Distributed Reduplication

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The central goal of theoretical linguistics is understanding the nature of the mental computations which are carried out in producing the representations which the articulatory system acts on in producing speech. Although there are many new ideas in this monograph about the computations which are put to use in reduplicative phonology, some fairly radical, the intent is quite conservative. I hope to provide evidence that the model of the phonological computation which was developed by Chomsky and Halle in *The Sound Patterns of English* (1968) is fundamentally correct: surface forms are produced by the successive modification of underlying forms.

I will call this model *derivational phonology*. The name is misleading, but in such common use that an attempt to change it might create even more confusion. It is misleading because the particular feature of the SPE model that distinguishes it is not that the computation employs derivations. All computations of any complexity go through a sequence of intermediate states, hence have intermediate representations and derivations. Rival theories, Optimality Theory (Prince and Smolensky, 1993), for example, compute the input-output relations by means of derivations which consist of progressive filtering of (very large) sets of phonological representations. What distinguishes derivational phonology is not that it employs derivations, but the nature of the intermediate states in the derivational computation. It proposes that intermediate states in the computation have the same general form as initial states.
and final states; the step by step derivation of the output proceeds through *modification*. A better name than derivational phonology might be “developmental phonology,” emphasizing that the issue is the progressive change of a single entity. Derivational phonology shares with developmental biology the understanding that certain features of the current state of an organism/representation can only be understood in terms of the state of the organism/representation at earlier stages in its development.

A thorough and convincing demonstration of the adequacy of derivational phonology with respect to reduplicative phenomena has particular relevance at this time because many researchers still accept the claims of McCarthy and Prince (1995) that derivational phonology is incapable *in principle* of analyzing reduplication. Inadequacies in the analyses of reduplication that were available at the time their paper appeared gave some grounds for thinking that this might be so. But recent derivational analyses of reduplication, Raimy (2000) in particular, have shown that McCarthy and Prince’s criticisms of derivational phonology (at least insofar as reduplication is concerned) were only valid criticisms of particular proposals, not demonstrations of insoluble obstacles to a derivational analysis of reduplication. My hope is that this monograph will make this point more thoroughly and convincingly.

Although particular reduplicative processes in many languages are discussed in Chapters 1–6, which develop the general theory, the book closes with an extensive sequence of detailed case studies. The wide range of case studies is not simply intended to show off the accomplishments of Distributed Reduplication. It is intended to be evidence that the theory is true. It is a relatively easy task to show that some purported “general principles” successfully account for some particular phenomena in some particular language. But it is a much more difficult task to show that these general principles are truly general and can serve as the basis for analyzing widely different phenomena (within the range that UG makes possible) in very different languages.
Acknowledgments

There are many people to thank for making this monograph possible. Above all, it would not have been possible (not even close) without the ongoing support and guidance of Morris Halle. It is no accident that an impressive series of important books on phonology over the last 30 years begin with a tribute to the inspiration and guidance of Morris Halle. He is a singular teacher.

Thanks also to Sam Gutmann and Sylvain Bromberger for many comments. Since I devote several pages in what follows to showing that he did not get it right, I am glad to be able to acknowledge at the start that it was Eric Raimy’s work which showed that a derivational solution to the problems posed by reduplication was possible. He reminded us that most of the crucial advances in phonological theory are advances in understanding the structure of phonological representations.

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Chapter 1  
Preliminaries and Overview

I start from the assumption that humans exercising their language faculty carry out computations on abstract linguistic representations and that the core project of linguistics is to discover the form of these representations and the computational resources which are brought to bear in manipulating them. Linguists who are interested in this project build models with the hope that comparison of these models with human linguistic performance will elucidate some aspects of the language faculty and allow the construction of more refined models which will allow further elucidation. In short, they carry out scientific research. In this spirit, I will present a theory of reduplication.

Reduplication uses a copying mechanism. The most remarkable example of a copying-like process in the biological world is the transcription of genes to RNA. In the simplest case, a gene is a subsequence of a long DNA sequence. More complex cases involve multiple subsequences with intrusions that are truncated when transcription takes place. Transcription is a two step process. First, a marker, called a “transcription factor,” is attached to the DNA at the beginning of the gene to signal the position at which transcription should be initiated. In effect, a transcription factor is a “molecular diacritic.” Second, transcription itself takes place starting at the marker. Marking by the attachment of a transcription factor to the DNA and transcribing marked DNA, are independent mechanisms, carried out by different biological systems. I will attempt to establish in this paper that reduplication is
organized in roughly the same way, as a two-stage process. In place of the attachment of transcription factors to the DNA, junctures (called \( t\text{-junctures} \), transcription junctures) are inserted into the timing tier by the morphology. The transcription mechanism, which operates in the phonology, is triggered by these \( t\text{-junctures} \) to carry out transcription, just as the DNA transcription mechanism is triggered by transcription factors to carry out its biological copying. The \( t\text{-junctures} \) are interpreted as instructions which trigger and guide the duplication and/or truncation of certain material.

Since transcription takes place in the phonology, it is possible that phonological operations apply after \( t\text{-juncture} \) insertion but before transcription. It is also possible that phonological rules are sensitive to the presence of \( t\text{-junctures} \). A rich array of interactions is possible. Since several different operations can be involved, rule ordering can have significant effects. The sometimes surprising complexity of reduplication processes derives from the intricacy of the interaction of multiple simple processes. Since surface patterns are the combined result of the morphological insertion of \( t\text{-junctures} \) and various rules distributed throughout the phonology, the theory is dubbed Distributed Reduplication (DR).

The decomposition of copying into one stage in which junctures are inserted into a linear string, and a second stage in which actually doubling occurs, is familiar from another source; repetition blocks in music. Part of the standard repertoire of signs and symbols used in writing music scores are repeat marks: \( \| \) and \( \|\| \). They are instructions to be used in the translation of the score from an abstract representational to a concrete physical performance. There is a strong similarity between a music score and a phonological representation. Goldsmith (1976) describes an autosegmental representation as an “orchestral score.” Both a music score and an autosegmental representations are abstract representations which can be, but need not be, translated into a physical performance.\(^2\)

Two papers which were published in the 1970s have played a pivotal role in the development of theories of reduplication in the period since then. Wilbur (1973) discussed several interactions between reduplicative copying and the general system of phonological rules which showed that there was some kind of unexpected influence on the application of phonological rules to representations involving reduplication.
which had the effect of maintaining the identity of copied material and the material that it was copied from. She proposed that this required a revision of the then current view of phonology, with some kind of an Identity Condition standing outside of the derivation system, operating transderivationally, which produced the desired results. Moravčík (1978), in a broad survey of attested reduplication patterns, found that certain kinds of reduplication which linguists might naively think to be possible or even common, were not attested. In order to account for this, she advanced several proposals about the nature of the computation.

Most of the remainder of this introductory section is devoted to discussing the relation between DR and the work of Wilbur and Moravčík and outlining how their empirical findings will be explained in Chapters 2-6, starting from the idea that the first step in reduplication is insertion of t-junctures into the timing tier of a phonological representation.

1.1 Moravčík (1978)

The most striking empirical fact that came out of Moravčík’s survey is that syllable copy reduplication (Pattern 3 below) appears to be missing from the large inventory of reduplication patterns found in the world's languages. Patterns 1 and 2 below are widely attested, but Pattern 3 is unattested.

\[
\begin{array}{cccc}
\text{stem} & \text{Pattern 1} & \text{Pattern 2} & \text{*Pattern 3} \\
\text{gin.dal} & \text{gi-gin.dal} & \text{gin-gin.dal} & \text{gin-gin.dal} \\
\text{gi.dal} & \text{gi-gi.dal} & \text{gid-gi.dal} & \text{gi-gi.dal} \\
\text{gi:.dal} & \text{gi-gi:.dal} & \text{gi-gi:.dal} & \text{gi-gi:.dal} \\
\end{array}
\]

The puzzle that must be addressed by theories of reduplication is why syllable copy does not exist.

In order to explain the distribution of reduplication patterns she found, Moravčík proposed that the reduplication mechanism is restricted as shown in (2). It is useful for the sake of discussion to separate her hypothesis into a weak version and a strong version.
1. The mechanism of reduplication makes no reference to the prosodic structure of the stem.

2. The mechanism of reduplication chooses what to copy on the basis of a CV template.

Although both hypotheses have proved untenable in the form that she advanced them, both contain important kernels of truth that have been incorporated into later analyses.

Marantz (1982) highlighted the example of Yidiny plural reduplication (Nash 1979; 1980) as a counterexample to Moravcik’s proposals. It is exemplified below:

\[
\begin{array}{ll}
\text{stem} & \text{plural} \\
\text{gin.dal.ba} & \text{gin.dal-gin.dal.ba} \\
\text{mu.la.ri} & \text{mu.la-mu.la.ri}
\end{array}
\]

He noted that determining which substring is copied requires reference to the syllable structure of the stem, contradicting (2.1). Replication copies the first two syllables to the left. Although Marantz provided an analysis of Yidiny plural reduplication, by extending Moravcik’s idea of a CV template to a template containing prosodic units (syllables), he was then unable to explain why syllable reduplication does not occur. He concluded that it “…leaves us with a mystery.” (See Section 5.2 for more on Yidiny plural reduplication.)

Broselow and McCarthy (1983) provided part of the solution to the mystery. They realized that sometimes an affix applies not to the whole stem, but to a prosodic subunit of the stem. The computation of the material to be reduplicated therefore naturally bifurcates into two computations; the computation of the domain of the affix, and the computation of that portion of the domain that is copied. Moravcik’s (2.1) can then be modified to be a hypothesis about the second component of the computation. Prosodic Morphology (see McCarthy and Prince, 1995, and many references cited there) helped to clarify that the kinds of prosodic subunits of the stem which can be the domain of an affix must be “wordlike” in some sense. Prosodic requirements on words are weight requirements, bimoraicity or bisyllabic. Under this analysis, domain determination can certainly be sensitive to prosodic constituent boundaries, but only in a limited way. The sensitivity is to
foot boundaries, not syllable boundaries. Yidiny plural reduplication is now straightforward. The domain of the affix which generates the pattern is an initial bisyllabic foot. The entire domain is selected for copy. Yidiny plural reduplication is total reduplication (of the domain).

DR further subdivides the computation of the material to be transcribed. It is factored into three components:

(4) 1. Domain Selection;
2. Juncture Insertion; and
3. Prosodic Adjustment

Domain Selection and Juncture Insertion are morphological operations which establish the initial location of the t-junctures. But these locations can be modified (i.e. adjusted) by Prosodic Adjustment, which takes place in the phonology, prior to transcription. Although Prosodic Adjustment is in the phonology, it is morphologically conditioned. Many reduplicative morphemes trigger prosodic adjustment, but many do not, so (4.3) may or may not be present in the phonology.

A brief comparison with the architecture of Prosodic Morphology (PM) may be helpful in clarifying the architecture of DR. Prosodic Adjustment is governed by a target prosodic desideratum (or desiderata), which is roughly equivalent to PM’s notion of a prosodic template. The fact that some reduplicative affixes trigger prosodic adjustment but some do not is roughly equivalent to the PM distinction between templatic and atemplatic reduplication. A significant difference between PM and DR is that while atemplatic reduplication is exceptional in PM, it is prosodic adjustment that is exceptional in DR. Pattern 1 in (1), for example, involves no prosodic adjustment. The morphology simply inserts a [-juncture before the first timing slot and a ]-juncture after the first vowel. Pattern 2 is the result of the same juncture insertion rules, but the material bounded by the duplication junctures is adjusted to a heavy syllable by shifting the ]-juncture to the right.

Moravcik’s (2.1) holds of Juncture Insertion, which uses a very restricted inventory of insertion rules. Prosodic Adjustment is driven principally by a weight desideratum, although secondary prosodic desiderata (simple onset, C-finality, etc.) are possible. Furthermore, although there are cases in which the rules that Prosodic Adjustment uses to achieve satisfaction of the prosodic desiderata are not sufficient to
achieve satisfaction, several default rules are universally available. We shall see that these assumptions conspire to make syllable copy reduplication impossible.

Chapters 2-4 develop the general theory of juncture insertion and transcription. Chapters 5 and 6 are devoted to a careful examination of the space of possible juncture insertion rules, their interaction with prosodic adjustment, and the variety of reduplication patterns which this generates.

1.2 Wilbur (1973)

The kinds of examples that Wilbur pointed out and the hypothesis that she advanced to explain the facts was an important factor in the turn away from generative phonology taken by Optimality Theory and its further development into Correspondence Theory, McCarthy and Prince (1998). Optimality Theory provided a coherent framework in which an Identity Condition of the kind proposed by Wilbur could be embedded.

A well-known example of the kind of the interaction of reduction and the general phonology of a language which led Wilbur to propose the Identity Condition comes from Onn’s (1976) work on Malay. There are no underlying nasal vowels in Malay, but nasalization spreads to the right (under locality conditions which can be ignored in this introductory discussion, but which will be considered in more detail later) so that underlying ajan, for example, surfaces as a\~n\~an. Malay makes extensive use of total reduplication to realize various morphemes. Naively, one would expect totally reduplicated ajan to surface as a\~n\~an\~a\~n or a\~n\~a\~n\~a\~n, depending on the timing of reduplication and nasalization. Instead, it surfaces as a\~n\~a\~n\~a\~n, with no apparent source of nasalization of the initial vowel. Wilbur concluded that effects of this kind result from an Identity Condition which holds between the source of reduplication and the reduplicant that persists after copying has created the reduplicant. The mysterious nasalization is then analyzed as the joint result of nasalization of the post-nasal copy of a and the Identity Condition, which somehow makes the two copies of a identical. Wilbur did not propose an architecture within which the Identity Condition could produce the desired effect. It is easy to see how Wilbur’s Identity Condition evolved into the base-reduplicant
conditions of Correspondence Theory, which abandoned any attempt to understand the mechanism.

Wilbur effects did not receive a coherent account within derivational phonology until Raimy’s (2000) thesis. He proposed a radical revision of the structure of the timing tier. In particular, he proposed a structure in which the timing tier is not linearly ordered, so that a timing slot can be preceded or followed by more than one timing slot. The major weakness of Raimy’s proposal is that a nonlinear timing tier makes it impossible to build syllable and prosodic structure. Although DR rejects Prosodic Morphology’s analysis of reduplication, it is important that certain of its insights be maintained. This is impossible unless reduplicative structure and prosodic structure can freely coexist. A full critique of Raimy’s proposal is given in Chapter 8.

DR takes a very different approach to understanding Wilbur effects, using ideas of McCarthy (1986). The key step is a correct understanding of the copying operation. It is a two stage process, illustrated for the Malay example in (5).

\[ (5) \quad \text{copy} \quad \text{NCC Repair} \]

\[
\begin{array}{c}
\text{x x x x} \\
\mid \mid \mid \mid \\
a \eta a n \\
\text{repair}
\end{array}
\quad \rightarrow
\begin{array}{c}
x x x x x x x \times \times \times \times \times \times \\
\mid \mid \mid \mid \mid \\
a \eta a n a \eta a n
\end{array}
\]

The first step, which will be called Transcription (Trscr) in what follows, copies only timing slots and their phonemic associations, not phonemes themselves. The second step repairs the violations of the No Crossing Constraint (NCC) which Transcription creates. In (5), the repair is carried out by what McCarthy called phoneme fission.

