would place stress on the non-schwa vowel in the stem (**g^{w}ə-g^{w}ədíl*), but this would violate the immutable requirement that the reduplicant be dominant or stress-attracting.

[12] The ʔ that sometimes appears between reduplicant and base is shown by Bates (1986) to be a separate morpheme.

[13] A number of examples of this type arguably have long vowels only underlyingly. See Bates (1986), Urbanczyk (1996a: 209).

•CVː roots (16b.ii). The reduplicant is light in Lushootseed, and therefore exact copying of a long vowel is impossible. Default *i* emerges in place of the imperfect copy. An alternative candidate would copy the long vowel as short (**s*-*dú*-*duːk*ʷ), but this violate IDENT$_{BR}$(μ).[14]

•CCV roots (16b.iii). The reduplicant has a monoconsonantal onset in Lushootseed, so the initial cluster of CCV roots cannot be copied intact. Default *i* emerges in place of skipping the second consonant (**č'á*-č'*ƛ'aʔ* — cf. Sanskrit *du-druv*), which would violate CONTIG$_{BR}$ (which requires that correspondence preserve string-contiguity relations.)

The situation, then, is precisely as Bates describes it: when CV reduplication is independently excluded, C*i* reduplication occurs in its stead. Following Urbanczyk (1996a), we will now show precisely how this is accomplished in terms of constraint interaction.

The Cə roots (16b.i) pit exactness of copying (**g*ʷə́-*g*ʷə*dil*) against the avoidance of stressed schwa (*g*ʷ*í*-*g*ʷə*dil*). The latter wins, reflecting a general (though not invariant) pattern of the language. Apart from the effects of accentually dominant morphemes, the Lushootseed stress pattern locates stress on the leftmost non-schwa vowel or, if all vowels are schwa, on the first syllable (Urbanczyk 1996a: 135f.):

(17) Stress in Lushootseed (Hess 1977; Bates, Hess, & Hilbert 1994)

a.	ʔítut	'sleep'
	čúqʷud	'to whittle something'
	kʷáxʷadad	'spiritual help'
	pástəd	'white person (< *Boston*)'
b.	čəgʷás	'wife'
	təyíl	'to go upstream'
	k'ədáyu	'rat'
c.	pə́lxʷəd	'to scatter something'
	ǰə́səd	'foot'

Stress patterns like this one are well documented. In OT terms, they reflect the domination of a constraint demanding initial stress (EDGEMOST) by a constraint banning stressed schwa (Prince & Smolensky 1993; Kenstowicz 1994c). The following tableaux correspond to each of the types given in (17):

[14] IDENT$_{BR}$(μ) is crucial to the analysis of the quantitative transfer phenomenon in reduplication, on which see the references in footnote 21.

(18) Deriving the Lushootseed Stress Pattern

	*ə́	EDGEMOST
a. ☞ ʔítut		
b. ʔitút		*!
c. ☞ təyíl		*
d. tə́yil	*!	
e. ☞ ǰə́səd	*	
f. ǰəsə́d	*	*!

In words that contain a non-schwa vowel after an initial string of schwas (18c), top-ranked *ə́ is decisive. But in other words, the interesting candidates tie on this constraint, either because all obey it (18a, b) or all violate it (18e, f). Of course, appropriate IO faithfulness constraints must dominate *ə́, to forestall replacing ə in initial syllables by some more stressable vowel.

This same constraint, *ə́, which is only contingently obeyed in the language as a whole, is categorically obeyed in diminutive reduplication. Rather than copy and stress ə, the reduplicant has non-copying with a default, more readily stressable vowel in its place. The main TETU ranking is this:

(19) *ə́ >> MAX_{BR}, DEP_{BR}

/RED+gʷədil/	*ə́	MAX_{BR}	DEP_{BR}
a. ☞ $g^w{}_1$í-$g^w{}_1ə_2$dil		****	*
b. $g^w{}_1ə́_2$-$g^w{}_1ə_2$dil	*!	***	

Thus, less exact copying is preferred to stressing a schwa. To complete the TETU picture, we observe that MAX_{IO} and DEP_{IO} must dominate *ə́, or else ǰə́sə*d* (18c) would come out as *ǰ*ísəd*. In this way, stressed schwa is banned from the inventory of the reduplicant even though it is tolerated in the language as a whole.

A couple of details remain. One is the choice of the emergent vowel in the reduplicant. Schwa itself would normally be a likely candidate for default status, but obviously not under stress. Thus, the choice is among *i*, *u*, and *a*. The responsible constraints are the same as H(*i*) in §2.2, and our remarks there also apply here. Another detail concerns the rationale for the constraint *ə́, on which see Kenstowicz 1994c.

We will proceed more rapidly through the other two cases of fixed segmentism in Lushootseed (16b.ii, iii). They involve emergence of the fixed vowel when copying the base's vowel would create BR identity problems, either by copying a vowel without preserving its length or by skipping a consonant. As we noted above, the constraints IDENT$_{BR}$(μ) and CONTIG$_{BR}$ (itself dominated by L-ANCHOR$_{BR}$) govern these aspects of base-reduplicant matching, respectively. Through domination of MAX$_{BR}$ and DEP$_{BR}$, they demand non-copying in place of less-than-perfect copying:

(20) IDENT$_{BR}$(μ) >> MAX$_{BR}$, DEP$_{BR}$

/RED+duːk^w/	IDENT$_{BR}$(μ)	MAX$_{BR}$	DEP$_{BR}$
a. ☞ s-d$_1$í-d$_1$u$_2$ːk^w		**	*
b. s-d$_1$ú$_2$-d$_1$u$_2$ːk^w	*!	*	

(21) L-ANCHOR$_{BR}$ >> CONTIG$_{BR}$ >> MAX$_{BR}$, DEP$_{BR}$

/RED+č'ƛ'aʔ/	L-ANCHOR$_{BR}$	CONTIG$_{BR}$	MAX$_{BR}$	DEP$_{BR}$
a. ☞ č'$_1$í-č'$_1$ƛ'$_2$a$_3$ʔ			***	*
b. č'$_1$á$_3$-č'$_1$ƛ'$_2$a$_3$ʔ		*!	**	
c. ƛ'$_2$á$_3$-č'$_1$ƛ'$_2$a$_3$ʔ	*!		**	

In (20), the choice is between copying the vowel minus its length (b) or not copying it at all (a). And in (21), the choice is between copying the vowel by skipping one of the consonants or, again, not copying the vowel at all (a). With these rankings, non-copying (and emergence of the unmarked) is the outcome. Of course, perfect copying could be achieved by ignoring the restrictions on the reduplicant (no long vowels, no initial clusters), but here we have assumed those to be undominated constraints.

In summary, Lushootseed diminutive reduplication is remarkable for the following reasons.

■It confirms the predictions developed in §2.1. In Lushootseed as a whole, stressed schwa is avoided, though it is possible under duress. Therefore, in keeping with our extended notion of what a default is (see (9)), it is appropriate to say that the default for schwa is to be unstressed. The phonology of the reduplicant accords exactly with this independently motivated default, and thus we find support for one of the predictions: fixed segmentism by TETU will match language-particular defaults (10). Another prediction is that an inventory restriction on the reduplicant in one case will be paralleled by an inventory restriction on a whole language in another case (7, 8). This is also true of *ə́. In

Indonesian (Cohn & McCarthy 1994), stressed schwa is prohibited categorically, indicating crucial domination of an IO faithfulness constraint.

■It shows that fixed segmentism need not be an invariant property of all instances of the reduplicative morpheme, thereby supporting another of our predictions (11). The appearance of fixed segmentism, or not, is a matter of the interaction of constraints through ranking.

■Though inYoruba (and other cases below) it is phonological markedness constraints that lead to non-copying and consequent emergence of fixed segmentism, Lushootseed proves that even BR correspondence constraints themselves can have this effect. The causes of fixed segmentism in Lushootseed include an emergent phonological constraint (*ə́) as well as certain high-ranking BR correspondence constraints (IDENT$_{BR}$(μ), CONTIG$_{BR}$).

■Lushootseed supplies evidence concerning the delicate question of whether fixed segments are non-copies or imperfect copies — that is, whether MAX$_{BR}$/DEP$_{BR}$ or IDENT$_{BR}$ are violated by fixed segments. The constraint interaction in (20) presents a direct conflict between IDENT$_{BR}$ and MAX$_{BR}$/DEP$_{BR}$; the former dominates, so non-copying is the result. The fixed *i* of Lushootseed is truly epenthetic and not an imperfect copy.

■The Lushootseed evidence confirms the inadequacy of other models of fixed segmentism. The prespecification theory in Marantz 1982 is all-or-nothing, but Lushootseed shows that fixed segmentism is contingent on a delicate interplay of phonological and BR correspondence constraints. Kiparsky 1986 adds a type of conditional prespecification, but the conditions only serve to limit what kinds of segments can be associated to a template slot; they do not say what to do when a template slot cannot be matched satisfactorily.

The Steriade 1988 model attributes fixed segmentism to rules applied to a full copy of the base prior to template matching (see (39, 40) below). Since the full copy contains information about length, accommodation to the template may involve vowel shortening. But there is no way in the full-copy model to deal with forms like *s-<u>dí</u>-duːk*^{w}, where the incompatibility of vowel length with the template leads to epenthetic *i* rather than a shortened *u*. In particular, since fixed segmentism is handled with rules applied *before* template-matching, it cannot depend on *failure* of satisfactory template-matching, as in Lushootseed.

In contrast, Urbanczyk's (1996a) analysis, which we have summarized here, shows that constraint ranking in OT can exactly and revealingly characterize the conditions and nature of Lushootseed fixed segmentism, thereby giving full formal expression to Bates's (1986) insight that fixed segmentism emerges when exact copying is excluded by independent constraints.

2.4 Case Study: Tübatulabal

One of the great, recurrent topics of phonological investigation is the prosodic and segmental structure of the Uto-Aztecan language Tübatulabal. The matter was first raised in Swadesh & Voegelin's (1939) article "A Problem in Phonological Alternation", based on Voegelin's field research (Voegelin 1935a, 1935b). Later generations of phonologists became familiar with this article through its inclusion in Joos (1957), and many have put their hand to elucidating one aspect of the problem or another: Anderson 1974, Benki 1995, Carden 1984, Crowhurst 1991ab, Gutmann 1982, Hayes 1995, Heath 1977, 1981, Howard 1973, van der Hulst 1984, Kager 1989, Kenstowicz 1977, Kiparsky 1986, Levin 1983, Lightner 1971, McCarthy & Prince 1986, McCawley 1969, Prince 1983, and Wheeler 1979, 1980.

Because the interesting alternations are most apparent in reduplicated words, many of these studies have looked at reduplication. They have, however, usually focused on the quantitative structure of the reduplicant (and of the language generally), while our focus will be on the segmental properties of reduplication. There are two such properties, fixed initial ʔ and the contextually-determined possibility of a nasal coda:

(22) The Segmental Phonology of Reduplication in Tübatulabal (Voegelin 1958)[15]

a. Reduplicant-initial ʔ, regardless of base-initial consonant

piːʃin	ʔiː-biːʃin	'he is snoring'
piːbiːwin	ʔiː-biːbiːwin	'to play jew's harp'
pɨtɨta	ʔɨ-pɨtɨta	'to turn over'
pɨʃɨka	ʔɨ-pɨʃɨka	'to slip'
toːyan	ʔoː-doyan	'he is copulating'
toha	ʔoː-doha	'to hunt'
ʃɨʔɨwɨ	ʔɨː-ʃɨʔɨwɨ	'it looks different'
ʔaːbaʔiw	ʔaː-ʔabaʔiw	'it is showing'
muːdaka	ʔuː-muːdaka	'to dodge'
ʔoːm	ʔoː-ʔom	'to string beads'
leːwin	ʔe-leːwin	'to pack it'

[15]The *t/d* and vowel length alternations, both automatic properties of Tübatulabal phonology, are discussed below and in the literature cited at the beginning of this section.

b. Reduplicant-final nasal, copying base, if base begins with oral stop or affricate

paŋham	ʔam-baŋham	'to hide in the blind'
tumuːga	ʔun-dumuːga†	'to dream'
kamʔ	ʔaŋ-gamʔ	'it fits'
ʦama	ʔan-ʣama	'it's burning'
cf.		
ʔoːm	ʔoː-ʔom, *ʔoN-ʔom	'to string beads'
ʔɨːma	ʔɨː-ʔɨma, *ʔɨN-ʔɨma	'to tie bands'

We will argue that the reduplicant-initial ʔ accords with the default status of that segment in Tübatulabal, paralleling the analysis of *i* in Yoruba. And we will show that the reduplicant-final nasal is governed by the same universal markedness constraints that define the structure of inventories in languages like Japanese or Diola-Fogny. Thus, reduplication in Tübatulabal provides support for both of our principal predictions about fixed segmentism as TETU.[16]

It is no accident that the fixed initial consonant of the Tübatulabal reduplicant is ʔ — this is, after all, the default onset of this language and many others. The default status of ʔ in Tübatulabal is proven by its role in the resolution of hiatus (Voegelin 1935a: 74, 114). In accordance with the definition (9), glottal stop is the default onset because it better satisfies some hierarchy of markedness constraints H(ʔ) than any other possible onset. Thus, in situations of hiatus in Tübatulabal, where epenthesis of *some* consonant is compelled by high-ranking ONSET (i.e., ONSET >> DEP_{IO}), the default consonant that emerges is ʔ, simply because it is better, according to H(ʔ), than alternatives like *p*, *k*, or *t* (McCarthy 1993, Smolensky 1993). The necessary constraint hierarchy is exactly parallel to the one responsible for *i*-epenthesis in Yoruba (14), and further elaboration is unnecessary.