Just as the separation of reduplication into juncture insertion and actual doubling allowed for the intervention of prosodic adjustment, the separation of doubling into Transcription and subsequent NCC repair allows for the intervention of phonological rules. The application of phonological rules to structures like (5) with long-distance geminates is the source of many of the puzzling Identity Effects which have been discovered. Note that the initial vowel \( a \) in (5) occurs in two different environments. One of the timing slots that it is linked to is initial, but the other timing slot that it is linked to immediately follows a timing
slot that is linked to a nasal consonant. More discussion is obviously required, and will be provided in Chapter 2, but if standard ideas about rule application to geminates are extended to long-distance geminates, and nasalization in Malay is not subject to geminate inalterability, then the derivation below results:

\[
\begin{array}{c}
\times \times \times \times \\times \times \times
\end{array}
\xrightarrow{\text{Nasalization}}
\begin{array}{c}
\times \times \times \times \\times \times \times
\end{array}
\]

\[
\begin{array}{c}
an
\end{array}
\xrightarrow{\text{NCC Repair}}
\begin{array}{c}
\tilde{a} \tilde{a} \tilde{a} \tilde{a} \tilde{a} \tilde{a}
\end{array}
\]

Nasalization of the initial vowel in \( a\tilde{y}an \rightarrow \tilde{a}\tilde{y}\tilde{a}\tilde{n}\tilde{a}\tilde{n} \) was posed as an insurmountable problem for derivational phonology by McCarthy and Prince (1998). The decomposition of reduplicative copying into Transcription and NCC Repair gives a simple derivational solution to the problem.

1.3 A guide to what is to follow

A closer look at the application of phonological operations on structures with crossing violations (called crossed structures in what follows as a descriptive convenience) will reveal some subtleties. Nasalization is generally thought to be a feature spreading operation. The NCC cannot be a derivational constraint on Transcription, otherwise (5) would be impossible. But the NCC (or something like it) does appear to constrain feature spreading, as a derivational constraint. In order to make the analysis illustrated in (6) convincing, a thorough discussion of crossed structures and feature spreading in crossed structures is required. Chapter 2 contains a discussion of the No Crossing Constraint, constraints on feature spreading, and the application of phonological rules in crossed structures. Some skepticism has been expressed about the existence of nasalization overapplication in Malay, and about the existence of Wilbur effects in general. The discussion of Chapter 2 meets many of these objections by showing that spreading in crossed structures is severely
constrained. Although \( ajan \rightarrow ājanāqān \) is predicted, for example, \( aran \rightarrow āranāran \) is not.

A theory of reduplication must fit into a general theory of morphophonology. Chapter 3 outlines a theory of morphology and the place of reduplication in this theory. Juncture insertion is nonconcatenative morphology. In spite of the fact that reduplication often produces strings of elements on the surface that look like prefixes or suffixes, reduplicative inflection derives from the same kind of morphology which produces \( sīj \rightarrow saj \) as the realization of the past tense morpheme in English for the verb root \( sing \). Realization of the past tense morpheme in this context does not cause the concatenation of affix. But it does trigger an operation applied to the stem (vowel ablaut).

Steriade (1988) proposed that reduplication consists of total stem reduplication coupled with truncation. DR takes from this the idea that reduplication consists of the transcription of some substring of the stem (not the whole stem) coupled with truncation. A theory of truncation is presented in Chapter 4 and its complex interactions with copying are explored. It will turn out that many instances of metathesis as well as infixation are best analyzed as varieties of reduplication.

Chapter 5 develops Broselow and McCarthy’s (1983) idea that the effective stem in reduplication processes is sometimes only a subword of the stem. The notion “subword” must be made precise. Both foot-based and morphologically based subwords will be recognized. Chapter 6 investigates prosodic adjustment in detail, with a detailed discussion of heavy syllable prefixal reduplication in the related Austronesian languages Mokilese, Ponapean, Agta, and Ilocano.

Chapter 7, by far the longest chapter, is a series of case studies. Almost all of the languages with well-studied complex reduplicative processes are discussed in some detail: Asheninca Campa, Chaha, Kinande, Lushootseed, Ndebele, Sanskrit, and Washo. In the author’s experience, it is one thing to develop a theory that is designed for one particular language, but it is quite another to propose a theory which holds itself responsible for the full range of empirical data. The test of a theory is not the excellent job it does on its “poster child” language (to borrow Donca Steriade’s colorful phrase), but its ability to make sense of a phenomenon as a computational ability that is put to use in different ways in different languages.
Appendix C is a critique of Raimy (2000). What I have called Distributed Reduplication is based on ideas of McCarthy, Steriade, and Odden and Odden. Although DR shares very little with Raimy’s approach to reduplication, his 1999 dissertation, was the direct inspiration for the development of DR. He demonstrated that the key to understanding Identity Effects in reduplication is to be found in understanding the special structures involved in reduplication. DR follows his lead in this, but comes to different conclusions about the special structure involved. Raimy proposed a nonlinear timing tier. DR rejects that in favor of McCarthy’s idea of long-distance geminates. Appendix C is devoted to detailing the weaknesses in Raimy’s approach, indirectly justifying the approach taken by DR.
A convenient term to refer to the representations with long-distance geminates produced by Transcription is useful, since I will frequently need to refer to such structures. They will be called crossed structures.

Transcription is relatively straightforward, but something needs to be said about directionality. Transcription can be to the right or the left.

The newly created timing slots in (7) are shaded.

If the initial representation had only timing slots and phonemic associations, as above, there would be no distinction between the resulting structures. They are both:
But the structures in (7) are impoverished, not showing morphological and prosodic structure. If less impoverished structure is considered, the distinction between left and right transcription then is clear. Consider:

Right Transcription in (8a) is highly disruptive, requiring syllable reorganization, but Left Transcription is not. More for conceptual reasons and the sake of concreteness than because there is strong evidence one way or the other, I will assume that the unmarked choice is the one which is least disruptive to the structure of the stem. This choice is fixed for the affix, so that if one direction of transcription produces a simpler outcome in most cases, that choice is assigned to the affix. If the duplicant is aligned with one edge of the stem and not the other, the direction of transcription is toward that edge, at least as the unmarked choice. The notion “disruptive”, of course, is not clearly defined, so this should be taken as a preliminary statement. There can be conflicts between disrupting morpheme structure and disrupting prosodic structure. Further discussion will be postponed until the issue presents itself concretely.

2.1 The No Crossing Constraint (NCC)

Some readers may be reluctant to consider representations like (9) seriously because they massively violate the NCC, the ban on crossed association lines.
If the role of the NCC in phonology is considered carefully, however, good grounds can be found for at least entertaining the possibility that structures like (9) are present at some underlying level.

Constraints play various roles in derivational phonology. Derivational constraints restrict the output of rules. Rule application that would result in a violation of the constraint is blocked. Halle and Idsardi’s (1995) analysis of footing and stress is a good example of the extensive use of derivational constraints to control the application of a simple rule system. Constraints on the distribution of foot delimiters interact in that theory with general rules inserting foot delimiters to account for the stress facts of a large variety of languages. Most researchers, however, have not considered the NCC to be a derivational constraint.

Goldsmith (1990), in summing up the rule formalism relevant to tonal phonology, says:

> If a rule is formulated to add a single association line, it can, in principle, cause a line-crossing situation. In this case, ... the line that the rule adds remains, but the line that formerly existed is taken to be the offending line, and is automatically erased.

On this view, the NCC does not block rule application. Rules can apply even though their output violates it. A subsequent repair operation brings the structure into compliance with the NCC. For Goldsmith, repair is immediate (i.e. automatic), so that the structure with crossing violations is highly transitory. Nevertheless, it is clear that Goldsmith does not consider the NCC to be a derivational constraint.

Closer to the concerns of this paper is the position taken by McCarthy in his groundbreaking work on nonconcatenative Semitic morphology. Example (10) below illustrates the kind of morphology which McCarthy proposed for Semitic root-template association. It is (42) from McCarthy (1986).

\[
(10) \quad /sb/_{\text{root}} + \mu \Rightarrow \begin{array}{c}
\text{root} \\
\text{affix}
\end{array}
\begin{array}{c}
\times & \times & \times & \times & \times \\
\text{s} & \text{i} & \text{b} & \text{e}
\end{array}
\]

\[
\Rightarrow \begin{array}{c}
\text{root} \\
\text{affix}
\end{array}
\begin{array}{c}
\times & \times & \times & \times & \times \\
\text{s} & \text{i} & \text{b} & \text{e}
\end{array}
\]
The affix $\mu$ specifies a template and vocalism. The combination of root and affix is partitioned into two units: the timing slots derived directly from the root consonants and the timing slots derived from the template vocalism. The CVCCVC template requires four consonants. The two consonants of the root are associated with the first two consonant positions, left-to-right, and the last two are filled by multiple association of the rightmost root consonant.

McCarthy implemented the idea by supposing that the stem and affix segments are placed on distinct autosegmental tiers. This provided a means to avoid the NCC violation in (10). The idea is that the derivation proceeds as (11), with the root and affix segments initially on distinct tiers, as shown in (11.1). The phonemes above and below the line should be viewed as being on different tiers. An operation called Tier Conflation applies, eliminating split phoneme tiers, but creating NCC violations. Violations of the NCC are then removed by the operation fission, which copies phonemes and their associations with the timing tier, to eliminate the crossing constraints.

\[
\begin{align*}
(11) & \quad 1. \text{ Morphology: } /sb/_{\text{root}} + \text{ template } \rightarrow \times & \times & \times & \times & \times \\
& \quad \text{ s } & \text{ b} \\
& \quad 2. \text{ Tier Conflation: } \rightarrow \times & \times & \times & \times & \times \\
& \quad \text{ s } & \text{ i } & \text{ b } & \text{ e} \\
& \quad 3. \text{ Fission: } \rightarrow \times & \times & \times & \times & \times \\
& \quad \text{ s } & \text{ i } & \text{ b } & \text{ e } & \text{ b}
\end{align*}
\]

McCarthy did not propose an explanation for why Tier Conflation applies in (11.2). It was necessary to assume that it did in order to explain the fact that at late stages in the morphophonology, nonadjacent consonants do not act as if they are connected. McCarthy implies that fission applies more or less immediately to remove the NCC violations caused by Tier Conflation, taking a position similar to Goldsmith’s. But he does not formally distinguish between output conditions which demand repair of violations at some point before the output interface
and conditions which demand immediate repair. The picture he paints is that some phonology takes place while the root and affix tiers are split, then Tier Conflation takes place at some point for some reason, with repair following immediately in order to bring the representation into compliance with the NCC.

It is equivalent, and much more straightforward, to assume that there are no split tiers, and that NCC violations may persist in the phonology, repaired eventually but not necessarily immediately. It seems to me that the more straightforward approach was not taken because the importance of the NCC in restricting tone and feature spreading in some environments made it appear to be a strict constraint on derivation. The closest that McCarthy was willing to come to admitting NCC violations into phonology was to stipulate that the NCC could be temporarily violated, but violations had to be immediately repaired. Like Goldsmith, McCarthy does not consider the question of immediate repair versus eventual repair. Certainly, no evidence was presented that repair must be immediate.

Sagey (1988) argues that the NCC is an output condition on phonology. Whereas Goldsmith and McCarthy assume that NCC repair is immediate, undertaken as soon as NCC violations are created, Sagey does not. DR follows Sagey on this point. NCC violations are repaired at some point in the derivation, but not necessarily immediately after they are created. This has the important consequence that representations like the initial representation in (5) can persist long enough for phonological processes to take place while the structure has crossed association lines before the NCC violations are repaired by fission. This is crucial in accounting for apparently anomalous nasalization in reduplicated forms in Malay and other similar examples which will be examined later.

In this paper, I assume that the NCC is an interface condition, satisfied at the phonology-phonetics interface. The relevant point is that the NCC violations in (11) are not necessarily repaired immediately, so that phonological rules may apply to (11) before repair. As an interface condition, the NCC is not a constraint on rule application, but a constraint on possible grammars. I assume that derivational phonology does not employ lookahead. Derivational steps cannot be directly influenced by interface conditions, except insofar as those requirements are incorporated into the design of the grammar. Grammars that produce
outputs which generate structures at the interface which violate the NCC are rejected, not rule applications which produce outputs which violate the NCC.

Marantz (1982) briefly entertains a proposal (close to our own) which admits NCC violations, but quickly rejects it as implausible. He briefly considers the structure (12), but rejects it almost out of hand.

(12) $\begin{array}{cccccc}
C & V & C & C & V & C \\
\downarrow & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\
t & a & k & k & i
\end{array}$

The structure (12) is just a pre-$\times$-slot version of the structure which has been proposed here. In rejecting (12), Marantz says that “association lines would cross in violation of the basic condition on autosegmental phonology [association lines never cross]…” He adds in a footnote (fn. 8) the argument that even if crossed associations were allowed, then special stipulations would be needed to ensure that phenomena like mirror-image reduplication were not permitted.

I already argued above that “the basic condition on autosegmental phonology” is not a derivational constraint. The second concern carries no weight. Derivational morphophonology does not operate by free generation and filtering. Transcription is not free association filtered by a system of well-formedness conditions on possible associations, but a core algorithm of the language faculty. The same mechanism that ensures that dog doesn’t come out of the lexicon as god ensures that total reduplication of dog produces dog-dog, not god-dog. It is hard to escape the conclusion that the essential obstacle to adopting (12) was the presumed inviolability of the constraint against crossed associations.

2.2 Rule application in structures with long-distance geminates

Crossed structures can persist long enough for phonological processes apply to them before NCC repair, but processes applying in crossed structures are constrained in two important ways by the special characteristics of these structures. First, geminate inalterability can prevent rule application that would otherwise be expected. Second, constraints on feature spreading are particularly restrictive because multiple linking gives multiple opportunities for intervention effects.
2.2.1 Geminate inalterability
The effects of geminate inalterability in Biblical Hebrew (BH) are well-known and provide a good illustration of the issue. See Kenstowicz (1994:410) for a particularly clear discussion. There is a spirantization process in BH which applies to postvocalic stops, but is blocked on geminate stops. For example, *yiktob → yixtov*, with both postvocalic stops spirantizing, but the postvocalic geminate in *sappir* is unaffected by spirantization (*saффir*).

(13) a. \[\begin{array}{c}
\text{y} \quad \text{i} \quad \text{k} \quad \text{t} \quad \text{o} \quad \text{b} \\
\downarrow
\end{array}\]  

b. \[\begin{array}{c}
\text{s} \quad \text{a} \quad \text{p} \quad \text{i} \quad \text{r} \\
\downarrow \\
\ast \downarrow \\
\text{x} \quad \text{v} \quad \text{f}
\end{array}\]

In (13), the timing slots involved in spirantization are circled (with a dotted perimeter). An arrow points from the the timing slot whose vocalic association conditions application of spirantization to the timing slot whose associated phoneme is the target of spirantization. Obviously, this notation is not part of the phonological representation. It is used only in this chapter and is intended to guide the reader through the complexities of rule application in crossed structures.

Based on the work of Hayes (1986) and Schein and Steriade (1986), Kenstowicz concludes that the crucial factor is that only one of the timing slots associated with *p* in (13b) is in the proper environment for spirantization (i.e. postvocalic). Kenstowicz says:

\[\text{...two outcomes are possible a priori. We might expect the rule to “overapply” even though just one of the legs of the geminate satisfies it. Alternatively, the rule might be suspended even though one portion of the multiply linked representation does satisfy it.}\]

Kenstowicz does not use the term in this context, but we can say that the rule “underapplies” if the rule does not apply even though one leg of the geminate does satisfy the condition for rule application.