Moreover, in an equally close parallel to (15), H(ʔ) will compel imperfect copying, with ʔ emerging in place of a copy of the base-initial consonant. As we know from (4), fixed segmentism emerges when BR identity requirements are subordinated to markedness constraints like H(ʔ). In a reduplicated form like ʔ*oː–doyan*, three kinds of BR identity are violated in pursuit of segmental unmarkedness:

- MAX_{BR} is violated because the base's *d* (as well as *y*, *a*, *n*) lacks a reduplicative correspondent.
- DEP_{BR} is violated by the fixed, non-correspondent ʔ.

[16]Reduplication yields the "telic" form of the verb (essentially, a perfective) from the corresponding "atelic" (essentially, an imperfective). In a small set of verbs, indicated here by postposed †, the aspectual relation is reversed, and the reduplicated form is atelic.

•L-ANCHOR$_{BR}$ requires that the leftmost segment of the base have a correspondent in the reduplicant. This is a special, edge-specific version of MAX$_{BR}$, keyed to the well-known propensity of reduplicative affixes to copy edge material (Marantz 1982, McCarthy & Prince 1986: §4, Yip 1988). R-ANCHOR$_{BR}$ is high-ranking and determinate of the outcome in Nancowry, to be analyzed in §2.5.[17]

The full ranking is therefore as in (23):

(23) TETU in Tübatulabal, I

/RED+toyan/	MAX$_{IO}$	ONSET	H(ʔ)	MAX$_{BR}$	DEP$_{BR}$	L-ANCHOR$_{BR}$
a. ☞ ʔo$_2$ː–d$_1$o$_2$yan			*d, y, n*	*d, y, a, n*	*	*
b. t$_1$o$_2$ː–d$_1$o$_2$yan			*t,! d, y, n*	*y, a, n*		
c. o$_2$ː–d$_1$o$_2$yan		*!	*d, y, n*	*d, y, a, n*		*
d. ʔ$_1$o$_2$ː–ʔ$_1$o$_2$ʔaʔ	*d, y, n* !					

Form (23a) has the fixed reduplicant-initial ʔ, which is not in correspondence with anything in the base — that is, it is epenthetic. Form (23b) is a more exact copy, but incurs worse violation of H(ʔ). Since H(ʔ) dominates the BR identity requirements, (23b) is non-optimal. Form (23c) involves non-copying of the base-initial consonant, but does not replace it with ʔ — a fatal error, given ONSET's undominated status in this language. And form (23d), which replaces all consonants by ʔ, achieves significant markedness improvement across the board and perfect copying, but it does so at the expense of fatally violating undominated MAX$_{IO}$. This result is typical of TETU situations.

We have shown, then, that fixed ʔ in the Tübatulabal reduplicant has the same formal basis as default epenthetic ʔ. This argument is directly analogous to the account of the vocalic default in Yoruba. Moreover, we are in a better position with Tübatulabal than with Yoruba to be precise about the details of the markedness constraints involved, since markedness constraints for consonants have been more extensively studied than those for vowels. Perhaps the most important factor in consonantal markedness is place of articulation. Based on the literature on coronal underspecification (Paradis & Prunet 1991), Prince & Smolensky (1993: Chapter 9; see also Smolensky 1993) propose a meta-constraint, a universal constraint hierarchy, which asserts that coronal place is less marked

[17] Systems like Tübatulabal raise interesting issues about categorical versus gradient interpretation of ANCHOR violations. A gradient interpretation is required to ensure that the leftmost vowel, even though not initial, is copied. For relevant discussion, see Alderete et al. 1996: Appendix A, Gafos 1997, and Zoll 1996.

than dorsal or labial. Lombardi (1997) extends this hierarchy to include pharyngeal (including laryngeal) Place as less marked than coronal:

(24) Place Markedness Hierarchy

*PL/LAB, *PL/DORS >> *PL/COR >> *PL/PHAR

This is a universally non-permutable hierarchy, and so ʔ will always incur lower-ranking marks on it than a coronal, labial, or dorsal will. It is this universal hierarchy of Place markedness that serves as H(ʔ).

A few remarks about the Place markedness hierarchy are appropriate before we continue with the analysis of Tübatulabal:

■As an alternative to (24), one might drop the *PL/PHAR term of the hierarchy (returning to Prince & Smolensky's original) and see ʔ as truly place-less, in which case it incurs no violation-marks at all (and is in the truest sense "unmarked"). This idea may have merits, but it encounters serious difficulties with phonological systems like those of Arabic, in which ʔ both is epenthetic and has effects on the Place of adjoining vowels (McCarthy 1994).

■The mere existence of (24) in UG does not ensure that ʔ (or *a*) will always have default status in every language. Recall the definition (9): any higher-ranking constraint can vitiate the effects of the Place markedness meta-constraint. So, for example, the commonly-observed constraint barring ʔ from coda position will conflict with (24) in any situation of coda-filling epenthesis. More generally, it seems likely that the markedness constraints of UG will reflect the difficulty of perceiving glottal stop as well as the ease of producing it. To be fully precise, then, the hierarchy H(ʔ) must not only include (24), it must also rank (24) above any constraints that would tend to disfavor ʔ.

■Though (24) favors segments articulated in the pharyngeal region over others, it does not by itself choose among the various possibilities. Other constraints decisively favor ʔ as the default. One, undominated in Tübatulabal militates against articulations like ʕ and ħ, which are in any case quite rare cross-linguistically. Another selects ʔ over *h*, on the grounds that a low-sonority stop is superior to a high-sonority continuant in syllable onsets (Clements 1990; Prince & Smolensky 1993: Chapt. 8). See Lombardi 1997 for discussion.

■Donca Steriade (p.c.) has suggested that ʔ is favored epenthetically and disfavored underlyingly for a single reason, low perceptual salience. This insight, suitably formalized, would also be fully compatible with the logic of TETU and our analysis of Tübatulabal. It is worth noting, though, that there are non-trivial problems of formalization in capturing the insight. There are also significant empirical difficulties with languages like Arabic, whose ʔ is underlying, epenthetic, and able to trigger assimilation of vowels.

We will now account for the reduplicant's coda. The reduplicant does not usually have a coda. There is no constraint like ONSET to demand that syllables have codas, so any coda posited, even ʔ, would involve gratuitous violation of Place markedness, even though it would better satsify MAX$_{BR}$. The next tableau makes this clear (substituting the hierarchy (24) for H(ʔ), in accordance with the argument just given):

(25) The Coda-less Reduplicant in Tübatulabal

/RED+ʃɨʔɨwɨ/	*PL/DORS, *PL/LAB	*PL/COR	*PL/PH	MAX$_{BR}$
a. ☞ʔɨ$_2$ː–ʃɨ$_2$ʔɨwɨ	*w*	ʃ	ʔ,ʔ	ʃ, ʔ, ɨ, *w*, ɨ
b. ʔɨ$_2$ʔ$_3$–ʃɨ$_2$ʔ$_3$ɨwɨ	*w*	ʃ	ʔ, ʔ, ʔ*!*	ʃ, ɨ, *w*, ɨ

The full Place markedness hierarchy militates against all consonants, whatever their source or nature. By dominating MAX$_{BR}$, it bars the copying of consonants in Tübatulabal, in onset or coda position.

There is, however, one circumstance where the reduplicant will tolerate, and in fact requires, a coda. If having a coda does not introduce additional Place markedness violations, then there will be a tie on all Place markedness constraints. This tie is passed along to MAX$_{BR}$, which consistently favors additional copying, and thus will force the reduplicant to have a coda. Exactly this situation is evidenced in (22b): a nasal is copied if it can share Place with a following base-initial stop (e.g., ʔ*un-dumuːga*). We assume that the single Place node shared by the nasal+stop cluster (represented here by the ligature *n͡d*) incurs just one violation of the relevant Place markedness constraint; that is, the *PL/X constraints look at autosegmental tiers rather than individual segments (McCarthy & Prince 1994a, Itô & Mester 1994, Beckman 1995). Thus, Place markedness does not decide between copying a Place-linked coda nasal or not copying it; this tie then goes to MAX$_{BR}$, and so the nasal is indeed copied. The following tableau shows this result formally:

(26) The Assimilated Nasal Coda in the Tübatulabal Reduplicant

/RED+dumuːga/	*PL/DORS, *PL/LAB	*PL/COR	*PL/PH	MAX$_{BR}$
a. ☞ ʔu$_2$n͡$_3$-d$_1$u$_2$m$_3$uːga	*g, m*	*n͡d*	ʔ	*uː, g, a*
b. ʔu$_2$-d$_1$u$_2$m$_3$uːga	*g, m*	*d*	ʔ	*m!, uː, g, a*

The only relevant difference between these two candidates is in the extent of copying: in (26a) the *m* is copied, non-identically, as *n* in the reduplicant, while in (26b) the *m* is not copied at all. This minor (and entirely automatic) imperfection of B-R identity aside, the form in (26a) is a better copy than the one in (26b). And they tie on Place markedness, because the doubly-linked [coronal] feature of *n͡d* gets the same violation mark as the singly-linked [coronal] feature of *d*.[18]

Two final points about the analysis. First, the reduplicant permits a nasal coda only before a root-initial oral stop or affricate. This follows from an independently motivated restriction on Place-linking in NC clusters, on which see Padgett 1991, 1994, 1995c, Rosenthall 1989, Selkirk 1990, 1991. Second, the restriction on reduplicant codas is a further instance of TETU, since the language as a whole permits a much wider range of codas, as Carden (1984) emphasizes (also see Heath 1981). For example, the roots listed in Voegelin 1958 include clusters of various shapes that are impossible in the reduplicant: non-homorganic, beginning with a non-nasal, and ending with a non-stop.

To sum up, we have shown that the occurrence and distribution of a nasal coda in the Tübatulabal reduplicant follows from precisely the same constraint interaction that yields the initial ʔ: domination of MAX_{BR} by the Place markedness hierarchy. This argument yields several results that are relevant to our concerns here:

■It exemplifies the prediction that the reduplicant's inventory can be a proper subset of the whole language's (6).

■It supports our claim that every fixed-segmentism TETU effect — i.e., every inventory restriction on a reduplicant — has a counterpart in the inventory structure of whole languages, and vice-versa (7, 8). It is well known that various languages restrict their coda inventories to Place-linked clusters, just as Tübatulabal restricts its reduplicant. The accounts given of these inventory restrictions are little different from the analysis proposed here: a constraint bans independent, unshared Place specifications from the coda or permits Place specifications only in the onset (Itô 1986, 1989; Goldsmith 1990). Moreover, some work has extended such coda conditions in precisely the way one would expect from application of the Place markedess hierarchy (Yip 1991). In any case, we have here a clear and established parallel between inventory restrictions affecting whole languages and those affecting just the reduplicant.

[18]Other candidates, not included in this tableau, fare even worse. One is *ʔum–dumuːga*, which has a slightly more exact copy, but at the price of worse performance on *PL/LAB and equally fatal violation of the constraint responsible for NC assimilation (see Padgett 1995b for relevant discussion). Likewise, *ʔun–dumuːga*, with an unlinked cluster carrying two instances of the feature [coronal], incurs an additional violation of high-ranking *PL/COR (and perhaps some version of the OCP as well).

■It exemplifies one of the predicted types of variance in fixed segmentism (11). The reduplicant has a coda only when copying and Place-linking is possible; otherwise the reduplicant is coda-less.

Compare this to a prespecificational treatment. Though it is possible to prespecify the reduplicant's onset with ʔ, it is not possible to prespecify the coda. It is not the case that the reduplicant always has a Place-linked nasal coda; it has one only when the base supplies a nasal to be copied. Therefore, the prespecificational model of Marantz 1982 cannot account for one of the two main observations about the Tübatulabal reduplicant. Cases similar to this one lead Kiparsky (1986: 61) to propose that there are two distinct types of templatic prespecification, absolute and conditional. Absolute prespecification is the same as in Marantz 1982; conditional prespecification determines the class of potential fillers for a template slot, but does not require that the slot be filled in fact. Descriptively, this is an improvement, but still it misses a generalization: what is absolute or conditional in Tübatulabal prespecification is exactly what is absolute or conditional in the language as a whole, since onsets are obligatory but codas are not. Furthermore, even Kiparsky's enriched theory of prespecification cannot extend to cases like Lushootseed (§2.3) or Nancowry (§2.5).

Furthermore, this analysis argues against the rule-based theory of fixed segmentism in Steriade (1988). For Steriade, markedness parameters specify the shape of reduplicative templates, so the condition on the reduplicant's coda would be more or less the same as we have proposed.[19] But truly *fixed* segmentism phenomenon like the initial ʔ are attributed to "various phonological rules" applied to a copy of the base before it is matched against the template (Steriade 1988: 134). Therefore, as in the prespecification analysis, no connection can be made in these terms between the restriction on the reduplicant's onset and the restriction on its coda. (For more extensive discussion of this approach, see §2.5 below.)

■It supports the claim, implicit in OT and explicit in §2.1, that markedness phenomena cannot be restricted to context-free effects. The emphasis on context-free default fill-in rules in some of the underspecification literature and its Praguian predecessors might lead to the impression that markedness is always an all-or-nothing proposition. The analysis of Tübatulabal, and OT analyses generally, show that this limitation on theories of markedness is artificial and incorrect. For Tübatulabal, the least marked consonant word-initially is ʔ, but in a coda, it is a homorganic nasal. Thus, reference to the context K in which harmonic evaluation of the default segment takes place is

[19]Nonetheless, the Steriade 1988 theory, like all approaches based on serial derivations, encounters rule-ordering difficulties in satisfying this condition. See the discussion immediately below and at the end of §2.5.

a necessary feature of the definition (9). What this means in practice is that fixed segmentism is not really so fixed; constraint ranking can cause the nature and appearance of fixed segmentism to depend on details of the phonological and morphological environment. We see that with the Tübatulabal coda, and we see it even more emphatically in Lushootseed (§2.3) and Nancowry (§2.5).