It is useful to call a timing slot and an associated phoneme an occurrence of the phoneme. The structural condition of a rule refers to occurrences of phonemes, not directly to phonemes. This is what gives
rise to an ambiguity and requires additional specification in order to determine how the rule applies to phonemes which are linked to multiple timing slots. Some phoneme altering rules require that all occurrences of the phoneme satisfy the structural condition of the rule, others require only that at least one occurrence of the phoneme satisfies the structural condition. If there is an occurrence of a phoneme which satisfies the condition for the application of some rule which has another occurrence which does not, then the rule will either overapply or underapply. Rules which underapply in this situation are said to be subject to *geminate inalterability*.

Based on the facts above, spirantization in Biblical Hebrew requires all the timing slots associated with the potential spirantizing stop to be postvocalic (i.e. to follow a timing slot associated with a vowel). That is, spirantization in BH is subject to *geminate inalterability*. Kenstowicz points out that the way that spirantization applies to geminates in BH is typical: “Many languages spirantize postvocalic or intervocalic stops. In virtually every case, a geminate consonant resists spirantization.” In Southern Paiute spirantization applies after reduplication, producing *pi∫wa* → *pivi∫wa*. There is nothing surprising here. First, *pi∫wa* → *pipi∫wa*. Then after fission, spirantization applies.

(14) \[ \times \times \times \times \times \times \rightarrow \times \times \times \times \times \times \rightarrow \times \times \times \times \times \times \times \times \times \times \]
\[ p \ i \ η \ w \ a \quad p \ i \ η \ w \ a \quad p \ i \ p \ i \ η \ w \ a \]

Spirantization cannot apply before fission, because it is subject to geminate inalterability. It cannot apply in:

(15) \[ \times \times \times \times \times \times \]
\[ p \ i \ η \ w \ a \]

One of the occurrences of *p* is postvocalic, but one is not. If the spirantization rule were ordered so that it applied in (15), it would underapply. It would fail to spirantize *p* even though one of its occurrences satisfies the condition for spirantization.
Kiparsky (2003) calls attention to the Southern Paiute example and the fact that there are no languages in which spirantization overapplies in similar examples. In the analysis developed here, this is no surprise. It simply reflects Kenstowicz’s observation that spirantization is quite generally subject to geminate inalterability. Kiparsky points out that this result is not consistent with Correspondence Theory, which has no mechanism other than stipulation to keep spirantization from overapplying to the reduplicant. Note that in DR, the following are structurally identical in relevant respects:

(16) a. $\times \circ \times \times \times \times$  
    b. $\times \circ \times \times \times \times \times$  

    s a p i r  
    p i n w a  
    f v  

It is worth noting that if rule ordering in Southern Paiute were different and strict cyclicity were observed, there would be no spirantization in pipiNwa. This would be the result if NCC repair were cyclic (as I believe that it always is) and spirantization applied cyclically after transcription but before NCC repair and did not apply post-cyclically. Geminate inalterability would block spirantization in the crossed structure and, because of rule ordering and strict cyclicity, spirantization would have no opportunity to apply in the structure after NCC repair.

If progressive nasalization in Malay were subject to geminate inalterability, then nasalization of the initial $a$ would not occur in (17) because only one of the occurrences of the initial $a$ is in a nasalizing environment.

(17) $\times \times \times \circ \times \times \times$  

However, because Malay progressive nasalization is not subject to geminate inalterability, $a$ nasalizes in (17) because one of its occurrences is in a nasalizing environment, even though another of its occurrences is not.
2.2.2 Constraints on feature sharing

If the NCC is conceived of as a constraint which tolerates temporary violation provided that repair follows (either immediately or eventually), it cannot block undesirable feature spreading. A feature could simply spread over any arbitrary intervening feature and, if a violation of the NCC results, the resulting structure could be repaired by feature fission. Nevertheless, something like the NCC does appear to be at work in constraining feature spreading, at least in cases where the intervening feature has certain special properties. Since a precise understanding of at least certain aspects of the constraints on feature spreading will be necessary in order to understand how these constraints operate in the multiply linked structures created by reduplication, we consider them here.

In cases in which features of a certain kind block certain varieties of feature spreading, the NCC is often held to be responsible. Halle (1995), based on work of Calabrese (1995), takes a nuanced position with respect to the application of the NCC in constraining feature spreading. In the case of a contrastive intervening feature, the NCC is taken to be a derivational constraint, blocking rule application. In the case of a noncontrastive intervening feature, the NCC can be freely violated, but violations are repaired. In effect, Halle takes the NCC to be a derivational constraint with respect to contrastive features and an interface condition with respect to noncontrastive features. He is not explicit about the timing of NCC repair (eventual or immediate), since it is not relevant to his concerns.

Typically, spreading rules are stated in two parts. The first part specifies the source, directionality, and target. This is given by statements like “spread [+back] to the left from vowels to consonants.” The second part gives the locality conditions on the spreading. One way of doing this is to specify the phonemes which are opaque to the spreading. I will assume that the locality conditions on spreading are given by constraints of the form:
transcription and rule application in crossed structures

(18) \[ * \times \ldots \times \ldots \times \] if \( \alpha \) is opaque to F spreading.

\[ \alpha \]

\[ [F] \]

i.e. Sharing F over \( \alpha \) is blocked (derivationally) if \( \alpha \) is opaque to F-spread.

The symbols \( \circ \) represent root nodes. Timing slots are not associated directly with features, but indirectly via root nodes. There is controversy about whether root nodes themselves are linked directly to segmental features or whether there are various intervening nodes. This depends on assumptions about feature geometry which are not directly relevant to the considerations here. I take the association to be direct, for reasons of simplicity of exposition. Nothing here will depend upon this assumption. If a timing slot is associated with a root node which is associated with a feature F, then I will say that the timing slot has the feature F.

This gives a general framework for considering feature spreading rules. Halle’s specific proposal was that a phoneme \( \alpha \) is opaque to F-spread if it has a contrastive feature on the same tier as F. In the case of a noncontrastive feature on the same tier as F, spreading is allowed, but the resulting structure is later repaired.

It is convenient to have a verbal statement of (18).

(19) Feature sharing between timing slots is blocked if an intervening timing slot is associated with a root node which is opaque to F-sharing.

It is implicit in (19) that the intervening timing slot is not also linked to the shared feature. There is no intention to prevent a feature from being shared by a string of consecutive timing slots.

Principle (19) is obviously related to the NCC, particularly if the opacity is caused by the presence of features on the same tier as the shared feature. But the relation between (19) and the NCC is indirect. The NCC is an interface condition, a constraint on grammars, while Principle (19) is a constraint on rules. Grammars can adopt various strategies for ensuring that they produce output representations which
satisfy interface conditions. One option is to repair defective representations by operations like Fission. Another is to ensure that rules do not produce defective outputs by imposing derivational constraints like (19). In this, Principle (19) is more like Fission than it is like the NCC itself. It is one (of many) strategies that can be adopted for ensuring that the NCC is satisfied at the interface. We will see later that although Fission is the most common way that the NCC violations that Transcription produces are repaired, there are other strategies in certain cases.

Now that a precise formulation of the form that constraints on feature spreading take has been proposed, the analysis of Malay nasalization in reduplicated forms can be considered more carefully. I will assume that progressive nasalization spreads [+Nas] to the right, targeting vowels and nasal consonants. Spreading a [+Nas] to consonants which are already [+Nas] has the consequence that a form like anêm will have a single [+Nas] feature, shared between the final three root nodes, as shown below:

(20)

Locality is not an issue in spreading [+Nas] in (21) below because all timing slots come to share a single [+Nas] feature.

(21)
There are somewhat more complex reduplicated forms with unexpected nasalization which do raise the issue of locality. Onn (1976) gives the four examples in (22).

\[(22)\]  

<table>
<thead>
<tr>
<th>root surface</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. hama hamoglob ‘germ’ hāmoglob ‘germs’</td>
</tr>
<tr>
<td>b. waŋi waŋi ‘fragrant’ wāŋi wāŋi ‘fragrant (intensi’)</td>
</tr>
<tr>
<td>c. aşan aşan ‘reverie’ aşan aşan ‘ambition’</td>
</tr>
<tr>
<td>d. aşin aşin ‘wind’ aşin aşin ‘unconfirmed news’</td>
</tr>
</tbody>
</table>

The analysis of (23d) is the same in relevant details as the analysis of (23c), which was given above. The analysis of (22a) and (22b) depends upon the particularities of the locality of progressive nasalization in Malay. According to Onn (1976:69), glides (w, y, h, and ?) are transparent to nasal spread, but other consonants are not. He gives derivations like mewah → mēwāh and mayaŋ → māyāŋ to illustrate the transparency of glides to progressive nasalization. There are no underlying nasal vowels in Malay.

The analysis of waŋi → wāŋi wāŋi is given below:

\[(23)\]  

\[
\text{Six timing slots come to share a single [+Nas] feature. The six timing slots are not consecutive. The span is broken up by a timing slot associated with } w. \text{ But since glides are transparent to nasal spreading, there is no locality violation.}
\]

Notably, in all of the examples provided by Onn in which there is unexpected vowel nasalization in the reduplicated form, there is a single nasal span broken up at most by intervening glides. The theory outlined here predicts this. Unfortunately, Onn did not provide examples to show that nasalization does not occur if a nonglide nonnasal consonant intervenes between the source of nasalization and the unexpectedly
nasalized vowel. Kiparsky (2003) has tested such examples with a number of native speakers of the dialect that Onn describes and finds no nasalization.

An analysis of one of Kiparsky’s examples is given in (24). It shows why \textit{harum} → \textit{harum-hərum} (*hərum-hərum).

(24)

\begin{center}
\begin{tikzpicture}
\node (a) at (0,0) {\{h\}}; \node (b) at (1,0) {\{a\} \rightarrow \{\ddot{a}\}}; \node (c) at (2,0) {\{r\}}; \node (d) at (3,0) {\{u\}}; \node (e) at (4,0) {\{m\}}; \node (f) at (-2,0) {\{\text{-Nas}\}}; \node (g) at (-1,0) {\{\text{-Nas}\}}; \node (h) at (0,0) {\{\text{-Nas}\}}; \node (i) at (1,0) {\{\text{-Nas}\}}; \node (j) at (2,0) {\{\text{+Nas}\}};
\end{tikzpicture}
\end{center}

This operation is disallowed by the locality condition on spreading since the consonant \textit{r} intervenes in the disconnected span of 4 timing slots which share a single nasal feature.

It should be noted that blocking nasal spreading in the complex structure created by Transcription raises the possibility of underapplication of nasalization. Why isn’t the result \textit{harum} → \textit{harum-harum}, with neither \textit{a} nasalized at the surface? If nasalization did not apply again after Transcription, this would be the result. Presumably, the observed nasalization in \textit{harum} → \textit{harum-hərum} occurs after NCC repair.

Inkelas and Zoll (2004) point out that regressive velar assimilation at the reduplicant-stem boundary is common, but it never overapplies. For example, reduplication of the form \textit{kan} → \textit{kajkan} is common, but \textit{kan} → \textit{kajkay}, with overapplication of place spreading, is unattested. This is expected under the analysis developed here, since \textit{kan} → \textit{kajkay} would require impossible place spreading in the unrepaid output of Transcription. The medial vowel blocks the required place assimilation.

(25)

\begin{center}
\begin{tikzpicture}
\node (a) at (0,0) {\{k\}}; \node (b) at (1,0) {\{a\}}; \node (c) at (2,0) {\text{n} \rightarrow \text{ŋ}}; \node (d) at (3,0) {\{\text{Velar}\}}; \node (e) at (4,0) {\{\text{Coronal}\}};
\end{tikzpicture}
\end{center}
In (25), 4 timing slots come to share a velar place feature. But two instances of a intervene. Place sharing across a is not possible. Otherwise, we would expect nak → ĭak. Place assimilation as shown in (25) is therefore impossible.

Inkelas and Zoll’s intention is to completely discredit the idea of overapplication in reduplication, since the theory of reduplication which they propose has no explanation for it. We have seen, however, that overapplication in the theory proposed here is highly restricted. A number of conditions must be met: 1) NCC repair must be delayed long enough for phonological processes to take place in the complex structure produced by Transcription; 2) whatever phonological processes do apply to the unrepaired output of Transcription must not be subject to geminate inalterability; and 3) because of the peculiar structure of the unrepaired output of Transcription, feature spreading operations can apply in only fairly unique situations. It should be no surprise that examples of overapplication are rare. Several additional examples are given in Chapter 7. All of them involve feature changing operations, not spreading rules. Malay nasalization is the only example I know of in which a spreading rule overapplies.

2.2.3 Korean consecutive reduplication
Chung (1999) discusses various kinds of reduplication in Korean. One particularly interesting variety (p. 170), which he calls “consecutive reduplication”, provides another good example of the kind of rule overapplication which we have already seen in Malay. It is restricted to the strata of Sino-Korean words, but there are many examples. Both monosyllabic and bisyllabic roots reduplicate with intensive semantics. Reduplication of monosyllabic roots is unremarkable. The reduplication of bisyllabic roots is much more interesting:

\[(26) \quad \text{root} \quad \text{reduplicated}\]
\[
\begin{align*}
\text{a. kikwe} & \quad \text{ki-ki-kwe-kwe} & \quad \text{‘very strange’} \\
\text{b. kimyo} & \quad \text{ki-ki-myo-myo} & \quad \text{‘marvelous’} \\
\text{c. hyånsak} & \quad \text{hyån-hyån-sak-s’ak} & \quad \text{‘all forms and colors’} \\
\text{d. cason} & \quad \text{ca-ca-son-son} & \quad \text{‘generation after generation’} \\
\text{e. sipi} & \quad \text{si-si-pi-pi} & \quad \text{‘judgment’} \\
\text{f. sikak} & \quad \text{si-si-kak-k’ak} & \quad \text{‘hourly’} \\
\text{g. kuçol} & \quad \text{ku-ku-cøl-cøl} & \quad \text{‘every phrase and sentence’}
\end{align*}
\]
Each of the two syllables reduplicates independently. Since the initial syllable is reduplicated (see (26c) in particular), this looks like a counterexample to Moravcik’s claim that there is no initial syllable reduplication. Unlike initial syllable reduplication, there are several attested cases of final syllable reduplication. In Chapter 6, it will be shown how this asymmetry follows from the assumptions of DR. What appears to be initial syllable reduplication in (26) is reduplication of the remnant of final syllable reduplication. In Chapter 6, the relevant juncture insertion rules will be discussed in detail and derivation leading up to the multiply linked structure produced by Transcription, the lefthand side of (29) below, will be justified. Here I will concentrate on the way that phonological rules apply in the multiply linked structures produced by transcription. The only phonology at work in the examples in (26) is consonant tensing, which applies to a syllable initial consonant which is preceded by an obstruent, as seen in (26c,f).

The phonological changes in the examples in (27) are much more interesting. The changes have been boldfaced.

(27) a. hi.lak hi-hi-naŋ-nak ‘rejoicing’
    b. yu.lak yu-yu-naŋ-nak ‘quite willingly’
    c. u.lyaŋ u-u-nyaŋ-nyaŋ ‘very lonely’
    d. lwe.lak nwe-rwe-naŋ-nak ‘broad-minded’

Four different phonological rules are involved in producing the boldfaced changes in (27).

(28) a. Onset $l \rightarrow n$ following a noncoronal consonant coda.
    b. Word initially, $l$ deletes / ___ high vowel, else $l \rightarrow n$.
    c. Onset $l \rightarrow r$ following an open syllable.
    d. $k \rightarrow \eta$ / ___ nasal (regressive nasal assimilation).