■It supports another premise of OT: that distinct aspects of phonological well-formedness are determined in parallel rather than serially. When confronted with the Tübatulabal data, serial analyses run head-long into an ordering paradox: the nasal is copyable because it assimilates to the following stop, but it cannot assimilate until it has copied. Serialism demands that either copying or assimilation take place first, but neither order yields the correct result.[20] In our account, this issue never arises: the well-formedness of copying and assimilation are evaluated together, in parallel. The conception of OT as a parallelist theory therefore receives support from the grammar of Tübatulabal.

A few details remain before we can leave Tübatulabal. One concerns the status of vowels with respect to Place markedness. Though we have disregarded the vowels in our discussion thus far, the analysis of Nancowry below in §2.5 shows that they too participate in harmonic evaluation of Place markedness (precisely as one would expect from unified Place theories (Clements & Hume 1995, Ní Chiosáin & Padgett 1993). This assumption leads to a refinement of the analysis: separate V and C versions of MAX and DEP are posited (McCarthy & Prince 1994b, McCarthy 1996; cf. FILL in Prince & Smolensky 1993). In Tübatulabal, MAX-V_{BR}/DEP-V_{BR} are ranked differently than MAX-C_{BR}/DEP-C_{BR}. The V-specific versions dominate Place markedness. which itself dominates the C-specific versions, as the tableaux above show. If MAX-V_{BR}/DEP-V_{BR} were low-ranking, we would expect to see default behavior in both the consonant and the vowel of the reduplicant — exactly as we do observe in Nancowry (§2.5).

Another detail concerns the interplay among vowel quantity and stop voicing in reduplicated forms, the more familiar aspects of Tübatulabal phonology. All initial stops are voiceless. When reduplication puts them in medial position, some become voiced (*piːʃin/ʔiː-biːʃin*) and others do not (*pɨtɨta/ʔɨ-pɨtɨta*). When the root-initial stop is alternating, the vowel of the reduplicant is long, and when the stop is non-alternating, the vowel of the reduplicant is short. (This same regularity holds root-internally.) Consonants other than oral stops do not alternate in voicing, but they do evince a

[20]Thus, serial accounts of Tübatulabal and similar cases (Southern Paiute, Ponapean) must resort to expedients like dividing template-matching up into several stages: first reduplicate with a CVC template, then stray erase, then assimilate, then add a coda condition to the CVC template, then stray erase again.

similarly arbitrary effect on vowel length in the reduplicant: compare *loːgoʔ/ʔoː-loːgoʔ* with *leːwin/ʔe–leːwin*. Stops which alternate in voicing permit copying of a nasal, as in (26), but non-alternating stops prevent nasal copying: compare *tumuːga/ʔun-dumuːga* with *tomot͡ska/ʔo-tomot͡ska*.

One generalization to be drawn is this: when a root begins with an alternating stop, its reduplicant must be a heavy syllable, with either a long vowel or, if possible, a coda nasal.[21] But when a root begins with a non-alternating stop, its reduplicant must be a light syllable, with a short vowel and without a coda nasal. A similar distinction must be made between two types of continuants and nasals, though without the correlative voicing alternation (and without the nasal coda option, for reasons explained above). For Swadesh & Voegelin, the distinction being made here is phonologically arbitrary — every phonemic consonant has two morphophonemes underlying it. But other analysts (McCawley 1969, Heath 1981, Benki 1995) have taken the position that Tübatulabal has an underlying distinction between simplex and geminate consonants. As expected, the geminates resist intervocalic voicing and they require the preceding reduplicant to be light.[22]

In summary, we have argued that two fixed properties of the Tübatulabal reduplicant — the initial ʔ and the homorganic nasal coda — are forced by the Place markedness hierarchy through domination of MAX_{BR}. These unmarked properties are emergent, in the sense that they are not observed in the language as a whole, because of high-ranking MAX_{IO}. As predicted by the TETU model of fixed segmentism, these properties show significant correlations with the independently proven default status of ʔ in Tübatulabal and the typology of coda restrictions.

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[21]Crowhurst (1991b) emphasizes the importance of syllable bimoraicity in determining the quantitative structure of the Tübatulabal reduplicant. She also finds evidence of quantitative transfer in reduplication. (On transfer, see Levin 1983, Clements 1985, Hammond 1988, McCarthy and Prince 1988, Steriade 1988, Selkirk 1988, Urbanczyk 1996a, and the discussion of Lushootseed in §2.3.) In a couple of attested forms, both with /CVːN.../ structure, copying vowel length takes precedence over copying a nasal: *ʔaː-baːndɨk*, **ʔam-baːndɨk*. This example shows two things: that the prohibition on CVːN syllables is an *emergent* property of the reduplicant, which may be violated in the base portion of the very same word (cf. Heath 1981: 209), and that among B-R faithfulness requirements, transfer of length takes precedence (through ranking) over MAX_{BR}.

[22]The possibility of having geminates at reduplicant-base juncture leads naturally to the question of whether better satisfaction of MAX_{BR} could be achieved by recruiting a root-initial geminate as part of the reduplicant. For instance, *paːbɨ* reduplicates as *ʔaː-baːbɨ*, but one might imagine reduplicating it as **ʔa–pːaːbɨ*, where the *p* is both an IO correspondent of the underlying root-initial /b/ and a heavily modified BR correspondent of the root-medial *b*. Relevant here is the constraint MORPHDIS (McCarthy & Prince 1995: 310), which prohibits such trans-morphemic fusion.

2.5 Case Study: Nancowry

> There was nothing in it to suggest a clue, — some clothes, some books, and a considerable number of curiosities from the Andaman Islands.
> Arthur Conan Doyle,
> *The Sign of the Four.*

Nancowry or Nicobarese is an Austro-Asiatic language spoken in the Andaman Islands. Radhakrishnan 1981 provides a detailed discussion of Nancowry phonology and morphology, and this has served as the basis of our analysis below. In addition, we have checked the generalizations against a comprehensive list of roots and their derivatives that he provides. Our attention was first directed to Nancowry by the discussion in Carden 1984 and Steriade 1988.

In Nancowry, roots are usually monosyllabic but occasionally disyllabic. Stress falls on the last (or only) syllable of the root, and never on affixes. The range of permissible phonological contrasts in stressed syllables is much broader than in unstressed syllables: stressed syllables have 10 oral vowels, 10 distinctively nasalized vowels, and 5 diphthongs, but unstressed syllables have only the vowels *i*, *u*, and *a* (and no nasalized vowels or diphthongs). This reduction of the inventory in unstressed syllables is a familiar phenomenon; we assume (but will not present) an analysis in terms of the interaction of markedness and positional faithfulness constraints (see fn. 4 for references).

Since the reduplicant itself is unstressed in Nancowry, the general reduction of vowel contrasts in unstressed syllables permits some immediate simplification of the discussion. As we argued in §2.1 and §2.2, the default segmentism in the reduplicant can never come from *outside* the global inventory of the language — the reduplicant's segmentism can never be more marked than what we find in the language as a whole, though it may be less marked. Since no unstressed syllable can contain a vowel other than (oral) *i*, *u*, or *a*, and since the reduplicant is unstressed, it follows that we need not consider candidate reduplicants containing vowels other than these three, and we will proceed on the basis of this result.[23]

The morphology of Nancowry includes prefixation, suffixation, infixation, and reduplication. The reduplicant is prefixed, and reduplication is permitted only with monosyllabic roots (Radhakrishnan 1981: 51). The reduplicant conforms to the following generalizations:

[23] In many languages, ə is a default vowel, hence maximally unmarked. But in Nancowry the peripheral vowels *i*, *u*, and *a* are maximally unmarked, as the evidence of vowel reduction shows. This contrast supports the claim that markedness is a consequence of a language-particular ranking of constraints.

(27) Descriptive Summary of Nancowry Reduplicative Data

Root-Final Consonant	Root	RED+Root	Gloss	Number of Roots of This Type
a. With root-final acute stop — reduplicant is ʔ*it* or ʔ*in*				
t	cɯt	ʔit–cɯt	‘go or come’/‘to go, to come’	15
n	ɲuan	ʔin–ɲuan	‘groaning noise’/‘to groan’	12
c[24]	cac	ʔit–cac	‘word’/‘to pray’	14
ɲ	seɲ	ʔin–seɲ	‘to cut things to pieces’/id.	9
b. With root-final acute continuant — reduplicant is ʔ*i*				
s	tus	ʔi–tus	‘to fall off [bird’s feather]’/‘to pluck out’	4
y	ruay	ʔi–ruay	‘moving backwards & forwards’/‘to beckon’	7
c. With root-final grave stop — reduplicant is ʔ*up*/ʔ*um* or ʔ*uk/*ʔ*u*ŋ				
p	kəp	ʔup–kəp	‘to hold’/‘to sting’	10
m	rom	ʔum–rom	‘flesh of fruit’/‘to eat pandanus fruit’	9
k	ɲiak	ʔuk–ɲiak	‘binding’/‘to bind’	13
ŋ	miaŋ	ʔuŋ–miaŋ	‘corner’/id.	13
d. With root-final grave continuant — reduplicant is ʔ*u*				
w	hɔw	ʔu–hɔw–a	‘empty’/‘cave’	10
ɫ[25]	tuaɫ	ʔu–tuaɫ	‘round’/‘a knot’	18
e. With root-final ʔ — reduplicant is ʔ*u*				
ʔ	yaʔ	ʔu–yaʔ	‘to leave s.’/‘to lay an egg’	7
f. With root-final *h* — reduplicant is ʔ*u* or ʔ*i*				
h	kõh	ʔu–kõh	‘downward curve’/‘round, spherical’	18
	fah	ʔi–fah	‘to sweep’/id.	12
	təh	ʔu–təh - ʔi–təh	unattested/‘to refuse’	2
g. With root-final vowel — reduplicant is ʔ*i*				
	mũa	ʔi–mũa	‘twisted’/‘to wring’	8

The reduplicant, underlined in (27), shows a complex pattern of dependence on and independence from the base:

All Just as in Tübatulabal, the reduplicant is ʔ-initial without exception. This glottal stop is epenthetic, also as in Tübatulabal. The proof of ʔ’s epenthetic status comes from alternations like the following (Radhakrishnan 1981: 57): /ma+RED+kec/ → *mitkéc*. Here, agentive *ma*- is reduced to just *m*- with reduplicated roots, and the reduplicant-initial ʔ is missing.

All The reduplicant is unstressed, and in unstressed syllables generally Nancowry permits only the vowels *i, u,* or *a*. But even *a* is banned from the reduplicant.

[24]This segment is a palatal stop.

[25]“Almost always in word final position and occasionally in syllable final position [l] is articulated with a clear retraction, and consequently with a domal timbre” (Radhakrishnan 1981: 32). Thus, this segment is either ɫ or ʟ.

(27a, c) If the root ends in an oral or nasal stop, so does the reduplicant (except that the palatals *c* and ɲ are replaced by plain coronals). In these cases, the vowel of the reduplicant is determined by the following consonant, *i* with coronals and *u* with labials or dorsals.

(27b, d) If the root ends in a continuant, then the reduplicant has no coda. Nonetheless, the vowel of the reduplicant is still determined by the final consonant of the root, just as if it were actually present in the copy (*i* when the root ends in acute *s* or *y*, and *u* when the root ends in grave *w* or ɨ). This observation seems to require a serial derivation with an intermediate stage where the constinuant has been copied. It therefore presents an interesting challenge to the OT claim that the effects of various phonological processes are evaluated in parallel (on which see §2.4).

(27e, f) If the root ends in a laryngeal, the reduplicant has no coda. The choice of vowel in the reduplicant is inconsistent. Though all of the modest number of ʔ-final roots reduplicate with *u*, the large set of *h*-final roots is about evenly split between those with *u* and those with *i* (plus a few doublets).

(27g) Vowel-final roots reduplicate regularly with ʔ*i*. A few reduplicate with *u*, but all of these are attested with *w* before suffixes, so they are probably to be grouped with the *w*-final roots in (27d).

Our primary focus will be on the solidly attested and systematic behavior in (27a–d): the reduplication of roots ending in a high glide, *l*, *s*, or an oral or nasal stop. We will have less to say about the more obscure and less systematic behavior of laryngeal- or vowel-final roots (27e–g).

The following table summarizes some the main points of the analysis and provides a road-map to the more extensive discussion below:

Descriptive Generalization	Analytic Proposal
Initial ʔ. The reduplicant has initial ʔ.	Place TETU. Just as in Tübatulabal (§2.4), this is emergence of unmarked Place in the reduplicant, favoring default initial ʔ over a copy of the root-initial consonant.
C/V interaction. The backness of the reduplicant's nucleus is determined by its coda.	Place TETU. The reduplicant's nucleus and coda, if any, share Place for markedness reasons, paralleling Tübatulabal NC clusters (e.g., *ʔi͡t$_i$–cɯt$_i$* — cf. Tübatulabal *ʔu͡nd umuːga*).
Coda stop. The reduplicant has a coda if and only if the root ends in an oral or nasal stop.	R-ANCHOR$_{BR}$, NO-CODA TETU, Strictural faithfulness. R-ANCHOR$_{BR}$ is undominated; this means that the final segment of the root must stand in correspondence with the final segment of the reduplicant. NO-CODA is also emergent in the reduplicant. Together, these two constraints will favor copying of a root-final consonant by vocalizing it: *ʔi$_j$–tus$_j$*. But for reasons of strictural faithfulness only a continuant can stand in correspondence with a vowel. Root-final stops, then, are preserved in the reduplicant's coda: *ʔit$_i$–cɯt$_i$*.

Details aside, the central observation about Nancowry is this: only the root-final consonant is actually copied (and, we will show, it is *always* copied). The rest of the content of the reduplicant is determined by markedness considerations: the default consonant ʔ emerges in the onset, and the vowel is simply homorganic with the coda.