First, consider (27a). A naive copy theory of reduplication would incorrectly predict:

hilak $\rightarrow$ hi-hi-lak-lak $\rightarrow$ hi-hi-ŋ-naŋ-nak

This assumes that regressive nasalization can apply after onset $l \rightarrow n$. For naive copy theory, the onset $n$ in the first conjunct of the reduplicated second syllable is a mystery. The context for $l \rightarrow n$ is present only
in the second conjunct. This is a classic Wilbur Effect. From the point of view of naive copy theory, there is no motivation for $l \rightarrow n$ in the first conjunct. It is worth noting, by the way, that simply imposing a reduplicant-base identity condition is not sufficient, because it would incorrectly predict $hi-hi-na\text{\textae}t-na\text{\textae}$, with overapplication of nasal assimilation.

The DR account parallels the account of the overapplication of nasalization in Malay. Suppose that $l \rightarrow n$ applies to the output of Transcription, before crossing violations have been removed, as shown below:

\begin{equation}
\begin{array}{c}
\begin{array}{c}
\sigma \times \times \times \times \\
\h i l a k
\end{array}
\end{array}
\end{equation}

\begin{equation}
\begin{array}{c}
\begin{array}{c}
\sigma \times \times \times \times \\
\sigma \sigma \sigma \\
\h i n a k
\end{array}
\end{array}
\end{equation}

Note that the operation in (29) is not spreading, so the locality of spreading is not an issue. I assume that 1) NCC repair is cyclic; 2) onset $l \rightarrow n$ following a noncoronal coda consonant is cyclic, not subject to geminate inalterability, and ordered before NCC repair; and 3) word initial $l \rightarrow r$, onset $l \rightarrow r$ following a vowel, and regressive nasalization are all postcyclic. The derivation (29) then continues with cyclic NCC repair and postcyclic regressive assimilation, producing $hi-hi-na\text{\textae}t-na\text{\textae}$.

These considerations are sufficient to account for (27a,b,c). For (27d), we need to explain why the output is $nwe-\text{\textae}ke-\text{\textae}y-na\text{\textae}$ and not either $nwe-nwe-na\text{\textae}t-na\text{\textae}$ or $rwe-\text{\textae}ke-\text{\textae}y-na\text{\textae}$. The derivation begins like (27):
Neither word initial \(l \rightarrow n\) nor post-vocalic \(l \rightarrow r\) applies in the crossed structure in (30) because both rules are postcyclic, hence follow cyclic NCC repair. The output of cyclic NCC repair is therefore:

\[
(31)
\]

Post-cyclically, word initial \(l \rightarrow n\), post-vocalic \(l \rightarrow r\), and regressive nasalization all apply, producing \texttt{nwe-rwe-nay-nak}, with no overapplication of any of these three rules.

### 2.3 The Retraction Condition

Appendix 1 is devoted to a detailed discussion of the substance of the NCC. It would be a diversion to undertake that discussion here. The appendix is provided for interested readers. The formulation of the NCC which the discussion leads to is given in (32), which is an interface condition. A segment is taken to mean an element on a phonemic (as opposed to prosodic) tier.

\[
(32) \text{ Retraction Condition (RC): The set of timing slots which are} \\
\text{associated with a segment is connected.}
\]

In the remainder of this book, I will assume that the RC is an output condition on the phonology.

The RC is based on the proposal that autosegmental representation is the privilege of phonology, not available either in the lexicon or phonetics. Without autosegmental linking, relationships between tiers can only be expressed directly by temporal simultaneity. The RC
guarantees that the output of phonology can be transparently translated into a phonetic representation. These representations are not autosegmental, but composed of a parallel *tracks* implicitly related by temporal simultaneity rather than explicitly linked by autosegmental associations.

The RC is both weaker and stronger than the proposal that “association lines do not cross.” The representation (33a), with the medial timing slot unlinked, violates the RC but does not have crossed association lines. The representation (33b), on the other hand, has crossed association lines, but does not violate the RC.

(33) a. \[
\begin{array}{c}
\times \\
\alpha
\end{array}
\]  
\[\begin{array}{c}
\times \\
\beta
\end{array}\]
\[\begin{array}{c}
\times \\
\alpha
\end{array}\]
\[\begin{array}{c}
\times \\
\alpha \\
\beta
\end{array}\]

In fact, I assume that the phoneme tiers have no intrinsic order, so that if \(\alpha\) and \(\beta\) are phoneme segments the representations (33b) and (33c) are identical. This has various consequences, which seem to me to be correct: there are no floating segments, and there are no junctures on phoneme tiers. Segments must be associated with the timing tier, and only segments appear on phoneme tiers.

Since the phoneme tier is unordered, RC repair (which I will call NCC Repair or NCCR to maintain the familiar terminology) is straightforward phoneme fission:

(34) \[
\begin{array}{c}
\times \\
\times \\
\times \\
\times \\
\times \\
\times \\
\times \\
\times
\end{array}
\]  \[
\begin{array}{c}
\tilde{a}
\end{array}
\]  \[
\begin{array}{c}
\tilde{n}
\end{array}
\]  \[
\begin{array}{c}
\tilde{e}
\end{array}
\]  \[
\begin{array}{c}
\tilde{m}
\end{array}
\]  \[
\begin{array}{c}
\tilde{a}
\end{array}
\]  \[
\begin{array}{c}
\tilde{a}
\end{array}
\]  \[
\begin{array}{c}
\tilde{n}
\end{array}
\]  \[
\begin{array}{c}
\tilde{e}
\end{array}
\]  \[
\begin{array}{c}
\tilde{e}
\end{array}
\]  \[
\begin{array}{c}
\tilde{m}
\end{array}
\]  \[
\begin{array}{c}
\tilde{m}
\end{array}
\]

If the phoneme tiers were ordered, not only fission operations but multiple metathesis operations would be necessary to carry out RC repair. Since the phoneme tiers are unordered, the righthand side of (34) is equivalent to:

(35) \[
\begin{array}{c}
\times \\
\times \\
\times \\
\times \\
\times \\
\times \\
\times
\end{array}
\]  \[
\begin{array}{c}
\tilde{a}
\end{array}
\]  \[
\begin{array}{c}
\tilde{n}
\end{array}
\]  \[
\begin{array}{c}
\tilde{e}
\end{array}
\]  \[
\begin{array}{c}
\tilde{m}
\end{array}
\]  \[
\begin{array}{c}
\tilde{a}
\end{array}
\]  \[
\begin{array}{c}
\tilde{n}
\end{array}
\]  \[
\begin{array}{c}
\tilde{e}
\end{array}
\]  \[
\begin{array}{c}
\tilde{m}
\end{array}
\]  \[
\begin{array}{c}
\tilde{m}
\end{array}
\]
Reduplication is one of the ways in which the presence of a morpheme in the structure of a word is made manifest. The aim of this section is to sketch the theory of morphology that I assume in sufficient detail so that it is clear how reduplication fits into the general theory of word formation. The major tenants of Distributed Morphology (Halle and Marantz, 1993) are assumed: late lexical insertion and the proposition that complex word formation, at its core, is lexical insertion into the terminal nodes of a hierarchically organized structure produced by the syntax.

A morpheme is a bundle of morphological features, without phonological content. Morphophonology converts hierarchical structures whose terminal nodes are morphemes (which I will call m-structures) into morphophonological representations at the interface with postlexical phonology. The conversion is derivational, beginning with the initial m-structure which lexical insertion has not yet provided with phonological content. For the sake of simplicity, I will assume here that one of the sisters of every node in an m-structure is a terminal node and that the computation can determine the root node in some way. The conversion is carried out recursively, starting at the root morpheme and working up the tree.

Vocabulary choice at each terminal node determines a lexical item which is inserted into the structure at that node. I ignore here the question of how the choice is made. (See Halle and Marantz for the
theory.) A phonological string, perhaps null, is inserted at each step and phonological rules (usually called “the cycle”) apply before the computation moves up to the next higher node. After all of the nodes have been given phonological content in this way, further phonological rules (the “postcyclic rules”) apply and the derivation terminates.

A simple example will clarify the core process. Suppose that the initial m-structure is \((\alpha \beta \gamma)\), where the root is \(\alpha\). M-structures are hierarchically structured, but not linearly ordered. Linear order, to the extent that it is relevant to m-structures, is induced by the order of the phonological material which they are associated with. The initial m-structure could just as well have been written \((\gamma (\beta \alpha))\) or either of two other possibilities. Suppose, for example, that \(\alpha\) is realized by a root with exponent \(\nu\), \(\beta\) is realized by a prefix with exponent \(\rho\), and \(\gamma\) is realized by a suffix with exponent \(-d\). Assuming for simplicity that no phonological rules apply, the derivation that results is:

The derivation (36) consists of a sequence of lexical insertion operations. The point of this elementary example is to illustrate the recursive addition of the exponents of lexical items to the structure and the way in which the morphemes progressively acquire an induced linear order based on the types of lexical items which are used to realize them.

A lexical item can have a null exponent. Such a lexical item will be called a null lexical item. If \(\beta\) in (36) is realized by a null lexical item,
the derivation would be (37), still assuming that no phonological rules apply, only lexical insertion.

(37) \[ \alpha \beta \gamma \rightarrow \alpha \beta \gamma \rightarrow \alpha \beta_0 \gamma \]

In (37), \( \beta \) is marked as having been realized by a null morpheme by tagging it with \( \emptyset \). Something equivalent to this must be available to the morphology so that the fact that insertion has already applied to \( \beta \) is recorded. Obviously, if \( \beta \) is associated with nonnull phonology, no such marking is needed.

Note that the morpheme \( \beta \) does not acquire a linear order with respect to \( \alpha \) in (37). The final representation could just as well have been written:

(38) \[ \beta_0 \alpha \gamma \]

In (37), the morpheme which is realized by a null lexical item has no effect on the derivation. Often, however, null lexical items do affect the derivation. The insertion of a lexical item into the structure can trigger the application of morphophonological rules, even if the exponent of the lexical item is null. Furthermore, rules can be sensitive to the presence of morpheme structure, independently of how this structure is realized, so that the presence of a morpheme can affect the derivation independently of the phonological material which it is associated with.
There are two blocks of morphophonological rules: the *cyclic rule block* and the *postcyclic rule block*. By “rule block” I simply mean a rule structure of some kind which generates an ordered list of rules. In addition to the rules of the cyclic rule block, there can be rule blocks associated with lexical items (often consisting of a single rule) which are triggered by the insertion of the lexical item. After each lexical insertion operation, the rule block associated with that lexical item applies (if there is one) and then the cyclic block of phonological rules applies (unless the lexical item is specifically marked as “non-cyclic”).\(^1\) Halle (1990) calls the rules triggered by lexical insertion *readjustment rules*. See Halle and Marantz (1993) for discussion.

English past tense morphology provides good examples of readjustment rules. First, consider the derivation of *sold*, the past tense of *sell*. In (39) and various other places in this chapter, the initial lexical insertion step in which the root is realized is omitted for reasons of space.

\[(\text{SELL}) \text{ PAST} \rightarrow (\text{SELL}) \text{ PAST} \rightarrow (\text{SELL}) \text{ PAST}\]

The last operation is the result of a readjustment rule which backs the root vowel of a class of verb roots. *(SELL)* above should be understood as an abstract symbol representing a morpheme, which is a bundle of morphological features. Morphemes are without phonological content. This will be clearer after allomorphy is considered below.

Realization of *PAST* in (39) has two aspects, the insertion of an exponent and the application of the readjustment rule which this insertion triggers. Morpheme realization in this case has both a concatenative aspect (concatenation of the suffix -d) and a nonconcatenative aspect (application of the vowel ablaut rule). In the next example, the derivation *sang*, the past tense of *sing*, morpheme realization is entirely nonconcatenative.
The default past tense suffix is chosen for insertion in PAST in (39), and the null past tense suffix is chosen for insertion in (38). Here, and in what follows, I will use the idiom “inserts a null suffix” to mean that no suffix is inserted, but that the computation records the fact that lexical insertion for that morpheme has already been accomplished and the computation is at the next step, carrying out whatever lexically triggered rules are associated with the null lexical item that was chosen for insertion.

The existence of lexically triggered rules does not exhaust the possibilities of interaction between the morphological structure of a word and phonology. Cyclic, postcyclic, and lexically triggered rules themselves can all be *morphologically conditioned*. That is, morpheme structure can figure in the structural conditions of applicability of the rule.

The two instances of vowel ablaut readjustment in (38) and (39) should be contrasted with allomorphy, in which two different lexical items are used to realize the same morpheme, depending upon the context that the morpheme finds itself in. [[GO]], for example, is realized by the root *wend* in the context of Past, otherwise by the root *go*. In (38) and (39), there is a single lexical item whose exponent undergoes a minor rule governed modification in certain contexts, but in (41), the lexical item which is chosen for insertion in [[GO]] depends on the presence or absence of a PAST morpheme.
There is some room for debate, but *wend* is treated here as an irregular verb of the *send*-class (*send*/*sent*, *bend*/*bent*, *lend*/*lent*, *wend*/*went*).

The *say*/*say* alternation and *go*/*wend* alternations are often lumped together under the heading “allophonic variation.” This leads to confusion, since the source and character of the variation in the two cases is very different. I will avoid use of the term “allophonic”. Alternations in the choice of lexical item which realizes a particular morpheme will be called *allomorphy*. The alternation between *go* and *wend* as realizations of *[SING]* is allomorphic. So is the alternation in choice of the past tense affix (-*t*, -*d*, or null).

With this understanding of the architecture of the morphophonological computation, we are ready to consider the place of reduplication in this architecture.

### 3.1 Reduplicative affixation is lexically triggered readjustment

An affix which induces reduplication does so by triggering rules which insert t-junctures into the timing tier. Later phonological rules, sensitive to the presence of these junctures, carry out transcription, morpheme association, and NCC repair. Hayes and Abad (1989:357) give a good example from Ilocano, the paradigm (42). According to them, what they call “light reduplication” is used with the prefix *si*- to mean ‘covered with, filled with’:
(42)

a. buneŋ (type of knife) si-bu-buneŋ ‘carry a buneng’

b. pandiliŋ ‘skirt’ si-pa-pandiliŋ ‘wearing a skirt’

c. liŋ?et ‘perspiration’ si-li-liŋ?et ‘covered with perspiration’

d. roʔot ‘leaves, litter’ si-ro-roʔot ‘covered with litter’

e. jyaket ‘jacket’ si-ja-ja-jyaket ‘wearing a jacket’

The m-structure is of the form (NC COV), with the morpheme COV some kind of prepositional element which combines with a noun root. The lexical item which realizes COV has a prefixal exponent si- and its insertion triggers t-juncture insertion as shown in the illustrative derivation of (42d), which is given below.

![Diagram](image)

When the lexical item which realizes COV is inserted, rules which insert t-junctures into the verb root are triggered. We will return later to examine the structural description of such rules in detail. The present discussion is meant only to examine the place of these rules in the morphophonological derivation.

Transcription (Trscr below) follows at some point.

![Diagram](image)
Transcription in (44) is to the left, at the morpheme edge. Right transcription would produce a morpheme internal reduplicant.

The copied timing slots in the terminal representation in (44) are not associated with morphemes. It could be that they remain without morphemic association. The issue is far from clear, but I will tentatively assume that this violates basic tendencies of morphophonology and that repair is triggered which associates the timing slots of the reduplicant with a morpheme. There are two obvious possibilities, association with the verb root and association with the prepositional morpheme. The repair takes place in the COV-cycle, so it is reasonable to assume that association with the morpheme which generates the cycle. This proposal is also tentative. It could be that there is language particular variation, so that a similar process in another language might take the material added by transcription to be a root extension, rather than part of the prefix. If repair does proceed as tentatively suggested, the derivation (44) continues to:

![Diagram]

Juncture insertions rules will be examined in great detail in coming sections. The description below of the Ilocano rule above is a starting point.

(46) 1. $\emptyset \rightarrow [\] V$ (leftmost in stem)

2. $\emptyset \rightarrow [\] \times$ (leftmost in stem)

The term “stem” here and throughout has only a structural meaning. At the point of lexical insertion, the stem is the realization of the sister of the morpheme which is currently being realized. In (46.1), “V” is taken to be a predicate on timing slots, true if the timing slot is associated with a vowel. (This will later be extended so that the predicate is true of nuclei in general, not just vocalic nuclei.) The structural condition in (46.1) therefore specifies the insertion of a $\times$-juncture into the timing tier.
following a timing slot associated with a vowel. The leftmost instance of this configuration is chosen as the insertion site.

It will prove to be useful to write the rules (46) in a bipartite form, with the rules on the left and the domain to which they apply on the right.

\[
\begin{align*}
\emptyset \rightarrow [ /_{\text{left}} V \quad , \quad \emptyset \rightarrow [ /_{\text{left}} \times \quad ; \quad \text{stem}
\end{align*}
\]

In the interest of a compact notation, leftmost (or rightmost) application is specified by a subscript on the “/” symbol which introduces the environment for rule application. It will become clear in Chapter 5 that the variation in the rules which reduplicative affixes trigger is better accounted for if a domain is factored out and the rules written relative to the domain, as in (47). The domain is not always the stem. The domain of some reduplicative affixes is a morphological or prosodic subword of the stem. The general format is:

\[
(48) \quad \text{juncture insertion rules} \quad ; \quad \text{rule domain}
\]

Some simplification of (47) is possible on the basis of several natural default choices. First, rule application will be assumed to be leftmost, as the default. Second, the domain of juncture insertion rules is taken to the whole stem, as the default. Unpaired [- and ]-junctures which remain after juncture insertion are closed by inserting ] or [ at the edges of the stem. This is called Default Closure (DC).

In view of default leftmost juncture insertion rule application and Default Closure, (46) simplifies to:

\[
(49) \quad \emptyset \rightarrow \quad / \quad V \quad ; \quad \text{stem}
\]

This rule occurs so commonly that it is useful to have a name for it: C*V juncture insertion. The Ilocano r-affix above can then be described simply by saying that the exponent of COV is prefixal si- and that its concatenation triggers stem C*V juncture insertion. Derivations are not
usually shown with the detail that was lavished on (43) through (45) above. Generally, only a sketch will be given, as in (50a) or (50b). So:

(50)  
\[
\begin{align*}
\text{a. } \text{ro?ot} & \quad \rightarrow \quad \text{siro?ot} & \quad \rightarrow \quad \text{siro}j\ot & \quad \rightarrow \quad \text{si}[\text{ro}]\ot \\
\text{Trscr} & \quad \rightarrow \quad \text{si-ro-ro?ot} \\

\text{b. } \text{ro?ot} & \quad \rightarrow \quad \text{si}[\text{ro}]\ot & \quad \rightarrow \quad \text{si-ro-ro?ot} \\
\end{align*}
\]

The hyphens in the final representations should be understood as aids to the reader, not as phonological objects which are present in the morphophonological representation. Such hyphens will often be given to make it easier for the reader to recover the underlying process.

### 3.2 Klamath distributive and intensive reduplication

Klamath distributive and intensive reduplication and their interaction illustrate many of the ideas above. (The examples in this section are all taken from Zoll, 2002.)

(51) Klamath distributive reduplication

\[
\begin{align*}
\text{root} & \quad \text{reduplicated} & \quad \text{surface} \\
\text{a. } \text{qlin} & \quad \text{‘choke’} & \quad \text{qli-qli} & \quad \text{qli-qli\l} \\
\text{b. } \text{pag-a} & \quad \text{‘bark’} & \quad \text{pa-pag-a} & \quad \text{pa-pag-a} \\
\end{align*}
\]

Klamath has a rule (Root Vowel Reduction, RVR) which reduces the initial vowel of the root if that vowel is not the initial vowel of the word that the root is embedded in. Typically, prefixes cause RVR to apply. The surface forms in (51) are the result of RVR applied to a reduplicated form. The vowel deletes in open syllables, as in (51b), and reduces to schwa in closed syllables, as in (51a).

The lexical item which realizes the distributive morpheme and induces reduplication has a null exponent and triggers C\textsuperscript{*}V-juncture insertion. The derivation of (51a) is given in (52), with the distributive morpheme denoted by DIS. T&R (transcription and repair) denotes the
compound operation consisting of Transcription, morpheme association, and NCC repair (NCCR).

\[
(52) \quad [\text{QLIN}] \oplus [\text{QLIN}] \quad \xrightarrow{T&R} \quad [\text{QLIN}] \oplus [\text{QLIN}] \quad \xrightarrow{\text{RVR}} \quad [\text{QLIN}] \oplus [\text{QLIN}]
\]

RVR is a morphologically conditioned rule. It must be sensitive to the morpheme structure so that the initial vowel of the root can be located. This is a typical example of a morphologically conditioned rule. It is a phonological rule in form, but it is neither purely phonological nor a readjustment rule (i.e. directly triggered by the insertion of a lexical item).

It is worth reviewing the individual steps in the compound operation T&R.

\[
(53) \quad [\text{QLIN}] \quad \xrightarrow{\text{Trscr}} \quad [\text{QLIN}] \quad \xrightarrow{\text{phoneme fission}} \quad [\text{QLIN}]
\]
It is valid in this example to consider “transcription and repair” to be a compound operation. This is not always the case. Nothing in the theory being developed here prevents other operations from intervening between the various suboperations of the compound operation. The intervention of phonological rules between transcription and phoneme fission is the source of various effects that have been termed “over-application” in the literature. If other rules do intervene between the suboperations of the compound operation, it is no longer useful or valid to think of it as a compound operation.

It is crucial that RVR applies after fission in the derivation (52). Before transcription, the context for root vowel reduction is not present. If RVR applied after transcription, but before fission, the result in (51a), for example, would be *qləqlən* or *qliqlin*. If RVR were subject to geminate inalterability, underapplication would result since only one of the occurrences of the vowel is a root vowel, so RVR would not apply. If RVR were not subject to geminate inalterability, underapplication would result because the reduplicant vowel is simultaneously the root vowel before fission, so *qləqlən* would be produced. It is also crucial that transcription copies timing slots to the left, not the right. If transcription were to the right, the condition for application of RVR would not be met since the root vowel would remain the initial vowel of the word.

Transcription to the left in this example is not an arbitrary stipulation. As noted earlier, the default direction of transcription of a duplicant which is at the left edge of a morpheme and not simultaneously at its right edge, is to the left. The reason is straightforward. Transcription to the right would produce a the complex structure in (54), with the copied material intruding into the morpheme. This is probably not excluded by general principles and may in fact occur in some cases. But all other things being equal, simplicity favors maintaining morpheme contiguity.

\[
(54)
\]
Klamath has another reduplicative affix which realizes a morpheme which has intensive semantics (denoted by INT below). A few examples are given below.

(55) Klamath intensive reduplication

\[
\begin{array}{ccc}
\text{root} & \text{reduplicated} & \text{surface} \\
\text{a. } \text{Wit} & \text{‘flop (as a fish)’} & \text{Wit-Wit} & \text{Wit’-Wit’} \\
\text{b. } \text{kesp} & \text{‘pant for breath’} & \text{kesp-kesp} & \text{kesp-kesp’}
\end{array}
\]

W, according to Barker (1964), Zoll’s source, is a voiceless sonorant. The changes \( t \rightarrow t’ \) and \( p \rightarrow p’ \) are late glottalization processes, unrelated to reduplication. Two things stand out in (55): 1) the entire root is doubled; and 2) there is no vowel reduction. We will see that these things are related.

The lexical item which realizes INT has a null exponent and triggers the readjustment rule:

(56) \( \emptyset \rightarrow \[ \frac{\big/}{\big/ \times} ; \text{stem} \)

(Recall that there is default leftmost application and default closure.)

The morphology of (55a) is straightforward:

(57) \[
\begin{array}{ccc}
\text{[WIC]} & \text{INT} & \oplus \text{[WIC]} \\
\text{[WIC]} & \text{INT} & \oplus \text{INT} \\
\big/ \big/ \big/ & \big/ \big/ \big/ & \big/ \big/ \big/ \big/ \big/ \big/ \\
\text{W i t’} & \text{W i t’}
\end{array}
\]

In distributive reduplication, discussed above, transcription was to the left in order to avoid splitting the root. Total reduplication does not dictate a direction of transcription, since either left or right transcription is to the morpheme boundary. In Klamath, the absence of vowel reduction in the totally reduplicated forms in (55) indicate that copying is to the right.
RVR does not apply because the root vowel remains word initial.

Zoll observes that the vowel of the first conjunct of the intensive form does reduce when it is not word initial. She gives various examples, of which the following is particularly interesting because it combines intensive and distributive reduplication.

(59) Wić ‘be stiff’
Wić-Wić-l’i ‘stiff’
Wi-Woć-Wić-l’i ‘stiff-DISTRIBUTIVE’

The derivation of the distributive intensive form is given in some detail below, simplified in the interests of brevity by ignoring the -l’i suffix. The affix which realizes INT is assumed to be cyclic. I know of no cases in which there is a strong argument that a reduplicative affix is not cyclic (in the framework discussed in this paper) and will therefore assume throughout this paper that reduplicative affixes are cyclic. There are three cycles of lexical insertion.
An alternative approach to the analysis in (60) is given in a footnote.\(^3\)

### 3.3 Tagalog (apparent overapplication)

Tagalog has a nominalizing prefix which interacts with a phonological process of nasal assimilation and an intensive reduplicative affix in an interesting way. Lieber (1992:179) gives the following examples which illustrate the interaction of paN-prefixation and nasal coalescence.

\[(61) \quad \text{noun} \quad \text{prefixed noun} \]

- a. atip ‘roofing’ pan-atip ‘that used for roofing’
- b. putul ‘cut’ pa-mu:tu:lu ‘that used for cutting’

The nasal coda of the prefix combines with the stop onset of the root in (61b) to produce a single phoneme which has the nasality of the coda and the place of articulation of the onset. I assume that nasality first spreads to the right from \(\eta\), then the timing slot associated with \(\eta\) deletes:

\[
\text{pa\-nu:tu:lu} \rightarrow \text{pa\-mu:tu:lu} \rightarrow \text{pa\-mu:tu:lu}
\]
Tagalog has an intensive affix which has a null exponent and triggers \(C^*V\)-reduplication. \(paN\)-prefixation can combine with the intensive affix. The interaction that has provoked much discussion in the literature is exemplified below:

\[(62) \quad pa\text{-}mu\text{-}mu\text{tal} \quad \text{‘a cutting in quantity’}\]

If it assumed that \(C^*V\)-reduplication applies to the root before \(pay\)-prefixation, (62) is mysterious. The attempted derivation would be:

\[(63) \quad pu\text{-}tal \quad \text{root}\]
\[pu\text{-}pu\text{-}tal \quad C^*V\text{-reduplication (before prefixation)}\]
\[pa\text{-}pu\text{-}pu\text{-}tal \quad pay\text{-prefixation}\]
\[pa\text{-}mu\text{-}pu\text{-}tal \quad \text{nasal coalescence}\]

\(p \rightarrow m\) for the root initial consonant is unexplained. This has sometimes been interpreted as a Wilbur Identity Effect.

Aronoff (1988) and Lieber (1992) realized that (62) presents a puzzle only if it is assumed that prefixation follows reduplication. Under the assumption that the reduplicative affix combines with the stem after prefixation, the only problem is to explain the mechanism by which reduplication can reach inside the stem and double the initial \(C^*V\) of the root. Aronoff takes an approach which permits reduplication to “see” at least certain aspects of the morphological structure of the stem. Lieber rejects this and assumes that the prosodic structure of the stem is sufficient to locate the material which is to be doubled.

Many examples in the coming pages will show that juncture insertion can be sensitive to either the morphological and prosodic structure of the stem it combines with. Among reduplicative affixes whose juncture insertion rules make reference to morphological structure, sensitivity to an embedded root is very common. Since sensitivity to root boundaries is common, the simplest analysis in the present framework is to suppose that intensive reduplication in Tagalog is \(C^*V\) root reduplication. It is generated by the readjustment rule:

\[(64) \quad \emptyset \rightarrow \{ \} / V \quad ; \quad \text{root}\]

This is identical to (47) except that the domain of the rules is the root, not the stem.
Chapter 3

The derivation of (63) follows, beginning at the point just after the prefix has been inserted. NOM is the nominalizing morpheme and INT is the intensive morpheme.

The final representation in (65) is virtually the same as the representation that Lieber’s analysis produces. The derivation, however, is entirely different. In her theory, the intensive affix is a C"V-template, which is infixed. In (65), the intensive affix has a null exponent. In the final representation, INT has acquired associated phonological material, but this association is derived. INT itself is purely nonconcatenative. In the final representation in (65), mu could be accurately described as a “derived infix” or a “surface infix.”

3.4 Erromangan:

The interaction of reduplication and readjustment

The Oceanic Austronesian language Erromangan is the subject of an excellent study by Crowley (1998). Verbal inflectional morphology is particularly interesting since there is an extensive system of root readjustment. Since there is also total verb root reduplication associated with intensive semantics, the interaction of root readjustment and reduplication can be examined.
Tense and agreement morphology is largely prefixal. In the examples below, IMP is imperative and DISTPAST is the “distant past” tense. The orthography is Erromangan “practical orthography.” It should pose no problem, except that g represents IPA y.

(66) w-aruvo   y-epm-aruvo
2PL:IMP-sing  3SG:DISTPAST-PRIOR-sing
‘you all sing’  ‘he/she had sung’

y-etu-velom  y-em-aruvo
3SG:DISTPAST-NEG-come  3SG:DISTPAST-EM-sing
‘he/she did not come’  ‘(while) he/she was singing’

The prefix em- does not appear to be associated with independent semantics and plays only a formal role in the morphology. Certain prefixes require its presence. Crowley glosses it as “EM”.

There is another morphological element (which I will gloss as “AN”), which is present in certain environments and whose exponent appears immediately before the root. It is realized by the prefix n- for most roots, but as an- for a large class of roots which Crowley calls strong verbs. The AN-prefix/root combination is called the modified root.

(67) co-n-aruvo  c-am-n-aruvo
3SG:FUT-AN-sing  3SG-PRES-AN-sing
‘he/she will sing’  ‘he/she is singing’

c-an-vag > campag
3SG:FUT-AN-eat
‘he/she will eat’

Both allomorphs of AN trigger readjustment. an- triggers deletion of a root initial vowel, if there is one. The nasal n of both prefixes deletes before nasals (m, n, g), glides (y, w), the voiceless obstruents s and h and the lateral l. The readjustment rules are ordered, and V-deletion feeds n-deletion. Various examples of the derivation of modified root forms is given in (68). Various secondary morphophonological rules apply after readjustment to derive the modified root. They are responsible for np → mp, ntn → tn, and nr → nd below. To some extent, these secondary rules appear to be morphological conditioned (applying
in some, but not all, morphological environments). Since the precise conditions are not important to what follows, discussion is omitted.