Such thorough-going non-copying indicates significant domination of BR correspondence constraints by Place markedness, beyond even Tübatulabal. As we showed, the ranking in Tübatulabal (28a) puts the Place markedness hierarchy between the V-specific and C-specific BR faithfulness constraints. In Nancowry, however, the ranking (28b) subordinates both V- and C-specific BR faithfulness to Place markedness:

(28) Schematic Rankings Relative to the Place Markedness Hierarchy (24)

a. For Tübatulabal

MAX-V$_{BR}$, DEP-V$_{BR}$ >> Place Markedness >> MAX-C$_{BR}$, DEP-C$_{BR}$

b. For Nancowry

Place Markedness >> MAX-C$_{BR}$, DEP-C$_{BR}$, MAX-V$_{BR}$, DEP-V$_{BR}$

Hence, Tübatulabal has default consonants and copied vowels in the reduplicant, but Nancowry has default consonants *and* vowels. (We will address the special status of the root-final consonant shortly.)

The ranking (28b) presupposes that the Place markedness constraints are violated by vowels just as they are by consonants. That is to say, it presupposes a unified set of vowel and consonant features, as in Clements 1989, Clements & Hume 1995, Ní Chiosáin 1991, Ní Chiosáin & Padgett 1993, Jakobson, Fant, & Halle 1952, Selkirk 1991, and Smith 1988. Concretely, we will assume the following featural specifications for the three peripheral vowels:

- the vowel *i* is [coronal], like *t* or *c*;
- the vowel *u* is [labial], like *p* or *m*, and [dorsal], like *k* or ŋ;
- and the vowel *a* is [pharyngeal], like ʔ or *h*.

Other vowels will bear these features as well, but since only *i*, *u*, and *a* are permitted in unstressed syllables, and the reduplicant is unstressed, our attention is necessarily focused on them.

The unified vowel and consonant Place features have another important consquence in the phonology of Nancowry: through sharing of Place features, the nucleus of the reduplicant is determined by agreement with the adjacent coda, if any. Recall from (26) that the coda of the Tübatulabal reduplicant is also determined contextually, because Place markedness is evaluated autosegmentally over the linked Place features in an NC cluster. A parallel result holds for VC sequences in the Nancowry reduplicant. For example, sharing of [labial] Place (indicated by the ligature ⁀) in the form $ʔ\widehat{um}_3–c_1i_2m_3$ yields a more harmonic result, Place-markedness-wise, than does more exact copying in $*ʔi_2m_3–c_1i_2m_3$. The latter form incurs a violation of *PL/COR for the free-standing *i* in the reduplicant, while the linked $\widehat{um}$ sequence in the former incurs no more violation of *PL/LAB than *m* alone does. This is one of the ways in which the nature of default segmentism can depend on the local phonological context.[26] It also closely parallels the kind of determination of the quality of epenthetic vowels by consonantal context that is seen generally in some languages, such as Nisgha (Shaw 1987: 295–6, and below in §2.6).

Though the reduplicant's onset and nucleus show emergent unmarkedness, copying still goes on in Nancowry, root-finally. Place markedness is crucially dominated, then, by a constraint requiring faithful copying of the root-final consonant. This constraint is R-ANCHOR$_{BR}$(Root, Reduplicant), which demands that the segments at the right periphery of root and reduplicant stand in correspondence.[27] The ANCHORing constraints reconstruct in non-derivational terms the directional

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[26]Our claims about Place linkage in the Nancowry reduplicant are evidently neutral with respect to the question of how C-V or V-C interactions are mediated structurally. For different views of the matter, see Ní Chiosáin & Padgett 1993 and Clements & Hume 1995.

[27]It is important that the Nancowry reduplicant be anchored on the *root* rather than the reduplicative *base* (which would include any suffixes as well). Direct reference to the root is one way to achieve this, as in (28), and this approach makes sense in terms of the connections between alignment and anchoring made in McCarthy & Prince 1994b, 1995. Alternatively,

properties of autosegmental association (Clements & Ford 1979, McCarthy 1979, Marantz 1982). Usually, prefixing reduplication favors left-anchoring over right-anchoring (L-ANCHOR$_{BR}$ >> R-ANCHOR$_{BR}$), with the opposite situation obtaining in suffixing reduplication. But this typical state of affairs is inverted in the grammar of Nancowry. R-ANCHOR$_{BR}$ dominates Place markedness, forcing copying of the root-final consonant, but L-ANCHOR$_{BR}$ is low-ranked, since the root-initial consonant is replaced by epenthetic ʔ in the reduplicant. (Other languages with high-ranking R-ANCHOR$_{BR}$ in prefixing reduplication include Madurese (Stevens 1968, Marantz 1982, Weeda 1987) and Ulu Muar Malay (Hendon 1966, Kroeger 1989, Wee 1994).)

Let's pull these threads together. We have argued that Nancowry ranks the Place markedness hierarchy above various BR correspondence constraints: MAX-C$_{BR}$, MAX-V$_{BR}$, L-ANCHOR$_{BR}$. Hence, unmarked structure emerges in both onset and nucleus of the reduplicant: the onset is ʔ and the nucleus shares Place features with the following consonant. But despite this pattern of non-copying and emergent unmarkedness, the root-final consonant must be copied, because of top-ranked R-ANCHOR$_{BR}$. This interplay among these factors can be seen in the following tableau:

(29) /RED+naŋ/ → *ʔu͡ŋ–naŋ* 'dust, mushroom'

/RED+naŋ/	R-ANCHOR$_{BR}$	*PL/DORS *PL/LAB	*PL/COR	*PL/PH	MAX-C$_{BR}$	MAX-V$_{BR}$	L-ANCHOR$_{BR}$
a. ☞ ʔu͡ŋ$_3$–n$_1$a$_2$ŋ$_3$		*u͡ŋ*, ŋ	*n*	ʔ, *a*	*n*	*a*	*
b. ʔa$_2$ŋ$_3$–n$_1$a$_2$ŋ$_3$		ŋ, ŋ	*n*	ʔ, *a*, *a!*	*n*		*
c. n$_1$a$_2$ŋ$_3$–n$_1$a$_2$ŋ$_3$		ŋ, ŋ	*n*, *n !*	*a*, *a*			
d. ʔi–n$_1$a$_2$ŋ$_3$	* !	ŋ	*i*, *n*	ʔ, *a*	*n*, ŋ	*a*	*

The candidate in (a) is optimal. It copies the root-final ŋ, as demanded by R-ANCHOR$_{BR}$, but otherwise it allows unmarked structure to emerge in the reduplicant (default onset, linked nucleus). Form (b) has more complete copying than (a) does, but at the expense of greater Place markedness violation. That's a fatal mistake, given the relative ranking of Place markedness and MAX-V$_{BR}$. Form (c) has the same problem, but even worse, as does a candidate like *n$_1$u͡ŋ$_3$–n$_1$a$_2$ŋ$_3$*. Finally, (d) violates R-ANCHOR$_{BR}$, which through ranking takes precedence over minimization of Place markedness. In short, R-ANCHOR defines a specific condition where B-R faithfulness is strongly enforced, though

one might look to an approach based on interaction with R≤ROOT (McCarthy & Prince 1993a) or on a correspondence relation between root and reduplicant (Futagi 1996).

other important constraints on BR faithfulness (MAX, L-ANCHOR) are low-ranking.

Satisfaction of R-ANCHOR$_{BR}$ could also be achieved, in principle, by copying the root-final consonant while changing its place of articulation to achieve improved performance on the Place markedness hierarchy. This option is ruled out by ranking IDENT$_{BR}$(Place) above Place markedness:

(30) The Role of IDENT$_{BR}$(Place)

/RED+naŋ/	IDENT$_{BR}$(Place)	*PL/DORS, *PL/LAB	*PL/COR	*PL/PH	MAX-C$_{BR}$, MAX-V$_{BR}$
a. ☞ ʔu͡ŋ$_3$–n$_1$a$_2$ŋ$_3$		*u͡ŋ*, ŋ	*n*	ʔ, *a*	*n, a*
b. ʔi͡n$_3$–n$_1$a$_2$ŋ$_3$	* !	ŋ	*i͡n, n*	ʔ, *a*	*n, a*
c. ʔi͡n͡n$_3$–n$_1$a$_2$ŋ$_3$	* !	ŋ	*i͡n͡n*	ʔ, *a*	*n, a*

The output is the same as in the preceding tableau, but the failed candidates are different. Form (b) places root-final ŋ in correspondence with reduplicant-final *n*. This allows a markedness improvement (replacing a dorsal by a coronal), but is not optimal, because of domination by IDENT$_{BR}$(Place). Form (c) goes even further, spreading [coronal] from the root-initial consonant across coda and nucleus of the reduplicant. It incurs the same fatal IDENT$_{BR}$(Place) violation.[28]

We have now seen enough of the analysis to account for all the main properties of stop-final root reduplication (27a, c). The root-final consonant must be copied and it must faithfully preserve its place of articulation because R-ANCHOR$_{BR}$ and IDENT$_{BR}$(Place) are top-ranked. The rest of the reduplicant is made up of non-copied, reduced material: a ʔ onset and a nucleus that is homorganic to the following consonant. The ʔ onset maximizes harmony on the Place hierarchy, and the nucleus, by sharing Place with the coda, incurs exactly the same marks on the Place hierarchy as the coda alone does. (The reduplicant's nucleus cannot be mid or central because, as we noted at the outset of this section, only peripheral vowels are permitted in unstressed syllables.) Standing at the bottom of the hierarchy are several BR correspondence constraints: MAX-C$_{BR}$, MAX-V$_{BR}$, L-ANCHOR$_{BR}$. Of

[28] Another class of candidates with excessive Place spreading includes forms like *$\widehat{r_1 i n_3}$–$r_1u_2n_3$, with linkage of a single instance of [coronal] across the entire reduplicant, and *$\widehat{pum_3}$–$c_1i_2m_3$, with epenthetic *p* determined in the same way that epenthetic *u* is. Both of these candidates involve Place linkage in CV sequences, in contrast to the actual output forms, which have Place linkage in (tautosyllabic) VC sequences. We require, then, a constraint that distinguishes among permissible and impermissible linkages; through domination of the Place markedness hierarchy, it will rule out candidates like these.

There is ample precedent for such a constraint in the literature; indeed, the view implicit here — that harmony results from very general constraints whose freedom of action is limited by structural conditions — is almost intrinsic to autosegmental phonology. Precedents of particular relevance include principles barring Place linking on the basis of the featural composition (Selkirk 1988, 1989, 1990) or prosodic role (Fu 1990, Itô & Mester 1995: fn. 25, Lamontagne 1993: 135) of the linked segments. Janson's (1986) typological survey and references there are also appropriate.

course, as usual in TETU situations, the I-O faithfulness constraints MAX-C_{IO} and MAX-V_{IO} are top-ranked, crucially dominating the Place markedness constraints, thereby depriving them of having any similar effects on the I-O mapping.

We turn now from stop-final roots to continuant-final ones, which end in *s*, *ɬ*, *w*, or *y* (27b, d). With these roots, the reduplicant ends in a vowel — a vowel that is homorganic to the root-final consonant. Thus, roots ending in *s* or *y* have reduplicants ending in *i* (*ʔi–tus*, *ʔi–ruay*) while roots ending in *ɬ* or *w* have reduplicants ending in *u* (*ʔu–tuaɬ*, *ʔu–hɔw*). At first glance, these facts might seem to require some sort of serial derivation, in which the root-final continuant is copied, then determines the quality of the adjacent vowel, and finally deletes. Indeed, Steriade 1988 includes a proposal along these lines, which we discuss below (40). Hence, there is a broader issue here of compatibility with the OT tenet of parallelism, which was important in our account of Tübatulabal.

In fact, no serial derivation is necessary. We propose instead that the roots ending in continuants satisfy R-ANCHOR$_{BR}$ just as the roots ending in stops do, but they achieve satisfaction by altering the copied segment from a continuant to a vowel. Formally, the root-final consonant stands in correspondence with the reduplicant-final vowel: $ʔi_3–t_1u_2s_3$, $ʔi_4–r_1u_2a_3y_4$, $ʔu_4–t_1u_2a_3ɬ_4$, $ʔu_3–h_1ɔ_2w_3$ and so on. R-ANCHOR$_{BR}$, which demands correspondence between the rightmost segments of base and reduplicant, is satsfied here just as it is with the stop-final roots, but there is a mismatch of featural make-up (*i/s*, *u/ɬ*) or prosodic role (*i/y*, *u/w*) between the corresponding segments.

We will focus on the featural disparity, which is more challenging. When *s* is placed in correspondence with *i* or *ɬ* with *u*, there is disparity of stricture, and since B-R correspondence is at issue, the constraint being violated is IDENT$_{BR}$(Stricture). Violation must be compelled by emergence of some constraint; there are two possibilities for what that constraint is:

(i) A constraint banning continuants from coda position. This coda condition is proposed by Zec (1995: 111–112), who presents independent evidence for it from Kiowa. It is implicit in Steriade's (1988) account of Nancowry.

(ii) NO-CODA. For independent evidence of emergent NO-CODA in other reduplicative systems, see McCarthy & Prince 1994ab.

Either way, the responsible constraint is one that has an established basis in the inventory structure of whole languages, and therefore either approach conforms well to the main predictions of our theory.

Readers can work out the approach in (i) for themselves, since it's straightforward. Here, we'll focus on (ii), which has some additional subtleties. This approach sees NO-CODA as the factor motivating reduplicative vocalization in $ʔi_3$–$t_1u_2s_3$ and $ʔu_4$–$t_1u_2a_3ɨ_4$. But reduplicative vocalization of an oral or nasal stop (*$ʔu_j$–$kəp_j$, *$ʔu_j$–rom_j) is not possible, and in those cases the reduplicant has a coda (up_j–$kəp_j$, $ʔum_j$–rom_j). This distinction follows if the *s* → *i* mapping is seen as more faithful to stricture than the *p* → *u* mapping.