(68) Modified root formation

<table>
<thead>
<tr>
<th>root initial</th>
<th>V deletion</th>
<th>n deletion</th>
<th>modified root</th>
</tr>
</thead>
<tbody>
<tr>
<td>an-pat</td>
<td></td>
<td></td>
<td>ampat (&lt; anpat)</td>
</tr>
<tr>
<td>an-mah</td>
<td>aŋ-mah</td>
<td></td>
<td>amah</td>
</tr>
<tr>
<td>an-oruc</td>
<td>an-ŋruc</td>
<td></td>
<td>anduc (&lt; anruc)</td>
</tr>
<tr>
<td>an-etni</td>
<td>an-ŋtni</td>
<td></td>
<td>antni (&lt; antni)</td>
</tr>
<tr>
<td>an-elwo</td>
<td>an-ŋlwo</td>
<td>aŋ-ŋlwo</td>
<td>alwo</td>
</tr>
<tr>
<td>an-omol</td>
<td>an-ŋmol</td>
<td>aŋ-ŋmol</td>
<td>amol</td>
</tr>
</tbody>
</table>

Crowley takes a different approach to the formation of the modified root. He analyzes it as pure root mutation, with no prefix. The addition of fixed phonetic material to the root suggests, however, that the exponent of some morpheme is involved in modified root formation. The addition of the nasal n, subject to the readjustment rules discussed, and a for strong verbs does not have the character of simple root mutation. It is therefore preferable to take the added phonetic material to be the exponent of a morpheme, rather than material added by morphophonological rule. Crowley’s main argument against the presence of a prefix is the absence of a semantic content to the morpheme. Since he considers em- to be prefixal, and not realizing a morpheme with semantic content, this argument does not have much force.

Having sketched the application of readjustment in deriving certain verb forms, we are now in a position to examine its interaction with reduplication. Erromangan realizes an intensive morpheme via total root reduplication. Crowley notes that in intensive forms which call for the modified root, only one of the reduplicative conjuncts is modified. The 3PL:FUT intensive form of omol ‘fall’, which has the modified root amol, is cw-amol-omol (*cw-amol-amol). Under the theory of morphophonology adopted in this paper, which incorporates Halle’s idea of readjustment rules triggered by lexical insertion, this is expected if the morpheme which induces intensive reduplication is closest to the root, a plausible assumption. The derivation is given below:
Various theories of morphology (Anderson, 1992, for example) do not recognize readjustment rules as part of the architecture of morphophonology. Past tense *sold*, for example, is analyzed as the selection of the *sol* allomorph of *sell* from the lexicon, coupled with concatenation of the *-d* suffix. Such theories are criticized by Halle and Marantz (1993) for failing to make a qualitative distinction between alternations of the *sell/sold* type and alternations of the *go/went* type. The interaction of intensive reduplication and readjustment in Erromangan provides another powerful argument against “allomorphy only” theories of morphology. If there is only allomorphy, either the allomorph *omol* must be chosen, incorrectly yielding *cwomolomol*, or the allomorph *amol* must be chosen, incorrectly yielding *swamolamol*.

Above I argued that the modified root should be analyzed as resulting from prefixation plus readjustment. It is worth noting that the incompatibility of the Erromangan data with “allomorphy only” theories of morphology is independent of the claim that the modified root contains prefixal material. If Crowley’s proposal that the modified root is formed by pure root mutation had been accepted, the incompatibility would be equally clear.

### 3.5 Nuu-chah-nulth reduplicative readjustment

This book takes the position that reduplication is the consequence of juncture insertion rules which are triggered by lexical insertion. Lexical insertion, in general, has two aspects; the concatenation of the exponent of the lexical item and the application of the readjustment rules which the lexical item triggers. The fact that reduplicative readjustment is accompanied by lexical insertion is often obscured by the fact that the exponent is null, so that only nonconcatenative morphology is induced.

Nuu-chah-nulth, a Wakashan language spoken on Vancouver Island (off the Southwestern coast of Canada), provides many examples of morphemes which have both robust nonnull affixal morphology and
simultaneous robust reduplicative morphology. Kim (2002) identifies 8 different classes of verb suffixes of this type in Nuu-chah-nulth. Suffixes in each affix class have a nonnull exponent, but also induce a pattern of root reduplication characteristic of the suffix class. The habitual suffix (Class II in Kim’s classification), for example, has the exponent -ʔiːk and induces the following pattern of reduplication:

(70) a. č’usč + ʔiːk → č’uː-č’usč-ʔiːk
   suspicious habitual
b. ʔuːwa + ʔiːk → ʔuː-ʔuːwa-ʔiːk
   it-to-say habitual

A full list of the 8 suffix classes is given below, along with an example suffix from each class and examples of its reduplicative effect on typical verb roots. See Kim for glosses and further details. In each case one verb root whose initial vowel is short and one verb root whose initial vowel is long is given. For classes I-1 and II-2, the length of the reduplicant vowel mirrors the vowel length of the initial vowel of the underlying verb root. For the other suffix classes, the length of the reduplicant vowel is determined by the suffix class, not the underlying verb root. For the last four suffix classes, the length of the initial vowel of the verb root is adjusted to a fixed length characteristic of the suffix class.

(71) Nuu-chah-nulth reduplicative suffix classes

Class I-1 (e.g. -λα): C₁V₁C₂ / C₁V₁:C₂ reduplicant.
   yacmil → yac-yacmil-λα ʔuː → ʔuː-ʔuː-ʔuː-λα

Class I-2 (e.g. -ʔaluk): C₁V₁ / C₁V₁: reduplicant.
   ʔapx → ʔa-ʔapx-ʔaluk ʔukʷ → ʔuː-ʔuːkʷ-ʔa-ʔaluk

Class II (e.g. -ʔiːk): C₁V₁: reduplicant.
   č’uːš → č’uː-č’uː-ʔiːk ʔuːwa → ʔuː-ʔuːwa-ʔiːk

Class III (e.g. -ʔukʷ): C₁V₁ reduplicant.
   qʷi → qʷiːqʷiː-ʔukʷ ʔuː → ʔu他们都-ʔuː-ʔukʷ-ʔaluk

Class IV (e.g. -a): C₁V₁:C₂ reduplicant, long surface root vowel.
   t’ič → t’ič-t’ič-a

Class V (e.g. -k’uk): C₁V₁ reduplicant, short surface root vowel.
   λ’iːc → λ’iː-λ’iːc-ʔuk ʔiːxʷ(ʔa) → ʔiː-ʔiːxʷ-ʔa-k’uk
Class VI (e.g. -siš): $C_1V_1$: reduplicant, short surface root vowel.

\[
\text{wikity'ak} \rightarrow \text{wi:-wikity'ak-siš} \quad \text{sicity'ak} \rightarrow \text{si:-sicity'ak-siš}
\]

Class VII (e.g. -Piš): $C_1V_1$ reduplicant, long surface root vowel.

\[
\text{wiksapi} \rightarrow \text{wi-wiksapi-Piš} \quad \text{?u:ssapi} \rightarrow \text{?u-?u:ssapi-?iš}
\]

The theory necessary to account for precisely how these patterns are generated will be developed in later chapters. See in particular the discussion of Tohono O’odham reduplication in Section 7.5.

### 3.6 Some closing remarks

1. Showing the full morpheme structure is a typographic burden that we have borne in this section in order to emphasize the cyclic morphophonology. But it will be impossible to maintain this level of morphological detail in the coming sections. In general, the morpheme structure will not be represented in the sections that follow. The reader should keep in mind that this structure is always present and that the morphophonology, unsurprisingly, routinely makes reference to the morpheme structure.

2. UG must constrain the possible transformations of the stem which affixes can induce. Concatenation of an exponent is inescapable. Since it appeared from McCarthy’s work on Semitic verb morphology that templatic operations had to be admitted into morphophonology, Marantz attempted (with considerable success) to analyze reduplication without expanding the power of affixes beyond concatenation and templatic morphology. The cost was an expansion of the array of possible templates and possibilities for associating phonemes with the template. Marantz needed to introduce CV-templates, whole morpheme templates, and others, as well as propose new varieties of association with templates. DR proposes a new kind of operation on stems, the insertion of duplication junctures (soon to be joined by truncation junctures). Aside from questions of empirical adequacy, it is fair to question the wisdom of expanding the powers of affixal stem modification. The cost is the introduction of a new stem modification mechanism. The benefit, as I hope to demonstrate, is a conceptually and empirically satisfactory theory of reduplication. It has the added benefit of freeing templatic morphology from the burden of accounting for reduplication, so that a much more highly constrained templatic theory is possible.\textsuperscript{4}
Constraining the variety of possible reduplicative affixes will receive ongoing attention in the sections which follow. I will show that entirely plausible restrictions on the array of possible juncture insertion rules yields a theory which is empirically adequate, on the one hand, and adequately constrained, on the other.
Chapter 4

Truncated reduplication

We first consider string copy as a general process. One way the computation might be organized is illustrated by the successive stages of the computation in (72). The string which is to be copied is marked with { and } symbols, and the location to which it is to be copied is marked with a ◁ symbol. Markers ⟨ and ⟩ are inserted in (72.2) in order to keep track of which elements have already been copied. The actual copying is done in (72.3) through (72.5). At each step, the ⟩ symbol is shifted to the right of an element to be copied, and that element is copied to the immediate left of the ◁ symbol. Finally, ⟩-Shift is no longer possible, and the computation terminates by removing the bookkeeping symbols.

(72) 1. { k a t } ◁
2. {⟨}k a t ◁
3. {⟨ k⟩a t } k ◁
4. {⟨ k a⟩t } k a ◁
5. {⟨ k a t ⟩} k a t ◁
6. k a t k a t ◁

I will suppose that (left) transcription uses this mechanism, with the duplication junctures [ and ] used as end markers in place of { and }, and the target location of copy immediately to the left of [, so that no ◁ symbol is needed. The full reduplication of kat to kat-kat, with
copying to the left, is then computed derivationally as shown in (73), with names given to the three suboperations which are used in carrying out transcription.

\[
\begin{array}{c}
\text{(73)} \\
\begin{array}{c}
\times \times \times \\
k \ a \ t
\end{array} \xrightarrow{\text{Init}} \begin{array}{c}
\langle \rangle \times \times \\
k \ a \ t
\end{array} \xrightarrow{\text{CopyShift}} \begin{array}{c}
\langle \rangle \times \times \times \\
k \ a \ t
\end{array} \\
\begin{array}{c}
\times \times \times \\
k \ a \ t
\end{array} \xrightarrow{\text{CopyShift}} \begin{array}{c}
\langle \rangle \times \times \times \\
k \ a \ t
\end{array} \xrightarrow{\text{CopyShift}} \begin{array}{c}
\langle \rangle \times \times \times \\
k \ a \ t
\end{array} \xrightarrow{\text{Reduce}} \begin{array}{c}
\times \times \times \times \\
k \ a \ t
\end{array}
\end{array}
\]

A mirror image version is used for copying to the right, with Init inserting \( \langle \rangle \) in the context \( / \times \_ \) and \( \langle \rangle \) shifting to the left as copying is carried out from right to left.

4.1 Truncation at the leading edge (reduplicant truncation)

The \( \langle \rangle \) and \( \rangle \) symbols above are inserted by the transcription rules and used for keeping track of the progress of the computation. They are bookkeeping symbols, nevertheless they are real phonological objects, called truncation junctures. (Their relation to truncation will soon be apparent.) A juncture which is either a duplication juncture or a truncation juncture will be called a transcription juncture or \( t \)-juncture. Suppose that morphology takes it upon itself to insert truncation junctures in addition to duplication junctures. For example:

\[
\begin{array}{c}
\times \times \times \\
k \ a \ t
\end{array} \xrightarrow{\text{morphology}} \begin{array}{c}
\langle \rangle \times \times \times \\
k \ a \ t
\end{array}
\]

As far as phonology is concerned, this looks like an intermediate representation in the derivation (73), and it is treated as such by transcription. The derivation below results:
Truncated reduplication

CopyShift $\rightarrow \times[(\times \times)\times]$

\[ \langle k \times a \times t \rangle \]

CopyShift $\rightarrow \times[(\times \times)\times]$

\[ \langle k \times a \times t \rangle \]

Reduce $\rightarrow \times \times \times \times$

So, under left transcription, $[kat] \rightarrow \overline{kat}[kat]$, but $[(k)at] \rightarrow \overline{at}[kat]$. To aid readability, the reduplicant is shaded and the remnant is boxed. I call this leading edge truncation, or reduplicant truncation. The general rule is $[(u)v] \rightarrow \overline{v}[uv]$ under left transcription and $[u(v)] \rightarrow \overline{uv}[v]$ under right transcription, where $u$ and $v$ are strings. A $\langle ... \rangle$ block at the leading edge of the duplicant is “truncated” from the copy. In fact, of course, it is not actually truncated. It is simply not copied.

Madurese plural reduplication (Stevens, 1968:34) was discussed by Marantz (1982). Some examples follow:

(74) root plural

buwa? wa?-buwa?-an ‘fruits’
maen en-maen-an ‘toys’
estre tre-estre-an ‘wives’

Assuming Left Transcription, the pretranscription structures have leading edge truncation.

(75) $[(bu)wa?] \rightarrow \overline{wa?}[buwa?]

[(ma)en] \rightarrow \overline{en}[maen]

[(es)tre] \rightarrow \overline{tre}[estre]

It remains to show how these pretranscription structures come about as the result of morphological rules which insert t-junctures and rules which might affect the configuration before transcription applies. The focus of this chapter is on transcription, so these questions will be put off until Chapters 5 and 6.

Marantz (1982:451) also discussed a Chukchee reduplicative pattern which is similar to the Madurese pattern, but in which the partial copy of the stem is to the right. Some examples are given in (76). The
meaning associated with the morpheme which induces the reduplication is the absolutive singular.

\[(76) \quad \text{root} \quad \text{absolutive singular} \]

\[
\begin{align*}
nute & \quad \text{nute-nut} & \quad \text{‘earth, ground’} \\
inu & \quad \text{inu-in} & \quad \text{(part of a reindeer leg)} \\
jil?e & \quad \text{jil?e-jil} & \quad \text{‘gopher’}
\end{align*}
\]

The reduplicated forms are the result of right transcription and the pretranscription forms with leading edge truncation in (77).

\[(77) \quad [\text{nut}(e)] \rightarrow \overline{\text{nute}} \quad \text{nut} \\
[\text{in}(u)] \rightarrow \overline{\text{inu}} \quad \text{in} \\
[\text{jil}(?e)] \rightarrow \overline{\text{jil}e} \quad \text{jil}
\]

The derivation of the pretranscription forms will be given in Chapter 6.

4.1.1 Truncated prefixes and suffixes
There are many examples of leading edge truncation coupled with prefixation or suffixation. Yoruba has a nominalizing affix which produces the following pattern:

\[(78) \quad \text{root} \quad \text{nominal form} \]

\[
\begin{align*}
\text{lod} & \quad \text{li-lod} & \quad \text{‘to go’} \\
\text{dun} & \quad \text{di-dun} & \quad \text{‘to be tasty, sweet’}
\end{align*}
\]

The data is from Pulleybank and given in Marantz (1982:449), who analyzed Yoruba nominalizing reduplication as “prefixing a CV reduplication skeleton whose V is fixed to i.”

The considerations above suggest a rather different analysis: i is a prefix, but juncture insertion rules apply after the prefix has been concatenated with the stem, as shown below:
The statement of the juncture insertion rules is significantly simplified if the exponents of lexical items can contain t-junctures and the domain of juncture insertion rules is taken to be the stem.\(^1\) If the Yoruba NOM-prefix is taken to be \(\langle (i) \rangle\)-, juncture insertion reduces to:

\[ \emptyset \rightarrow \emptyset / \left/ \langle (i) \rangle \right. V \]

The resulting simplification justifies the assumption that t-junctures can enter the computation not only because they are inserted in the stem by juncture insertion rules, but also because they are embedded in the exponents of lexical items. I will henceforth make this assumption. In the discussion of Chaha in Chapter 7, it will be proposed that t-junctures can be embedded not only in the exponents of inflectional affixes, but also in roots.

Affixes similar to the Yoruba nominalizing affix are widespread. Healy (1960) reports the following data from Agta.

\begin{center}
\begin{array}{lll}
\text{root} & \text{diminutive} \\
\text{wer} & \text{‘creek’} & \text{wala-wer} & \text{‘small creek’} \\
\text{baq} & \text{‘g-string’} & \text{bala-baq} & \text{‘small g-string’} \\
\text{pesuk} & \text{‘peso’} & \text{pala-pesuk} & \text{‘a mere peso’} \\
\text{?assaj} & \text{‘small’} & \text{?ala-?assaj} & \text{‘very small’} \\
\end{array}
\end{center}

The similarity between the diminutive affix responsible for (80) and the nominalizing affix responsible for (78) should be clear. The exponent is \(\langle (ala) \rangle\)- and it triggers \(\emptyset \rightarrow \) /\Left V.\(^2\) An illustrative derivation follows in (81). Recall that the domain of the juncture insertion rule is the stem \text{wer}, not \(\langle (ala)\text{wer} \rangle\).
What is called “tasty-shmasty reduplication” is the only productive reduplication process in English and has therefore received an inordinate amount of attention. Examples are well-known: oil-smoil, money-shmoney, Bush-Shmush, etc. An interesting point is that the reduplicated form has the prosody of a two word sequence. The suffix \(-shm\), coupled with the juncture insertion rule \(\emptyset \rightarrow [ / \_\_V\), where \# is an embedded word boundary, produces derivations like the following:

\[
\begin{array}{c}
\text{Trsc}\rightarrow \times \times \times \times \times \times (w-ala-wer)
\end{array}
\]

Penalfini and Breen (1999) discuss three reduplicative processes in Arrernte, an Arandic language of Central Australia, which furnish good examples of reduplicative prefixes and suffixes. Penalfini and Breen fit them into the mold of Prosodic Morphology by claiming that syllables in Arrernte are necessarily onsetless, but an analysis in the terms developed here is much more straightforward. The affixes are easily described:

\[
\begin{array}{c}
\text{Penalfini and Breen (1999)} \text{ discuss three reduplicative processes in Arrernte, an Arandic language of Central Australia, which furnish good examples of reduplicative prefixes and suffixes. Penalfini and Breen fit them into the mold of Prosodic Morphology by claiming that syllables in Arrernte are necessarily onsetless, but an analysis in the terms developed here is much more straightforward. The affixes are easily described:}
\end{array}
\]

\[
\begin{array}{c}
\text{exponent \quad juncture insertion}
\end{array}
\]

\[
\begin{array}{c}
\text{Habitative:} \quad -en \quad 0 \rightarrow [ / Right \_\_V
\text{Frequentative:} \quad -\langle ep\rangle \quad 0 \rightarrow [ / Right \_\_V
\text{Attenuative:} \quad \langle elp\rangle- \quad 0 \rightarrow ] / \_\_V_{second}
\end{array}
\]

The specification of the context \(\_\_V_{second}\), “before the second vowel”, is provisional. The vocabulary for writing juncture insertion
rules will be severely constrained in Chapter 5 so that / \ __ V\textsubscript{second} \ will no longer be a possible structural description for a juncture insertion rule. Writing the desired rule in Arrernte will depend on the assumption that juncture insertion rules can be relativized to a subword (either prosodic or morphological) of the stem. That is, the domain of the juncture insertion rules associated with an affix can be specified to be a subword of the stem. In Arrernte attenuative reduplication, the domain is taken to be the initial bisyllabic foot and the rule is \( \emptyset \to [) \Rightleftharpoons \__ V \).

A few examples of frequentative reduplication are given below, along with derivations. The semantics are clear from the glosses. The portion of the root which is copied, along with the copy, are boldfaced to make it easier for the reader to parse the reduplicated forms.

(84) Frequentative ( -\langle ep\rangle ; \emptyset \to [ \Rightleftharpoons \__ V )  
  a. \( eN\)-em ‘is standing’, \( eNeN\)-em ‘keeps standing’
      \( eN \to [eN\langle ep\rangle] \to \underline{eN} eN \)
  b. \( ater\)-em ‘is fighting’, \( atereper\)-em ‘keeps fighting’
      \( ater \to at[er\langle ep\rangle] \to at[erep] er \)
  c. \( anentelil\)-em ‘is putting together’,
      \( anentilepi\)-em ‘keeps putting together’
      \( anentelil \to anentel[il\langle ep\rangle] \to anentel[ilep] il \)

A few examples of habitative reduplication, along with derivations, are given in (85). The morpheme which is realized by the habitative affix is nominalizing. The semantics are variable, under the general rubric of “object habitually associated with the action denoted by root.”

(85) Habitative ( -\(en\); \emptyset \to [ \Rightleftharpoons \__ V )  
  a. \( ank\) ‘eat’, \( anken\)\(ankan\) ‘food’
      \( ank \to [ank-en] \to \underline{ankan} anken \)
  b. \( at^w\)er ‘fight’, \( at^w\)ere\(er\)en
      \( at^w\)er \to at^[er-en] \to at^[er\underline{en}] enen \)
A few examples of attenuative reduplication follow in (86). The semantics are generally “beginning to do something” or “doing something unintensively.”

(86) Attenuative ( \{\text{elp}− \; 0 \rightarrow \} / \text{V}_\text{second} )

a. itir-em ‘thinking’, \text{itelpitir-em} ‘half thinking’
   itir \rightarrow \{(\text{elp})i\text{l}i\text{r} \rightarrow \text{it}_{\text{elp}}i\text{r} \}

b. emp"ar-em ‘making’,
   emp"\text{elpemp}"ar-em ‘starting to make’
   emp"ar \rightarrow \{(\text{elp})emp"ar \rightarrow emp"\text{elpemp}"ar \}

Although the juncture insertion rule cannot apply to a monosyllabic root, because there is no second vowel, Default Closure applies.

\begin{align*}
\text{prefix} & \rightarrow \{(\text{elp})\text{ar} \rightarrow \{(\text{elp})\text{ar} \} \rightarrow \text{ar}_{\text{elpar}}\}
\end{align*}

So the root \text{ar} gives \text{ar-em} ‘looking’ and \text{arelpar-em} ‘starting to look’.

4.2 Nested duplicants

There are a number of examples in which the morphology creates a duplicant which is nested inside another one, as in the form below.

\[
\begin{array}{c}
[[\times] \times] \\
\text{e} & \text{m}
\end{array}
\]

The core copying mechanism has little difficulty in transcribing such a form. Consider transcription to the right, for example. Transcription proceeds as follows:

(87) 
\begin{align*}
\text{Init+CopyShift} & \rightarrow \begin{array}{c}
\left[\times(\times)\right] \times \\
\text{e} & \text{m}
\end{array} \\
\text{Init+CopyShift} & \rightarrow \begin{array}{c}
\left[\times(\times)\right] \times \\
\text{e} & \text{m}
\end{array} \\
\text{Reduce} & \rightarrow \begin{array}{c}
\left[\times(\times)\right] \times \\
\text{e} & \text{m}
\end{array} \\
\text{CopyShift} & \rightarrow \begin{array}{c}
\left[\times(\times)\right] \times \\
\text{e} & \text{m}
\end{array} \\
\text{Reduce} & \rightarrow \begin{array}{c}
\times \times \times \times \\
\text{e} & \text{m}
\end{array}
\end{align*}
Two points should be noted. First, Init can apply to either the inner or outer duplicant. I assume that transcription is always from the edge in. In right transcription, this means that the transcription rules operate from right to left. Consequently, the initial application of Init targets the rightmost \( \) - juncture. Second, note that CopyShift always deposits the copy it makes outside of the outer duplicant. This is as it should be. All of the steps in (87) are steps in the transcription of the outer duplicant, even when the inner duplicant is being processed.

Wilbur (1973:10) called attention to two varieties of verbal reduplication in Takelma, based on the work of Sapir (1922), one of which uses (87a).

\[
\begin{align*}
(88) & \quad \text{root} & \quad \text{aorist stem} & \quad \text{frequentative stem}^3 \\
& \quad \text{hemg} & \quad \text{hemeq} & \quad \text{heme:mg} & \quad \text{‘take out’} \\
& \quad \text{masg} & \quad \text{masaq} & \quad \text{masa:sg} & \quad \text{‘put’} \\
& \quad \text{baxm} & \quad \text{baxam} & \quad \text{baxa:xm} & \quad \text{‘come’} \\
& \quad \text{wism} & \quad \text{wisim} & \quad \text{wisi:sm} & \quad \text{‘move’}
\end{align*}
\]

The juncture insertion rules for both aorist and frequentative reduplication begin with initial VC reduplication: \( \text{hemg} \rightarrow \text{h[em]g} \), for example. In the aorist, the duplicant consonant is truncated, and in the frequentative, the vowel is duplicated again. Transcription is to the right.

\[
\begin{align*}
(89) & \quad \text{root} & \quad \text{aorist} & \quad \text{frequentative} \\
& \quad \text{hemg} & \quad \text{h[em]eg} & \quad \text{h[e(m)e]g} & \quad \text{h[e][m]eg}
\end{align*}
\]

Right transcription of the aorist produces \( \text{hemeq} \), as shown in (90a), and right transcription of the frequentative produces \( \text{heme:mg} \), as shown in (90b), using (87).

\[
\begin{align*}
(90) & \quad \text{a. } \times[\times(\times)]\times & \quad \rightarrow & \quad \times \times \times \times \times \\
& & \quad \downarrow & \quad \downarrow & \quad \downarrow \\
& & \text{h e m g} & \text{h e m g} \\
& \quad \text{b. } \times[[\times]\times] & \quad \rightarrow & \quad \times \times \times \times \times \times \\
& & \downarrow & \downarrow & \downarrow & \downarrow & \downarrow \\
& & \text{h e m g} & \text{h e m g}
\end{align*}
\]
Several more examples of nested duplicants will be considered below. Before that, some reduplication specific extensions of the core copying mechanism are considered.

### 4.3 Medial truncation

Consider left transcription of

\[
\langle x \rangle \times \langle x \rangle \times \]

\[
\begin{array}{c}
\text{s} \\
\text{t} \\
\text{a} \\
\text{u}
\end{array}
\]

Using the rules discussed above leads to a deadend.

\[
\text{CopyShift} \rightarrow \times \langle x \rangle \times \langle x \rangle \times \]

\[
\begin{array}{c}
\text{s} \\
\text{t} \\
\text{a} \\
\text{u}
\end{array}
\]

\[
\text{CopyShift} \rightarrow \times \times \times \]

\[
\begin{array}{c}
\text{s} \\
\text{t} \\
\text{a} \\
\text{u}
\end{array}
\]

The transcription rules which reduplication uses are, in fact, extended to include (91), which allows the computation to proceed.

(91) Combine: \( \rightarrow \emptyset \)

The full derivation is then:

(92) \[
\begin{array}{c}
\text{s} \\
\text{t} \\
\text{a} \\
\text{u}
\end{array}
\]

\[
\text{CopyShift} \rightarrow \times \langle x \rangle \times \langle x \rangle \times \]

\[
\begin{array}{c}
\text{s} \\
\text{t} \\
\text{a} \\
\text{u}
\end{array}
\]

\[
\text{Combine} \rightarrow \times \langle x \rangle \times \langle x \rangle \times \]

\[
\begin{array}{c}
\text{s} \\
\text{t} \\
\text{a} \\
\text{u}
\end{array}
\]

\[
\text{CopyShift+Reduce} \rightarrow \times \times \times \times \times \]

\[
\begin{array}{c}
\text{s} \\
\text{t} \\
\text{a} \\
\text{u}
\end{array}
\]

Medial truncation of this kind is used extensively in Sanskrit verbal reduplication, from which (92) is taken. It is part of the computation of the perfect stem tustau of the verb stau ‘praise’. Medial truncation is also used in Kinande unintensive reduplication. Both Sanskrit and Kinande are discussed in detail in Chapter 7.
4.4 Truncation at the trailing edge (remnant truncation)

Now consider left transcription of

\[
\begin{array}{c}
\times \times \langle \times \rangle \\
\mid \mid \mid \\
l \ i \ m \ a
\end{array}
\]

The rules developed so far, including Combine, produce

\[
\begin{array}{c}
\times \times \langle \times \rangle \\
\mid \mid \mid \\
l \ i \ m \ a
\end{array} \xrightarrow{\text{Init+CopyShift}^*} \begin{array}{c}
\times \times \times \langle \times \rangle \\
\mid \mid \mid \\
l \ i \ m \ a
\end{array}
\]

\[
\begin{array}{c}
\times \times \times \langle \times \rangle \\
\mid \mid \mid \\
l \ i \ m \ a
\end{array} \xrightarrow{\text{Combine+Reduce}} \begin{array}{c}
\times \times \times \times \times \\
\mid \mid \mid \\
l \ i \ m \ a
\end{array}
\]

CopyShift* indicates multiple applications of CopyShift. The result is identical to the result of left transcribing

\[
\begin{array}{c}
\times \times \times \\
\mid \mid \mid \\
l \ i \ m \ a
\end{array}
\]

A further extension of the transcription rules takes advantage of this redundancy to provide more flexibility in transcription. The rule Combine is barred from applying to nonempty \( \langle \ldots \rangle \) blocks which are directly followed by \}. The rule CopyDelete, (94) below, applies instead.

(94) CopyDelete: \( \langle \times \rightarrow \rangle \langle \), with \( \times \) copied in the usual way

This rule applies only at the left edge of a far edge truncate and, as a special rule, bleeds Combine.

So, for example, rather than (93), the derivation (95) results.
Some descriptive terminology is useful to describe the effects of transcription. What remains of the duplicant is called the remnant and the copied material is called the reduplicant. Since in some situations the direction of transcription is not known, it is also useful to have names which are independent of the direction of transcription. The leftmost of the reduplicant and remnant is called the first conjunct and the rightmost is called the second conjunct.

Trailing edge truncation provides a simple mechanism whereby material can be inserted into the duplicant in such a way that the reduplicant is affected, but not the remnant. We will see in Chapter 6 that many reduplicative processes follow juncture insertion with adjustment of the reduplicant to a characteristic prosodic shape before transcription applies. Material added to satisfy the prosodic demands is often truncated, so that it appears in only one of the post-transcription conjuncts. In Ndebele, for example, a bisyllabic reduplicant is obtained from \([\text{lim}]\) in Ndebele by

\[
[\text{lim}] \rightarrow [\text{lim}(a)]
\]

The effect is \(\text{lim} \rightarrow \text{lima} [\text{lim}]\). This is called either Truncated Trailing Edge Epenthesis, which emphasizes the mechanism, or First Conjunct Vowel Epenthesis (FCVE), which emphasizes the effect.

In Mokilese, a bimoraic reduplicant is obtained from \([\text{wi}]\) by truncated timing slot epenthesis at the right edge, coupled with spreading. Again, transcription is to the left.

\[
(96) \quad [\times \times ] \quad \xrightarrow{\text{Truncated Lengthening}} \quad [\times \times \langle \times \rangle] \quad \xrightarrow{\text{Truncated Lengthening}} \quad [\times \times \times \times \times ] \quad (\text{wi:-wi})
\]
This is called *First Conjunct Vowel Lengthening* (FCVL).

The Ndebele and Mokilese examples above will be considered in detail in later sections with particular attention to how the morphology positions the t-junctions. The intention here is only to illustrate how the transcription process responds to t-junctions in the representation.