A scalar view of strictural distinctions and strictural faithfulness is required. Building on the earlier literature on *n*-ary features,[29] Gnanadesikan (1997) proposes that stricture distinctions are expressed by values on a ternary scale:

(31) Consonantal Stricture Scale

CS1 Stop > *CS2* Fricative/Liquid > *CS3* Vocoid/Laryngeal

The three points on the scale are roughly equivalent to the familiar [–cont], [+cons, +cont], and [–cons]; the scale is intended to replace those features, so the class of stops is designated by CS1, fricatives or liquids by CS2, and vocoids by CS3. See Gnanadesikan 1997 for applications to systems of lenition, the structure of inventories, and the properties of segmental coalescence, and for extensions to other phonological scales.

Introduction of the CS scale is not a mere swapping of a ternary feature for a pair of binary ones. Ternary (or longer) scales encourage a very different view of faithfulness than binary features do, and that is our concern here. To remain faithful to a value on a scale is, in the simplest case, to retain that value in the I→O or B→R mapping. But the scale allows a sensible formalization of *degree* of faithfulness to stricture: to move one step on the scale is clearly better, faithfulness-wise, than to move two steps. The B→R mappings permitted in Nancowry (*s* → *i*, *ɨ* → *u*) are all one-step movements on the scale, from CS2 to CS3, while the prohibited B→R mappings (*p*→ *u*, *m*→ *u*, etc.) are saltatory two-step movements, from CS1 to CS3.

Formally, these two degrees of unfaithful behavior are regulated by two separate, and therefore separately rankable, constraints:

[29] Previous work on *n*-ary features includes Clements 1991, Contreras 1969, Foley 1970, Ladefoged 1971, 1975, Lindau 1978, Rivas 1977, Saltarelli 1973, Selkirk 1984, Smith 1970/1, and Williamson 1977.

(32) Faithfulness on a Scale S (Gnanadesikan 1997)

a. IDENT(S)

Corresponding segments must have identical values on the scale S.

If $\alpha\Re\beta$, α is [iS], and β is [jS], then $i=j$.

b. IDENT^{Adj}(S)

Corresponding segments must have identical or adjacent values on the scale S.

If $\alpha\Re\beta$, α is [iS], and β is [jS], then $|i–j| \leq 1$.

These constraints directly express the observations of the preceding paragraph: one-step movements on a scale are different from, and more faithful than, two-step deviations. ("More faithful than" because IDENT(S) is violated whenever IDENT^{Adj}(S) is, but not vice-versa, according to the formulations given in (32).)

In Nancowry, NO-CODA is able to compel violation of IDENT$_{BR}$(Stricture), but not of IDENT$^{Adj}_{BR}$(Stricture). Hence, it is ranked between them:

(33) NO-CODA >> IDENT$_{BR}$(Stricture)

/RED+tus/	IDENT$^{Adj}_{BR}$(Stricture)	NO-CODA	IDENT$_{BR}$(Stricture)
a. ☞ʔi_3–$t_1u_2s_3$		*	*
b. ʔis_3–$t_1u_2s_3$		** !	

(34) IDENT$^{Adj}_{BR}$(Stricture) >> NO-CODA

/RED+cat/	IDENT$^{Adj}_{BR}$(Stricture)	NO-CODA	IDENT$_{BR}$(Stricture)
a. ☞ʔit_3–$c_1a_2t_3$		**	
b. ʔi_3–$c_1a_2t_3$	* !	*	*

As usual, all the candidates shown obey the undominated ANCHORing constraint. The ranking argument in (33) shows why a deviation of one step on the stricture scale is permissible to achieve coda-lessness in the reduplicant, and the argument in (34) shows why a deviation of two steps is not. Taken together, these arguments also show why we require separate faithfulness constraints for the adjacent and non-adjacent conditions: it would not be enough simply to minimize degree of violation of a single IDENT(Stricture) constraint, because neither ranking of this constraint with respect to NO-CODA could yield the correct outcome in both cases.[30]

The following tableaux pull the relevant constraints together to complete the picture of the

[30] In this respect, the situation is directly analogous to the power hierarchies of constraints derived by self-conjunction in Smolensky 1995. See also Alderete 1997 for further discussion.

continuant-final/stop-final root contrast:

(35) Continuant-Final Root

/RED+tus/	R-ANCHOR$_{BR}$	IDENT$^{Adj}_{BR}$(Str)	NO-CODA	IDENT$_{BR}$(Str)
a. ☞ ʔi_3–$t_1u_2s_3$			*	*
b. ʔis_3–$t_1u_2s_3$			** !	
c. ʔu_2–$t_1u_2s_3$	* !		*	

(36) Stop-Final Root

/RED+cat/	R-ANCHOR$_{BR}$	IDENT$^{Adj}_{BR}$(Str)	NO-CODA	IDENT$_{BR}$(Str)
a. ʔi_3–$c_1a_2t_3$		* !	*	*
b. ☞ ʔ$\widehat{it}_3$–$c_1a_2t_3$			**	
c. ʔa_2–$c_1a_2t_3$	* !		*	

The root-final consonant must be copied, because of R-ANCHOR$_{BR}$. But whether it is copied exactly or in vocalized form depends on whether or not it is a stop. Vocalization would satisfy NO-CODA, but vocalization of stops is ruled out by undominated IDENT$^{Adj}_{BR}$(Stricture); vocalization of continuants is possible, however, since it violates only low-ranking IDENT$_{BR}$(Stricture).

This wraps up the main points of our analysis of Nancowry. The following rankings have been argued for:

(37) Ranking Summary — Nancowry

a. Place Markedness Hierarchy >> MAX-C$_{BR}$, MAX-V$_{BR}$
- Argument in: (30)
- Sketch of argument: Non-copying of the onset and nucleus of the base to achieve improvements in Place markedness.

b. MAX-C$_{IO}$, MAX-V$_{IO}$ >> Place Markedness Hierarchy
- Sketch of argument: This is the familiar TETU effect. In Nancowry as a whole (i.e., outside the reduplicant) segments are not deleted simply to eliminate their Place-markedness violations.

c. R-ANCHOR$_{BR}$ >> Place Markedness Hierarchy
- Argument in: (29)
- Sketch of argument: The final consonant of the root *must* be copied, even though this will exact a cost in markedness terms. In fact, only the root-final consonant is ever copied in Nancowry.

d. IDENT$_{BR}^{Adj}$(Stricture) >> NO-CODA >> IDENT$_{BR}$(Stricture)
Argument in: (35, 36)
Sketch of argument: To avoid a coda in the reduplicant, the final consonant of the base is copied as a vowel, but only if it is already close to a vowel stricturally.

e. MAX-C$_{IO}$, IDENT$_{IO}$(Stricture) >> NO-CODA
Sketch of argument: Another TETU effect. The language as a whole has codas, and contrasts stops with fricatives in coda position.[31]

Overall, the ranking situation is a typical case of TETU: I-O faithfulness stands at the top of the hierarchy, B-R faithfulness at the bottom, and the markedness constraints on codas and Place are in the middle. Two BR correspondence constraints stand at the top of the hierarchy, though, and they give the system much of its interest and rich articulation. R-ANCHOR$_{BR}$ ensures that the root-final consonant is reduplicated, though Place markedness would be better served by not copying it. And IDENT$_{BR}^{Adj}$(Stricture), combined with R-ANCHOR$_{BR}$, forces CVC reduplicants with stop-final roots, in spite of NO-CODA .

A few details remain. One is the depalatalization phenomenon: a root-final palatal stop or nasal copies as a plain coronal. The same process is observed in Korean, but with effects for the whole language instead of just the reduplicant. Thus, the responsible markedness constraint dominates I-O faithfulness in the grammar of Korean, but dominates only B-R faithfulness in the grammar of Nancowry. This is another typical case of TETU. (Compare also Nuxalk in §2.6.)

Another detail concerns reduplication of V-final roots. It may be that there are no true V-final roots, or that all true V-final roots reduplicate with ʔ*i* (an expected default), but the details are too sketchy to settle the matter. Of 11 V-final roots, 8 reduplicate with ʔ*i* versus just 3 with ʔ*u*. Of those 3 roots, 2 are attested before vowel-initial suffixes with a final *w*, suggesting that the underlying root may end in *w*, in which case ʔ*u* reduplication is entirely expected. (The third root is simply not attested in the relevant environment.) Likewise, of the 8 roots that reduplicate with ʔ*i*, 3 are attested before vowel-initial suffixes with a final *y*, suggesting that the underlying root may end in *y*. (The other 5 roots are not attested in the relevant environment.) Clearly, additional information about these

[31]Recall that the reduplicant is unstressed, and therefore its TETU characteristics must be measured against other (non-reduplicative) unstressed syllables. In the language as a whole, the evidence for unstressed closed syllables is not overwhelming, but appears sufficient:
- Infixation of *-um-* in disyllabic or prefixed roots: /paló?/ → *pumló?*, /ha+káh/ → *humkáh*. Likewise with the infix *-in-*. Observe that the original vowel of the base is lost under infixation.
- The "particles", which may be incorporated roots, now unstressed and grammaticalized (Radhakrishnan 1981: 82).
- The loan *kulmore* 'gold' (Radhakrishnan 1981: 19).

roots before vowel-initial suffixes would settle the matter.

A final detail involves the roots ending in laryngeals. The factual situation is this. First, neither ʔ nor *h* appears as a coda in the reduplicant. Plausibly, this is another emergent constraint that is independently attested as a restriction on inventories (English *h*, Tiberian Hebrew or Bedouin Arabic gutturals — see McCarthy 1994). Second, Nancowry unstressed syllables can contain *i*, *u*, or *a*, but the reduplicant, even with a laryngeal-final root, can contain only *i* or *u*. This too is an emergent constraint: just as low-sonority ə is disfavored in *stressed* syllables (§2.3), high-sonority *a* is disfavored in *unstressed* syllables (Kenstowicz 1994c). Third, the choice between ʔ*u* and ʔ*i* with laryngeal-final roots is inconsistent. Roots ending in *h* are by far more common, and they divide between a majority with ʔ*u* and a large minority with ʔ. The few ʔ-final roots all reduplicate with ʔ*u*, not ʔ*i*. Radhakrishnan (1981) sees the explanation for ʔ*u* reduplication in a kind of laryngeal-dorsal connection, and certainly there are grounds for that in other languages (see Merlingen 1977: 44ff.).

A system with Nancowry's richness offers many opportunities for theory-testing and -comparison. It offers strong support for the predictions of the model proposed here. The reduplicant's inventory is a proper subset of the whole language's (6). The fixed ʔ onset of the reduplicant converges with the independently necessary default onset in epenthesis situations (10). The vowel of the reduplicant is high, but otherwise varies depending on the final consonant of the base (11). And the restrictions on the coda involve constraints (either NO-CODA or the coda conditions of Zec 1995) that are observed to have inventory-defining force in other languages (7, 8). Constraint ranking and violation — the only essential elements of OT — allow a complex pattern of interdependencies in the reduplicant to be derived from these simple markedness constraints. The complexity of the facts is principally obtained from interaction of these markedness constraints with a variety of BR correspondence constraints, all of which are also independently motivated.

In contrast, the prespecification model cannot deal with the facts of Nancowry even at the descriptive level, much less at the level of explanation. The argument is simply an extension of one made previously, and we will not belabor it here. It is, however, interesting to examine an account of Nancowry in yet another framework, the full-copy model of Steriade 1988.

The full-copy model is based on these premises:

(i) Full copying. The reduplicative affix induces copying of the full base, including all of its prosodic and segmental structure.

(ii) Fixed segmentism operations. After copying, but before template-matching, the full copy of the base may undergo various phonological operations, mostly substitutions, which replace copied segments by fixed segments.

(iii) Template matching. A template consists of settings for prosodic markedness parameters, such as “no codas” or “complex onsets disallowed”. The procedures for accommodating the full copy to the template include (on a language-particular basis) deletion, resyllabification, lengthening or shortening, and so on.

As we noted previously (§2.1), Steriade’s insight that markedness plays a role in defining templates is an important one (shared in part with Shaw 1987) — and this insight finds fullest expression in Optimality Theory through the rubric of emergence of the unmarked (McCarthy & Prince 1994ab). But full-copy as implemented in Steriade 1988 treats only prosodic structure in markedness terms; fixed segmentism is attributed to an apparatus of special operations. Nancowry supplies one of the arguments for this distinction, and so the full-copy analysis of Nancowry bears re-examination in light of our results above.

The analysis of Nancowry in Steriade 1988: 133–4 is just a sketch, but it is sufficient to clarify many of the details of how the model is applied to this case. At the first relevant point in the derivation, a full and exact copy of the root is made. At the next stage, this copy is subject to specific phonological substitution and assimilation operations which implement the various fixed-segmentism phenomena:

(38) Fixed-Segmentism Phonological Operations in Nancowry (after Steriade 1988: 134)[32]

a. Onset Substitution

Onset → ʔ

b. Nucleus Substitution

Nucleus → *u*

c. Assimilation

u → *i* / ___[coronal]

Observe that (38b) must precede (38c), as in the following derivation:

[32]These processes must somehow be limited to applying to the reduplicant only, since they would otherwise aggressively reorganize every word of the language. The details of how to implement this limitation formally have not been addressed in the full-copy model.

(39) Full Copy Derivation of ʔ*it*–*cɯt*

Input		cɯt
(i) Full Copy		cɯt-cɯt
(ii) Fixed-Segmentism Phonological Operations		
	Onset Sub. (38a)	ʔɯt-cɯt
	Nucleus Sub. (38b)	ʔut-cɯt
	Assimilation (38c)	ʔit-cɯt
(iii) Template Matching		"

For this particular form, the template-matching stage does nothing, but in other forms it leads to deletion of the coda. The idea is that the template is parametrized to require that the coda be a nasal or oral stop, and matching is by deletion of any non-conforming segment. This accounts for the coda-less reduplicants in (27b, d–g).

According to Steriade, examples like ʔ*i*-ʔ*as* 'sneeze' show the necessity for organizing the grammar into the full copy (i), post-copying phonology (ii), and template matching (iii) stages, applied in just that order. The derivation proceeds something like this:[33]

(40) Full Copy Derivation of ʔ*i*–ʔ*as*

Input		ʔas
(i) Full Copy		ʔas-ʔas
(ii) Fixed-Segmentism Phonological Operations		
	Onset Sub. (38a)	ʔas-ʔas (vacuous)
	Nucleus Sub. (38b)	ʔus-ʔas
	Assimilation (38c)	ʔis-ʔas
(iii) Template Matching		ʔi-ʔas

At stage (i), the final *s* comes along with the rest of the copy, though it will later be eliminated in template-matching. It is needed at stage (ii) to condition assimilation, which replaces the fixed vowel *u* with *i* before a coronal. Then at stage (iii) *s* deletes because it cannot be accommodated to the template, which permits only a stop as coda.

It is now clear why the full-copy model distinguishes three derivational steps. The information needed to apply the fixed-segmentism operations is available only at an *intermediate* stage of the derivation (40), after copying and before template-matching. The analysis presented here eliminates the need for this intermediate stage, and hence for the distinction between fixed-segmentism operations and template-matching, It does so by relating the vowel of the reduplicant directly to the root-final consonant in ʔ*i*-ʔ*as*, using only independently motivated BR correspondence constraints

[33] Thus, Steriade 1988: 134 writes, "The derivation of items like ʔ*i*-ʔ*as* indicates that the prefix coda starts out as containing whatever the base coda contains. We must have intermediate ʔ*us*-ʔ*as* and use *s* as a conditioning factor for the rule changing *u* to *i* before a coronal. Only later can *s* be eliminated."

interacting, through ranking, with independently motivated markedness constraints.

Moreover, by positing a component of apparently unrestricted substitution rules like those in (38), the full-copy model suffers an inevitable loss of explanation (and perhaps the appearance of simplification — a tempting illusion when universalist goals are ignored in favor of local descriptive advantage). Its most conspicuous explanatory fault is that it does not attempt to relate fixed-segmentism phenomena to markedness conditions. Markedness plays a role in full-copy, since markedness conditions define the template, but markedness is not invoked to explain the segmental phonology of the Nancowry reduplicant: the initial ʔ, the high nucleus, and the assimilatory nucleus-coda relation. Rather, fixed segmentism comes from bald stipulation: do this to the onset, do that to the nucleus. Unmarkedness in the reduplicant, whatever its nature, should come from a single source.

2.6 Summary

At a minimum, an Optimality-Theoretic approach to phonology and reduplicative morphology will posit a few bare primitives: universal markedness constraints, faithfulness constraints in the IO and BR dimensions, and adjudication of constraint conflict through ranking. We have shown how this minimal apparatus leads to a rich and articulated theory of reduplicative fixed-segmentism phenomena, one which makes significant predictions about the relation between fixed segmentism and universal or language-particular properties of inventories and defaults. Furthermore, it successfully characterizes the conditions under which fixed segmentism may be seen to vary according to details of the form under evaluation. We have also shown how the theory is applied and the predictions are played out in a variety of reduplicative systems, ranging from the relatively simple (Yoruba) to the highly complex (Nancowry).

The types of markedness constraints we have shown emerging in the reduplicant are mostly rather simple ones, such as the Place markedness hierarchy or NO-CODA. Here we will briefly review a few additional cases to demonstrate the diversity of markedness constraints that can produce fixed segmentism effects. The works cited should be consulted for additional discussion.

Yip (1993, 1995ab — see also §3.1) argues that a class of dissimilatory constraints, shared by morphology and phonology, is responsible for cases where the reduplicant and base are required to differ in some characteristics. For example, Javanese *lali* ‘forget’ reduplicates as *lola-lali* ‘id. (habitual-repetitive)’ because of a dissimilatory constraint against repetition of *a*. Since dissimilation also occurs in ordinary phonology, this type of fixed segmentism is also an expected result of TETU.[34]

Myers & Carleton (1996: 67 — see also Akinlabi 1997) analyze the phenomenon of tonal transfer and non-transfer in reduplication. In some reduplicative patterns of Chichewa, they argue, "tone is subject to the same correspondence as any feature, and ... non-correspondence can be attributed to general patterns of neutralisation." This is precisely a description of the effects of markedness constraints on the reduplicant.

It is by no means uncommon to find languages with processes of labial and palatal attraction, in which vowels become back/round or palatal in the vicinity of labial or palatal consonants respectively. (See Clements & Hume 1995 or Ní Chiosáin & Padgett 1993 for discussion and further references.) Vowel-to-vowel rounding harmony is also common in phonological systems. In Igbo, these processes are emergent in the reduplicant — but only if it is not identical to the base:

(41) Reduplication in Igbo[35] (Clark 1990, Clements 1989, Ní Chiosáin & Padgett 1995, Beckman 1998)

a. A high vowel in the base is copied exactly:

ti-ti	'cracking'	nu-nu	'pushing'
ji-ji	'snapping'	ju-ju	'being full'
mI-mI	'drying'	mu-mu	'learning'

b. Otherwise, the vowel of reduplicant is *i* if the consonant is alveopalatal and *u* if the consonant is labial/labiovelar/labialized:

cI-cO	'seeking'	bu-be	'cutting'
n^yi-n^yo	'shadow'	g͡bu-g͡be	'crawling'
yI-yO	'begging'	k^wu-k^we	'agreeing'
n^yi-n^ye	'giving'	fu-fe	'crossing'
bI-b^ya	'coming'		

c. Otherwise, the vowel of the reduplicant is *i* or *u*, in rounding harmony with the base vowel:[36]

ki-ke	'sharing'	ti-te	'rubbing'
nI-na	'going hme'	nu-no	'swallowing'
kU-kO	'telling'		

Descriptively, the vowel of the reduplicant is always high. If the vowel of the base is also high, it can be copied exactly, and it is. If the vowel of the reduplicant is non-high, then it cannot be copied exactly, and so it is not copied at all. A non-corresponding vowel is inserted instead, and its quality is determined by a ranking of TETU effects: labial/palatal attraction, otherwise rounding harmony.

[34] There are important issues, not yet fully understood, about how to reconcile Yip's results with ours. The text suggests a line of attack, but there is much additional work to be done.

[35] For clarity, tones and affixes have been suppressed.

[36] Inexplicably, the reduplicant has *u* just in case the base is γ*a*.

The “fixed” segmentism of Igbo is obviously variable in a way that depends directly on the phonology of the base.

This system shares several characteristics with languages we have already discussed (see Beckman 1998 and Ní Chiosáin & Padgett 1995 for full analyses). The vowel of the reduplicant is high by virtue of a TETU ranking identical to Yoruba’s (15). The ranking for “copy exactly if possible, otherwise ...” is abstractly the same as in Lushootseed (cf. (20)). The various “otherwise” conditions are characterized TETU rankings of the same constraints responsible for processes of labial/palatal attraction and rounding harmony in the full inventories of other languages. This discussion is obviously quite elliptic, but it is sufficient to show how the Igbo system accords with the premises of our approach.[37]

Reduplication in Makassarese shows a solid match between emergent structure in the reduplicant and the default structure of the language as a whole. Like Lushootseed, Makassarese has variation between exact copying (42a) and fixed segmentism when copying is inexact (42b):[38]

(42) Reduplication in Makassarese (Aronoff et al. 1987)

a. Exact reduplication of disyllabic roots

/batu/	<u>batu</u>-bátu	‘small stone(s)’
/tauŋ/	<u>taun</u>-táuŋ	‘yearly’
/ballaʔ/	<u>ballaʔ</u>-bállaʔ	‘little house’

b. ʔ-final reduplication of longer roots

/manara/	<u>manaʔ</u>-manára	‘sort of tower’
/balao/	<u>balaʔ</u>-baláo	‘toy rat’
/barambaŋ/	<u>baraʔ</u>-barámbaŋ	‘sort of chest’

The reduplicant respects a disyllabic template. When the root is also disyllabic, a perfect copy is possible, and that’s what’s found. But when the root is trisyllabic, perfect copying is incompatible with the template, and instead the reduplicant shows a kind of emergent default structure, with a final ʔ. This default is also seen in the language as a whole, when roots ending in illicit codas must undergo final epenthesis: /rantas/ → *rantasaʔ* ‘dirty’. This case is analyzed in detail by McCarthy & Prince (1994a); the overall approach is essentially the same as the account of Lushootseed in §2.3.

Tübatulabal and Nancowry show how universal constraints on coda consonants, known to be inventory-defining in some languages, can emerge in the reduplicant. Nuxalk (Bella Coola) and

[37] A nice parallel is provided by Nisgha (Shaw 1987), in which the quality of epenthetic vowels generally (not only in the reduplicant) is determined by the consonantal context.

[38] Even nominally disyllabic roots take a ʔ-final reduplicant if they are not analyzed as two syllables in the actual base under evaluation. This occurs with epenthesis (*<u>teʔteʔ</u>-téʔtereʔ* ‘rather quickly’, from /teʔter/) and suffixation (*<u>gassiʔ</u>-gassíŋi* ‘make strong’, from /gassiŋ+i/). See Aronoff et al. 1987 and McCarthy & Prince 1994a.

Nisgha provide additional evidence of this. Among its several reduplicative patterns, Nuxalk has one that consists of a closed syllable. The reduplicant's coda is limited to *x*, ɬ, *l*, *s*, and *n*:

(43) Reduplication in Nuxalk (Newman 1947, 1971; Nater 1984; Bagemihl 1991; Kiparsky 1986; Carlson 1997)

a.	mil-milix^{w}-ɬp	'plant of the bear berry'
	q'iɬ-q'ɬ	'scratch'
	tux-tux	'unwind'
	t'-q^{w}us-q^{w}s-i	'gnat'
	win-wints	'sandpiper'
b.	yax-yaaki	'mountain goat (diminutive)'
	nix-nik'i	'cut (continuative)'
	six-sik'^{w}	'pull (continuative)'
	nix-niq'χm	'to have cramps'
	s-c'ix-c'ix^{w}taɬp	'horsetail plant'
	ɬax-ɬ'aq'^{w}ɬp	'Douglas fir tree'
	pax-paχuk^{w}	'be afraid (continuative)'

Copied velars and post-velars, whether or not labialized, are altered to *x* to conform to this restriction (43b). Other non-conforming segment types simply fail to copy. The limitation is significant, since generally in Nuxalk codas can contain any consonant, including oral stops, affricates, post-velars, labialized consonants, and glottalized consonants, all of which are banned from the reduplicant's coda.

Carlson (1997) presents a TETU analysis of the Nuxalk coda restrictions cast within the framework presented here. Significantly, all the restrictions are independently attested in inventory-defining rankings in other languages. Zec (1995) shows how some languages limit moraic (and by extension coda) status to high-sonority segments; in Nuxalk, the reduplicant's coda must be a fricative, nasal, or liquid — a continuous class on the high end of the sonority scale. Likewise, many languages prohibit glottalized codas outright (e.g., Takelma — Sapir 1922); post-velar codas are disfavored in Semitic (McCarthy 1994); labialized codas are impossible in Latin (Steriade 1982: 18) or Zuni (Newman 1965: 13).

In Nisgha, coda affricates are prohibited in the reduplicant, though they are permitted generally in the language. The reduplicative correspondent of an affricate is a simple fricative:

(44) Reduplication of Affricates in Nisgha (Shaw 1987: 297–8)

	pis-páʦ	‘to lift, carry something’
	k’is-k’áʦ-k^{w}	‘to have arrived (boat, vehicle)’
	q’ɑs-q’úʦ	‘to cut something’
	has-híʦ	‘to send something/someone’
	ʦ’iɬ-ʦ’át͡ɬ	‘(music) record (sg); to have a rippled surface (pl)’
	q’ɑɬ-q’ɑ́t͡ɬ	‘to be slightly crooked’
cf.	ʦiɬ-ʦáɬ	‘to eat something up, to lose, fail’

Based on this and other evidence, Shaw proposes that the final slot of the reduplicative template is subject to a condition limiting it to being filled by the head of any branching structure. An affricate is a branching structure, featurally, and its head is on the right. In our terms, a constraint prohibiting coda affricates is emergent in Nisgha. The same constraint governs the whole inventory of languages like Misantla Totonac (MacKay 1994: 376) or Zuni (Newman 1965: 13).[39] The realization of the copied affricate as a fricative rather than a stop can be attributed to another constraint, the preference for high-sonority (moraic) codas documented by Zec (1995) and invoked immediately above in the analysis of Nuxalk.

3. Fixed Segmentism as Morphology: Melodic Overwriting

We now turn to the morphological type of fixed segmentism exemplified in (2). In §3.1, we will offer an OT implementation of the McCarthy & Prince (1986, 1990) idea of “melodic overwriting”. We will then return in §3.2 to the phonological type of fixed segmentism, showing why the two types are required, what the differences are between them, where they overlap, and what kinds of hypothetical patterns could not be subsumed under either one and are therefore predicted not to occur in any language.

3.1 A Theory of Melodic Overwriting

The phonological, TETU type of fixed segmentism was the focus of discussion up until this point. In that type, the choice of fixed segments is determined, often contextually, by phonological markedness constraints that are part of UG. We now turn to the other type of fixed segmentism, melodic overwriting (MO), which was represented by cases like Kolami echo words or English *table-šmable* in (2). Following McCarthy & Prince (1986, 1990) and Yip (1992ab), we will argue that the identity of the fixed segmentism in MO is determined morphologically: in *table-šmable*, for instance, the overwriting string, phonetically *šm-*, is a prefixal morpheme, and so its properties are those of

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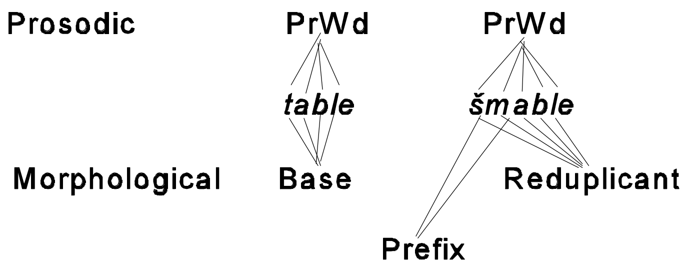
[39] Steriade 1992 lists a number of languages which prohibit contour segments in coda position. Thanks to Linda Lombardi for the Totonac reference.

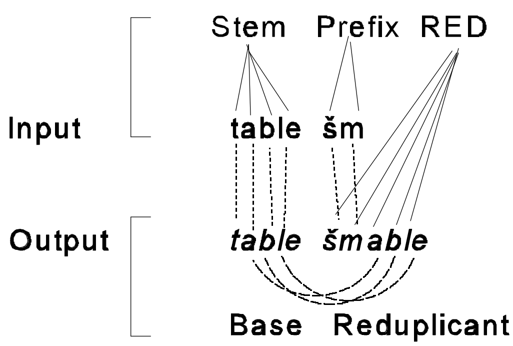
prefixes and other bound morphemes generally. But unlike a conventional prefix, *šm-* is realized simultaneously with the reduplicant and therefore can interfere with reduplicative copying.[40]

To clarify the outcome of the analysis, we begin with some assumptions about the structure and correspondence relations in MO, using *table-šmable* as an illustration:

(45) Structure and Correspondence Relations in MO
a. Prosodic and Morphological Structure of *table-šmable*



b. Correspondence Relations in *table šmable*



For compactness, we will write this form linearly as *[table]-[<u>šmable</u>]*, where brackets delimit PrWd's and underlining marks the reduplicant. Structurally, it consists of two PrWd's, the first identified as the base and the second as the reduplicant. The broken lines in (45b) show the correspondence relations (and should not be confused with the solid lines indicating constituent membership). As usual, the base has an IO correspondence relation with its input, and the reduplicant has a BR correspondence relation with the base. What's significant is that the overwriting string *šm* is a prefix that is realized simultaneously with the reduplicant. In this way, *šm-* is subject to evaluation for both BR and IO correspondence.[41]

The overlap of the reduplicant by *šm* is in violation of the constraint MORPHDIS (McCarthy & Prince 1995a: 310), which requires distinct morphemes to have distinct segmental contents. In the

[40]The overwriting pattern can also be found with tone. See Myers & Carleton 1996.

[41]Thanks to Ania Łubowicz for a good question on this point.

output *[table]-[šmable]*, the string *šm-* simultaneously realizes the input morphemes /šm-/ and RED, contrary to the dictates of MORPHDIS.[42] Moreover, this violation of MORPHDIS goes hand in hand with violation of the BR correspondence constraints: MAX_{BR}, because the reduplicant does not copy the *t* of the base, and DEP_{BR}, because the reduplicant contains material, *šm-*, that is not to be found in the base. These violations are compelled by IO faithfulness requirements on the base and the affix *šm-*.

Because *šm-* is an affix, it has the same IO faithfulness properties as any affix. Affixes are subject to IO faithfulness constraints just as roots are. The correspondence relations depicted in (45b) show this formally. Thus, any failure to realize input /šm-/ in the output will constitute a violation of MAX_{IO}. Affixes are also subject to constraints demanding peripheral alignment, initial in prefixes and final in suffixes (Prince & Smolensky 1991, 1993: 33f.; McCarthy & Prince 1993b). For *šm-*, then, the responsible constraint is ALIGN-L(*šm*, PrWd), which asserts that *šm-* is optimally located at the left edge of a prosodic word.

We now have the main elements for an analysis of MO with *šm-* or, indeed, with any affix. Its placement, initial in some prosodic word, is a typical affixal alignment effect. The fact that it overwrites the reduplicant comes from a ranking in which IO faithfulness takes precedence over MORPHDIS and BR identity:

(46) Faith_{IO} >> MORPHDIS, Faith_{BR} in *[table]-[šmable]*

/table+RED+šm/	MAX_{IO}	MORPHDIS	MAX_{BR}	DEP_{BR}
a. ☞ [table]-[šmable]		*	*	**
b. [table]-[table]	**!			
c. [šmable]-[table]	*!	*	**	*
d. [šmable]-[šmable]	*!	*		

Form (46b) has deleted the prefix *šm-*, a fatal mistake given the pre-eminence of IO faithfulness in the hierarchy. The other failed candidates (46c, d) preserve *šm-*, but have overwritten the base with it, leading to equally fatal IO faithfulness consequences. In contrast, (46a) preserves *šm-* and the base by tolerating defective copying. This ranking argument explains why overwriting is common in

[42] MORPHDIS supplies a link between MO and systems of "overcopying", where syllabification or coalescence at affix+reduplicant juncture alters the contents of the reduplicant and, by back-copying, the base as well. See McCarthy & Prince 1995a: §3.8 for discussion.

reduplication but not elsewhere: only reduplication involves distinct IO and BR faithfulness relations.[43]

In short, the constraints responsible for preservation, placement, and structure of *šm-* all treat it *as a prefixal morpheme*. Like any morpheme present in the input, its mapping to the output is governed by the faithfulness constraint MAX$_{IO}$. Like any prefix, its locus of placement is determined by ALIGN-L. The remaining details involve candidates that are also compatible with this hypothesis:

- *[table]-[šmə<u>table</u>]*. In this candidate, Gen has designated the *šm-* prefix as part of the base rather than part of the reduplicant,[44] so *šm-* stands between the reduplicant and its projection in the base. The difference between this candidate and the actual output falls in the scope of BR faithfulness: ranking MAX$_{BR}$ or R-ANCHOR$_{BR}$ above DEP$_{BR}$ will ensure the correct result. With the opposite ranking, *[table]-[šmə<u>table</u>]* would be optimal; a close parallel can be found in the Indonesian *pikir-məmikir* construction, with intervention of the prefix *məŋ-* (Uhrbach 1987, Cohn & McCarthy 1994).
- *[table]-[<u>tə</u>[<u>šmable</u>]]*. This candidate manages to get a PrWd-initial *šm-* and to avoid MAX$_{BR}$ violation by copying *t* in a kind of proclitic position. Here, the difference from the actual output is a prosodic-structural one: *[table]-[<u>tə</u>[<u>šmable</u>]]* violates NON-RECURS(PRWD) (Selkirk 1995, Itô & Mester 1992), because the category PrWd dominates itself. An approximate parallel to this failed candidate comes from an Estonian secret language that overwrites with *pi* and procliticizes the displaced material: ˈ*saːda* → *sa*ˈ*biːda* (Lehiste 1985).

There is undoubtedly more to be said about the structural properties of MO. Of particular interest is Bruening's (1997) work on Abkhaz. Because of differences between Abkhaz and English phonotactics, a wider range of interesting candidates is possible, and so much more can be said about the constraint conflicts that underlie the determination of output forms.

Having sketched an analysis of melodic overwriting in English,[45] we turn now to establishing

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[43] Besides MAX$_{IO}$, another IO faithfulness constraint relevant to (46) is L-ANCHOR$_{IO}$. It accounts for the contrast between *apple-<u>šmapple</u>* and **šmapple-<u>(šm)apple</u>*; the latter is unanchored because prefixation of *šm-* to the base has de-aligned underlying *apple*.

[44] Recall that the base is the string immediately preceding a postposed reduplicant (see §2.1 and McCarthy & Prince 1993a: Chapt. 5). Thus, the reduplicative base in *[table]-[šmə<u>table</u>]* is *table-šmə*.

[45] At first glance, English *šm-* reduplication appears to be subject to a phonological condition. Words with initial unstressed syllables are notably poor: *?electric-šmelectric, ?belief-šmelief, ?attack-šmattack.*

Observe, though, that words with initial secondary stress take primary stress when reduplicated with *šm-*: *Tàtamagóuchee* → *Tátamagòuchee-šmátamagòuchee*. This suggests that the real requirement may be contrastive stress on the

the broader typological basis of our claims. The main point will be to show that overwriting strings have the properties of affixal morphemes generally: faithfulness, alignment, and possibility of suppletion. In this endeavor, we have placed particular reliance on the carefully documented insights of Yip (1992ab), who has surveyed this field extensively.

Overwriting strings have faithfulness properties that are typical of affixes. Obviously, affixes can contain marked structures and maintain lexical contrasts (though sometimes they are less marked than roots — McCarthy & Prince 1995). Overwriting strings also contain marked structures (witness the examples above and below). And a single language can distinguish more than one overwriting string, with no phonological conditioning of the choice. For instance, Hindi overwrites with *w* (47b), *s*, and (rarely) *m*. Telugu (48b) has *ṭṭa*, *rra*, and *gi*. This is exactly what we expect from an affix, but it's strikingly different from phonological defaults like those discussed in §2.[46]

There are more subtle effects of IO faithfulness operating on overwriting strings. Tautomorphemic strings of segments are known to be subject to a CONTIGUITY$_{IO}$ constraint that forbids interruption of the underlying sequence (Kenstowicz 1994b, Spencer 1993, McCarthy & Prince 1995). If the overwriting string is a morpheme, then it should be subject to CONTIGUITY$_{IO}$ effects as well, and indeed it is. Yip 1992a:§2.1.3 observes that Kannada (with an echo-word pattern similar to Kolami) has /bhrame/ → *bhrame-gime* rather than **bhrame-grime,* even though *gr* is a possible onset in Kannada. We propose that CONTIGUITY$_{IO}$ on the overwriting morpheme /gi/ is decisive here. Yip 1992a:§3.2 suggests that avoidance of "discontinuous association" (≈CONTIGUITY$_{BR}$) favors *table-šmable* over **table-šamle*.

Overwriting strings also have the alignment properties of affixes. One result of research in OT is the idea that affixal position is determined by rankable, violable constraints. In the vast majority of cases, affixes are aligned with the left or right periphery, but non-peripheral position can be compelled by higher-ranking constraints (Prince & Smolensky 1991, 1993). For example, in Tagalog, *b-um-ilih* 'buy' is more harmonic than **um-bilih* because NO-CODA dominates ALIGN(*um*, L). Violation of the alignment constraint is minimal, though, so **bil-um-ih* is also non-optimal.

changed initial syllable. (The same requirement is observed in non-productively reduplicated words like *helter-skelter*.) Initial primary stress presents no difficulties; initial secondary stress is promoted to primary. But unstressed syllables can never receive a stress (Prince 1983: 34), and so words with initial unstressed syllables cannot meet accommodate to this construction. (Thanks to Alan Prince for discussion of these matters.)

[46]The overwriting string may even be an affix that occurs independently of reduplication. This is the situation in many Bantu languages where, according to Downing (1996c, to appear abc), the fixed *a* of CVC*a* reduplication is the ubiquitous "final vowel" morpheme (in her view, a morphological rather than phonological default).

If overwriting strings are truly affixes, then they too should show a bias toward peripheral position. And precisely that bias has been discovered by Yip (1992ab). Here are some examples of initial and final overwriting:

(47) Overwriting Initially (also Kolami and English (2))

a. Kamrupi *s* (Goswami 1955–6: 164)

ghar	ghar-sar	'house'/'house and similar things'
gharā	gharā-sarā	'horse'/'horse and the like'
khori	khori-sori	'fuel'/'fuel and the like'

b. Hindi *w* (Singh 1969: 189)

laɽkā	laɽkā-waɽkā	'boy'/ 'boy and the like'
pānī	pānī-wānī	'water'/'water and the like'

c. Marathi *bi* (Apte 1968)

kholi	kholi-bili	'room'/'room or some such dwelling'
aras	aras-biras	'decoration'/'decoration or something similar'
bikšis	bəkšis-bikšis	'prize'/'prize or some such reward'

(48) Overwriting Finally

a. Tzeltal *n* (Berlin 1963: 215)[47]

c'al	c'al-c'an	'to make it ready for carrying (e.g., cargo)'/'to continue carrying cargo'
t'oh	t'oh-t'un	'to peck it'/'to peck it vigorously'

b. Telugu *ʈʈa* (Bhaskararao 1977: 9)

kosa	koʈʈa-kosa	'end'/'extreme end'
civara	ciʈʈa-civara	'end'/'extreme end'
niluvu	niʈʈa-niluvu	'perpendicular'/'very perpendicular'

c. Vietnamese *ang* (Thompson 1987: 161 — diacritics suppressed)

no	no-nang	'to blossom'/'be full-blown'
tre	tre-trang	'be late'
bon	bon-bang	'be numerous, encumbering'

In (47), the overwriting string has the alignment properties of a prefix, and in (48), of a suffix

There is also an overwriting analogue to infixation. Affixes consisting of just a vowel overwrite the nucleus of a peripheral syllable in Marathi and Thai, for instance:

(49) Infixing a Vowel

a. Marathi (Apte 1968)

saman	saman-suman	'luggage'/'luggage, etc.'
dhak	dhak-dhuk	'fear'/'fear, apprehension and the like'
khəra	khəra-khura	'true'/'true, genuine, etc.'

b. Thai (Noss 1964: 52–3)

kın	kın-kən	'to eat'/'wining and dining'
thɛ̆ɛw	thɛ̆ɛw-thə̆əw	'row, section'/'general vicinity'
năŋsy̌y	năŋsy̌y-năŋsə̌ə	'books'/'literature and that sort of thing'

[47] Tzeltal reduplicative patterns like /c'ih/ → *c'ih-cu*, /pech/ → *pech-pu* are of further interest. If the overwriting string /u/ must be right-aligned, then this will rule out forms like **pech-puch*, even though they achieve better copying.

Better (i.e., peripheral) alignment of the overwriting segments is possible, but would violate constraints on BR anchoring or syllable structure. Tagalog-like, these constraints are ranked above the affixal alignment constraints that are dispositive of the affixes *u* (Marathi) and ə (Thai).

Finally, affixes can alternate suppletively. The choice of suppletive alternants, or allomorphs as they are sometimes called, may be conditioned by phonological constraints even though the allomorphs themselves are not related through a single underlying representation. For example, the Korean nominative is -*ka* post-vocalically and -*i* post-consonantally, a relation that makes perfect sense in terms of markedess, since ONSET and NO-CODA are satisfied, but not in terms of faithfulness, since -*ka* and -*i* cannot be seen as faithful representatives of a single underlying representation. (On the proper treatment of suppletive alternation in OT, see Mester 1994, Hargus 1995, Kager 1995, Russell 1995, Drachman, Kager, & Malikouti-Drachman 1996, Lapointe & Sells 1996, and Perlmutter 1996.)

Suppletive alternation may also affect the putative affix in overwriting fixed segmentism. The most conspicuous examples of this type come from identity-avoidance phenomena (Yip 1993, 1995ab). For instance, Telugu, which usually affixes *gi*, uses *pi* with *gi*-initial words (*gilaka*-<u>*pilaka*</u> 'rattle etc.'). The alternation is clearly suppletive, because there is no way to see /gi/ → *pi* in purely phonological terms. The constraint forcing suppletion, Yip argues, is part of a general pattern of dissimilation in phonology and morphology; indeed, she relates it directly to morphological haplology, which is another type of allomorphic alternation.

To sum up, we have argued in this section, following McCarthy & Prince (1986, 1990) and Yip (1992ab), that the overwriting string is an affixal morpheme.[48] We now turn to explicit comparison between this morphological source of fixed segmentism and the phonological source discussed in §2.

3.2 Phonological and Morphological Fixed Segmentism Compared

In §2, we showed how phonology can produce patterns of fixed reduplicative segmentism, through the emergence of the unmarked. In §3.1, we showed how morphology can also produce patterns of fixed reduplicative segmentism, through alignment of an affixal morpheme in the reduplicant. In

[48] Though the familiar understanding of "affix" is sufficient for these and other cases of overwriting discussed in the text, a more general, processual view of morphology may be required for echo words that involve subtractive morphology. Among the Marathi patterns is one that substracts the initial consonant of the preposed reduplicant (Apte 1968): <u>ə*dhla*</u>-*m*ə*dhla* 'from the middle', <u>*i*ɖ*a*</u>-*pi*ɖ*a* 'bad luck, bad omen, etc.' This is evidently unproductive and is not paralleled by productive processes in other systems with which we are familiar, so its relevance to the theory is not clear.

positing two distinct sources of fixed segmentism, we continue a line initiated by McCarthy & Prince (1986), and we differ significantly from approaches that attempt to unite all fixed-segmentism phenomena under a single rubric, such as prespecification (Marantz 1982, Yip 1982, Kiparsky 1986, Lieber 1987, Clark 1990) or post-copying substitution operations (Steriade 1988). Our goal in this section is to show why both types are required, where they differ, where they overlap, and where neither is applicable.

We can deduce a number of predicted characteristics from the respective theories of the two types of fixed segmentism. The theory of phonological fixed segmentism is based on TETU, in which some phonological markedness constraint M is ranked below correspondence constraints on IO faithfulness and above the equivalent constraints on the BR dimension. In this way, M has no inventory-defining power in the language as a whole, but it does have inventory-defining power in the reduplicant. The central role played by M leads to these predicted correlations (from §2.1):

(50) Properties of Phonological Fixed Segmentism Based on Emergence of M

a. M is a constraint of UG. Therefore:

i. If M is inventory-defining for just the reduplicant in one language, then it will, through ranking permutation, be inventory-defining for some other whole language.

ii. If M is inventory-defining for the whole of one language, then it will, through ranking permutation, be inventory-defining for just the reduplicant in some other language.

b. To emerge in the reduplicant, M must be ranked above any markedness constraint that would vitiate its effect. Therefore, any evidence from the general phonology of the language must be consistent with this ranking of M. In particular, any default segments in the same context as the phonological fixed segmentism should obey M.

c. M is a phonological markedness constraint in the OT sense. Therefore, the effects of M will show context sensitivity in determining fixed segmentism phenomena just as they do in phonology generally. This is one reason why "fixed" segmentism need not be invariant; it may show the influence of the context obtaining in the form under evaluation.

d. M is ranked in a full hierarchy, and so the effects of M will be contingent on interaction with other constraints. This is another reason why "fixed" segmentism need not be invariant; in particular, M may emerge only when copying is imperfect (as judged by high-ranking BR constraints) or M's emergence may be seen only as a failure to copy marked structure (with no compensating substitute).

In short, the theory of phonological fixed segmentism entails that it have all and only the properties of phonology generally.

Morphological fixed segmentism (§3.1) comes from affixation. The affix is realized in the reduplicant proper, because of the ranking results in (46). This morphological source of fixed segmentism also leads to certain predicted correlations:

(51) Properties of Morphological Fixed Segmentism Based on Affixation

a. Morphological fixed segmentism has the faithfulness properties of an affix. Therefore, its inventory structure is that of affixes generally in the language housing it. For the same reasons, there can be distinct, contrasting fixed-segmentism affixes within a single language.

b. Morphological fixed segmentism has the alignment properties of an affix. Therefore, it must be aligned peripherally, as prefix or suffix, or minimally displaced from peripheral position under compulsion from some higher-ranking constraint of UG.

c. Morphological fixed segmentism has the context-sensitivity of an affix. It will, of course, participate in any phonological process that affects other affixes of the same type in the host language. It can also display suppletive alternations.

In short, the theory of morphological fixed segmentism entails that it have all and only the properties of affixation generally.

Because they have these very different entailments, the respective theories of phonological and morphological fixed segmentism carve out largely distintinct empirical domains, though there is some overlap in the middle.

The "not so fixed" segmentism discussed in §2 can only be subsumed under the phonological theory (see (50d)). Examples include the Lushootseed nucleus (§2.3), the Tübatulabal coda (§2.4), the Nancowry nucleus and coda (§2.5), and the various phenomena of Makassarese, Nuxalk, and Nisgha highlighted in §2.6. For all of these cases, we have argued that the appearance or nature of the fixed segmentism is contingent on details of the interaction of phonological markedness constraints and/or BR identity constraints. There is no way to make sense of these contingencies in affixational terms.

Conversely, the phenomena discussed in §3.1 cannot be understood phonologically, though they have a straightforward affixational analysis. A phonological account is impossible because there is no constraint M which meets the criteria in (50) and would favor emergence of something like *šm-*. Though no one can claim to know all of the markedness constraints of UG, the typological study of inventories and defaults is sufficiently well advanced that we can be reasonably secure in making this statement and others like it.

As in most theories with a taxonomic twist, there is a small region of overlap. Where the markedness constraints of UG are simply not understood well enough, it may be difficult to say whether a particular instance of fixed segmentism is compatible with a TETU analysis or not. Further research on markedness constraints may resolve such indeterminacies. Very simple cases like Yoruba

(§2.2) are also somewhat indeterminate. Yoruba meets the TETU criteria (50), and TETU explains the correlation between fixed reduplicative segmentism and the independently motivated default vowel, but an affixal analysis is also descriptively adequate, because the fixed *i* of Yoruba shows no sensitivity to phonological context. The same could be said of the ʔ onset in Tübatulabal and Nancowry. This sort of overlap is untroubling, since it merely recapitulates in microcosm a familiar (and probably irreducible) indeterminism at the phonology/morphology boundary.

In addition to considering the scope of these theories, it is important to understand what is outside their scope. What kinds of fixed segmentism phenomena are predicted not to exist under the approach developed here? In general, systems that cannot be reconciled with either of the correlations in (50) and (51) are predicted to be impossible. If one were found and it stood up to scrutiny, it would constitute a counterexample to our proposals.

For example, suppose we have a case of fixed segmentism that is incompatible with the TETU markedness criteria in (50a, b). It must therefore be analyzed affixationally, under the rubric of melodic overwriting. But affixation brings with it certain entailments about the position of the fixed segment (51b): it must either be peripheral or minimally displaced from the periphery to satisfy some higher-ranking constraint of UG. Concretely, a counterexample to our proposals would therefore be something like a fixed *b* that overwrites the coda of the first syllable (or onset of the second syllable) in a polysyllabic reduplicant.

Here is another potential counterexample. Suppose a case of fixed segmentism shows a distinctly phonological pattern of emergent context sensitivity. (For instance, suppose the fixed segmentism is subject to an assimilatory process that is otherwise not observed in the language, as in Nancowry.) It must therefore be analyzed in TETU terms (compare the criteria (50c) and (51c)). But this entails that the fixed segmentism also meets the TETU markedness criteria in (50a, b). Concretely, a counterexample to our proposals would therefore be a fixed initial *s* that palatalizes to *š* before front vowels in a language where *s*-palatalization is otherwise not observed.

Turning this last case around, let us suppose that the fixed segmentism shows a distinctly morphological pattern of context-sensitive alternation, suppletion (see (51c)). It must therefore be analyzed affixationally. We do not expect it at the same time to show the type of context-sensitivity that is diagnostic of TETU (50c)). Concretely, a counterexample to our proposals would therefore be a language that is like Nancowry in every respect except that accidental resemblance between reduplicant and base triggers identity-based suppletion in the form of the reduplicant.

Finally, suppose that the fixed-segmentism effect has templatic force, blocking copying but supplying no substitute, as in the coda of the Tübatulabal reduplicant. This type of behavior is analyzeable in TETU terms (see (50d)), but it cannot be reconciled with the affixational model. Therefore, we predict, with Generalized Template Theory, that any such templatic effect will be interpretable in terms of markedness constraints of UG, with all that this entails (50a, b). Concretely, a counterexample to our proposals would therefore be a language that banned only some arbitrary list of segments from the reduplicant's coda.

This is by no means an exhaustive list of patterns that would counterexemplify our proposals, but it offers a general strategy: look for systems that cross-cut the correlations in (50) and (51). Perhaps needless to say, some deftness and delicacy are required in this enterprise. One caution is that compatibility with the TETU criteria (50a, b) does not ensure analysis in TETU terms. An affix can, by accident, conform to these criteria, as we noted above when discussing the region of overlap between the two sources of fixed segmentism. Another caution is that an affix may consist of just features rather than an entire segment — this is a well-established result of autosegmental phonology (see Akinlabi 1996, Zoll 1996 for recent discussion). Finally, there is nothing to exclude the possibility of a system that combines TETU in one part of the reduplicant with overwriting affixation in another. (For instance, the onset ʔ in Nancowry could in principle be overwriting, though the vowels are clearly TETU.) Our hypothetical counterexamples above have been constructed so as to side-step these traps, and each trap needs to be considered when evaluating evidence in the future.

To sum up, we have argued that affixation, overwriting a portion of the reduplicant, provides a distinct source of fixed segmentism. We have presented an analysis of this phenomenon in alignment and faithfulness terms, and we have compared it in detail to the TETU type of fixed segmentism studied in §2. Comparison reveals that the two types of fixed segmentism manifest different correlations of properties, and these correlations give the theory considerable predictive as well as taxonomic value. We ended with a non-exhaustive list of situations that would counterexemplify our proposals by illicitly cross-cutting the predicted correlations.

4. Conclusion

In this article, we have examined the phenomenon of fixed reduplicative segmentism. We have argued that there are two types of fixed segmentism, phonological and morphological. The phonological type exhibits exactly the properties of phonology generally, because it is based on the same universal markedness constraints as the rest of phonology, though they are limited in scope by constraint ranking. The morphological type exhibits exactly the properties of affixation generally, since it literally *is* affixation, but affixation simultaneous with the reduplicant rather than onto a base. This difference too is given by constraint ranking.

The predictions and the analyses are derived from a theory that posits literally no new constraints, devices, or other apparatus. Rather, the theory has only these premises, all of which are important in areas far removed from fixed segmentism:

(i) Markedness constraints. Markedness constraints are independently motivated by their role in characterizing inventories or defaults and forcing phonological alternations. Every markedness constraint mentioned here meets one or more of those criteria.

(ii) Alignment constraints. As we noted above, morphemic alignment constraints are an essential part of OT's account of infixation (Prince & Smolensky 1991, 1993; McCarthy & Prince 1993ab).

(iii) Faithfulness constraints, specifically a distinction between constraints on base-reduplicant identity and input-output faithfulness, set within Correspondence Theory. Faithfulness constraints are an indispensible element of OT. The argument for the specific distinction between two types of faithfulness is based on reduplicative over- and underapplication (McCarthy & Prince 1995, to appear).

(iv) Constraint ranking and violation. OT would not exist without these notions.

All of our analyses and the predictions they support are obtained from these premises and nothing more.

The close match between what is needed to analyze fixed segmentism and what is needed independently establishes strong preconditions for the adequacy of alternative models. A theory that rejects any of the premises (i)–(iv) must not only justify its assumptions with fixed-segmentism evidence; it must also provide a new account of those phenomena that supply independent motivation for those premises. Likewise, a theory that proposes to add a premise to (i)–(iv) must motivate this enrichment not only with fixed-segmentism evidence but also independently.

Of course, differences in details are always possible, but details do not impinge on the overall framework developed here. For instance, a theory of markedness oriented more toward the representational rather than the substantive (such as underspecification theory) could easily be substituted in the analyses above without doing any violence to our main conclusions. Changes in the assumptions at this level are fully compatible with the approach we have developed here and the results we have derived from it.

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