### 4.4.1 Reduplicant truncation combined with remnant truncation: Permutation, Metathesis, and Infixation

Now how left transcription responds to a form like \[\langle k \rangle a(t)\], with both leading edge truncation and trailing edge truncation. The result is \[\langle k \rangle a(t) \rightarrow at[ka]\], with k missing from the copy and t missing from the remnant. *Leading edge truncates do not appear in the copy and trailing edge truncates do not appear in the remnant.*

\[
\begin{align*}
(97) & \quad \langle k \rangle a(t) \\
1. & \quad a[\langle ka \rangle(t)] \quad \text{Copy/Shift} \\
2. & \quad at[\langle ka(t) \rangle] \quad \text{Copy/Shift} \\
3. & \quad at-ka(t) \quad \text{Reduce} \\
4. & \quad at-ka \quad \text{Truncate}
\end{align*}
\]

Surprisingly, juncture insertion and transcription can accomplish permutation: \[\langle k \rangle(a(t)) \rightarrow at-k.\]

\[
\begin{align*}
(98) & \quad \langle k \rangle(a(t)) \\
1. & \quad a[\langle k(a(t)) \rangle] \quad \text{Copy/Shift} \\
2. & \quad at[\langle k(a(t)) \rangle] \quad \text{Copy/Shift} \\
3. & \quad at-k(a(t)) \quad \text{Reduce} \\
4. & \quad at-k \quad \text{Truncate}
\end{align*}
\]

This is an important result. It means that both *metathesis and infixation are special cases of reduplication.*

Arrernte furnished several good examples of reduplicative prefixation and suffixation. It also furnishes an excellent example of how juncture insertion and transcription accomplish metathesis. According to Pensalfini and Breen (1999), from whom the data is taken, ‘Rabbit Talk is a language game that involves transposing the initial portion of
a word to the end of the word, not unlike the Pig Latin of English.” Examples follow:

(99) Arrernte Rabbit Talk

<table>
<thead>
<tr>
<th>Arrernte</th>
<th>Rabbit Talk</th>
</tr>
</thead>
<tbody>
<tr>
<td>emen</td>
<td>enem</td>
</tr>
<tr>
<td>ek*en'et'ek</td>
<td>e'net'ekek*</td>
</tr>
<tr>
<td>ar'ajk*</td>
<td>ajk*ar</td>
</tr>
<tr>
<td>itirem</td>
<td>iremit</td>
</tr>
<tr>
<td>ulket</td>
<td>etulk</td>
</tr>
</tbody>
</table>

‘plant food’ ‘to put in’ ‘no’ ‘thinking’ ‘perentie lizard’

For polysyllabic words, the translation from Arrernte to Rabbit Talk is accomplished by two rules:

\[ \emptyset \rightarrow [\emptyset \times \emptyset], \quad \emptyset \rightarrow (\emptyset \times \emptyset) \]

The derivation (100) assumes right transcription, but there is no evidence which favors right over left transcription.

\[
\begin{align*}
Juncture \text{ Insertion} & : \quad \times \times \times \times \times \times \times \xrightarrow{\text{DC}} \times \times \times \times \times \times \\
\text{Trscr} & : \quad \times \times \times \times \times \times \xrightarrow{\text{Trscr}} \times \times \times \times \times \times
\end{align*}
\]

There is allomorphy, with a different affix (prefixal y-) used for monosyllabic stems. This gives iŋk \(\rightarrow\) yink, emp \(\rightarrow\) yemp, etc.

**Permutation can be used to accomplish infixation.** We demonstrate this with an analysis of Choktaw passive morphology, which was discussed by McCarthy and Prince (1995). They give the following examples:

(101) stem infixed surface

<table>
<thead>
<tr>
<th>stem</th>
<th>infixed</th>
<th>surface</th>
</tr>
</thead>
<tbody>
<tr>
<td>abani</td>
<td>‘to barbecue’</td>
<td></td>
</tr>
<tr>
<td>apisa</td>
<td>‘to set a date’</td>
<td></td>
</tr>
<tr>
<td>hokçö</td>
<td>‘to plant’</td>
<td></td>
</tr>
<tr>
<td>takçö</td>
<td>‘to plant’</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>abani</th>
<th>albani</th>
</tr>
</thead>
<tbody>
<tr>
<td>apisa</td>
<td>alpisa</td>
</tr>
<tr>
<td>hokçö</td>
<td>holokçö</td>
</tr>
<tr>
<td>takçö</td>
<td>talakçö</td>
</tr>
</tbody>
</table>
Certain late operations (epenthesis, vowel spreading, and \(l\)-mutation) produce the surface forms.

Transparently, \(l\) is infixed after the initial vowel. A simple way to accomplish this is to prefix \(l\), then permute the prefix and the initial \(C^*V\) of the stem. This can be realized very simply by means of a reduplicative prefix. The exponent is \([l]X-\) and it triggers \(\emptyset \rightarrow \underbar{\emptyset} / V \_\_\_\_\_\_.

\[
\begin{align*}
takçi & \rightarrow [\langle l \rangle takçi] \rightarrow [\langle l \rangle (ta) kçi] \rightarrow [\langle l \rangle (ta) kçi] \rightarrow \underbar{\text{ta-l-}}_ci
\end{align*}
\]

An illustrative derivation follows in (102). It is assumed for the sake of concreteness that transcription is to the right, but there is no evidence for this.

(102) \[
\begin{align*}
\times \times \times \times \times & \rightarrow \underbar{\text{K}} \times \times \times \times \times \\
\text{prefix} & \quad \text{takci} \\
\text{JncIns} & \quad \text{takci} \\
\text{DC} & \quad \text{ta-l-kçi} \\
\text{Trscr} & \quad \text{ta-l-kçi}
\end{align*}
\]

Prosodic considerations are virtually absent from this analysis. McCarthy and Prince, on the other hand, are forced to fit their analysis into the mold of Prosodic Morphology, which obscures the simplicity of the morphology.

Formally, \(l\) infixation is actually prefixation under negative prosodic circumscription of an initial light syllable \(\sigma_{\mu}\), requiring Law-of-Parsing mediated restructuring of an initial heavy \(\sigma\) (Urbanczyk 1992). The morphological rule, restricted in this way, is expressed by \(O / \Phi(\sigma_{\mu}, \text{Left})\), where \(O = \text{“Prefix } l\text{”}\). (McCarthy and Prince, 1995:347)

The tortuous account of infixing passive morphology in Chocktaw which Prosodic Morphology is forced into is evidence for an important conclusion we hope to establish: Prosodic Morphology misidentifies
instances of juncture insertion in the context V__ as instances of prosodic specification via syllable weight. Earlier, the specification of C*V-reduplication was made without explicit appeal to prosody. The Choctaw passive is another example of the same kind. Choctaw passive is exactly what it seems to be, “put l after the first vowel.” Using the tools at its disposal, there is only one method for the morphophonology to accomplish this: “put” l at the edge of the stem by concatenation (as the exponent of a morpheme), then position it by reduplicative metathesis. A few secondary parameters must be fixed, either by language particularities or markedness. Is concatenation to the right or left? Is transcription to the right or left?

4.4.1.1. Varieties of Yaqui reduplication
Haugen (2003) discusses four different reduplicative verbal affixes in Yaqui, an Uto-Aztecan language spoken in northern Mexico, with a diaspora in Arizona in the US. One of the affixes is usually associated with iterative aspect, but is also used with a continuative meaning as well as various idiosyncratic meanings. I will simply identify it as “iterative”. The other three are associated with a habitual meaning. Comparison of the morphology is revealing.

(103) | prefix | juncture insertion | name |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(×)−</td>
<td>0 → ] / V__</td>
<td>iterative</td>
</tr>
<tr>
<td>(×)(−)</td>
<td>0 → ] / V__</td>
<td>geminating (habitual)</td>
</tr>
<tr>
<td>(none)</td>
<td>0 → ] / V__</td>
<td>light syllable (habitual)</td>
</tr>
<tr>
<td>(none)</td>
<td>0 → ] / Vseiรถnd ___</td>
<td>disyllabic (habitual)</td>
</tr>
</tbody>
</table>

× is a bare timing slot.

The effect of these affixes is illustrated below in some simple cases:
There are some minor complications for iterative and light syllable reduplication involving the interaction of long vowels and accent placement. There is a major complication in light syllable reduplication in case the initial syllable of the stem is closed. The entire syllable copies. This will be discussed in detail in Section 6.3.3 along with the interaction of vowel length and stress placement. It is a consequence of prosodic adjustment which applies after the affix combines with the stem, not to any modification of the specification of the prefix. Disyllabic reduplication is identical to Diyari plural reduplication, which is discussed in Section 5.2.

According to Haugen, the choice of affix between light syllable reduplication and geminating reduplication to realize habitual varies from speaker to speaker for some verbs and is sometimes unstable for a single speaker. He cites hinne/hi-hine and himma?ako/hi-hima?ako alternations. Viewed at the surface level, the connection between light syllable reduplication and geminating reduplication is obscure at best. But the analysis of geminating reduplication given above makes the connection clear. If the affix which generates geminating reduplication simplifies by losing its exponent, the affix which produces light syllable reduplication results.

\section{4.5 Transcription made easy}

To this point, the computation of transcription has been broken down into the basic low level operations which carry it out. It is possible to describe transcription at a higher level.
duplicants, ones not containing embedded duplicants, are easy to transcribe. \( \ldots \) blocks at the trailing edge of the duplicant appear in the reduplicant, but not the remnant. Other \( \ldots \) blocks appear in the remnant, but not the reduplicant. Other material appears in both the reduplicant and remnant.

For a simple duplicant \([\alpha]\), we introduce the notations Copy\((\[\alpha]\)) and Remnant\((\[\alpha]\)) whose meaning should be clear from (105). On the right side, the copy is shaded and the remnant is boxed. It is “what remains in the box after transcription.”

\[
\begin{align*}
(105) \quad & a. \quad [\text{lo}(\text{wac})] \rightarrow \text{lowac} \text{lo} \\
& \quad \text{Copy([lo(wac)])} = \text{lo}, \ \text{Remnant([lo(wac)])} = \text{lowac} \\
& b. \quad [\text{lim}(\alpha)] \rightarrow \text{lima} \text{lim} \\
& \quad \text{Copy([lim(\alpha)])} = \text{lima}, \ \text{Remnant([lim(\alpha)])} = \text{lim} \\
& c. \quad [\langle s \rangle t(\alpha)u] \rightarrow t\text{u} \text{stau} \\
& \quad \text{Copy([s]}t(\alpha)u]) = \text{tu}, \ \text{Remnant([s]}t(\alpha)u]) = \text{stau}
\end{align*}
\]

Note that Copy\(([\alpha])\) and Remnant\(([\alpha])\) can depend on the direction of transcription.

Transcription of complex duplicants can be simplified by using the reduction rule (106), combined with the rule for transcribing simple duplicants. The rule applies only if there are no other rules which can apply nearer to the active edge.

\[
(106) \quad [\alpha] \rightarrow \text{Remnant([\alpha])}, \ \text{with Copy([\alpha]) copied.}
\]

Broselow and McCarthy (1983:82) discuss a German language game in which words are broken up into syllables and subject to the operation exemplified by \( \text{kat} \rightarrow \text{kathatefat} \). The operation is suffixation of \(-\langle h \rangle\langle \text{lef} \rangle\), coupled with \( \emptyset \rightarrow [[/ ___V]. \ \text{So, for example, kat} \rightarrow \text{kat(h)}\langle \text{lef} \rangle \rightarrow k[[\text{at(h)}]\langle \text{lef} \rangle]). \ \text{Using (106), transcription is carried out in two steps as shown below.}

\[
(107) \quad 1. \quad k[[\text{at(h)}]\langle \text{lef} \rangle] \rightarrow \text{kath}[[\text{at}](\text{lef})] \\
2. \quad \text{kath}[[\text{at}](\text{lef})] \rightarrow \text{kathatef} \text{at}
\]
Creek pluralization uses the following for plural reduplication of stems which end in \( k \) followed by \( m, n, l, \) or \( s \). The stem is \textit{caniks}, ‘sideways’.

(108) 1. \([\text{ca}\langle \text{ni}\langle (k)(s)\rangle \rangle] \rightarrow [\text{ca}\langle \text{ni}\langle s\rangle \rangle] k\]

2. \([\text{ca}\langle \text{nis} \rangle \rangle k \rightarrow \text{canis} \text{ ca} k\]

Stems with other terminations do not have this embedded metathesis. For the stem \textit{lowack} ‘soft’, for example:

\[\text{lo}\langle \text{wac}\rangle k \rightarrow \text{lowac} \text{ lok}\]

Mokilese progressive reduplication uses double reduplication for monosyllabic stems. For example, \textit{ca:k} ‘bend’ \( \rightarrow \textit{ca:ca:ca:k}\).

(109) 1. \([\text{ca}\langle \text{aa} \rangle] k \rightarrow \text{ca}\langle \text{aa} \rangle \text{ ca} k\]

2. \(\text{ca}\langle \text{aa} \rangle k \rightarrow \text{ca}\langle \text{aa} \rangle \text{ ca} \text{ ca} \text{ ca} k\]
Chapter 5
Sources of variation

A wide variety of reduplicative surface patterns are found in the world’s languages. In part, the differences are due to different affix specifications; different exponents and different juncture insertion rules. But these differences do not account for the full range of variation. The surface pattern that is associated with a reduplicative affix is the result of a number of different factors, whose effect is felt at various stages in the derivation.

(110) 1. the exponent of the affix;
    2. the juncture insertion rules that the affix triggers;
    3. pretranscription modification of the duplicant;
    4. the direction of transcription; and
    5. post-transcription operations.

This chapter will focus primarily on the possibilities for (110.2) and secondarily on (110.5), particularly those aspects of post-transcription modification which are special to reduplication. Discussion of (110.3) is the focus of the next chapter. Pretranscription modification of the duplicant is very important in some languages, playing a major role in determining the surface pattern. This requires extensive discussion, which Chapter 6 is devoted to.

There is not a great deal to say about either (110.1) or (110.4). Obviously, different exponents produce different patterns, particularly
Sources of variation

since the exponents of reduplicative affixes can contain embedded embedded t-junctures. But since there is little that can be said of a general nature about the range of possible exponents other than to describe what occurs, (110.1) will be left without further comment. We saw in the discussion of Klamath in Chapter 3 that the possibility of root vowel syncope, which affects the surface pattern, depends on the direction of transcription. Other than noting that the direction of transcription can affect the surface pattern, nothing further will be said here about the variation which can be attributed to (110.4). There are only two choices.

5.1 Possible juncture insertion rules

We begin by putting aside the question of possible domains of juncture insertion rules, which is taken up in the next section, and simply assume that juncture insertion rules apply in some domain. The goal is to show that a very small inventory of juncture insertion rules suffices for an empirically adequate theory. Insertion sites for junctures are located with respect to the syllable nuclei of the domain, and the edges of the domain. In order to make this idea precise, we need the notion of the “nuclear skeleton” of the domain. Consider, for example, the representation in (111a), where the nuclei (ν) are explicitly represented on their own plane. Phonologically, the nuclear skeleton of (111a) is the structure (111b), which is embedded in (111a).

(111) a. \[\begin{array}{c}
\times \times \times \times \\
p c d o k
\end{array}\] b. \[\begin{array}{c}
\nu \\
\nu \\
\nu
\end{array}\]

Morphological associations are not shown in (111a), but (111a) and its nuclear skeleton are assumed to share the same morphological associations.

The starting point for establishing the inventory of juncture insertion rules is the proposal that juncture insertion rules are operations on the nuclear skeleton. Rules like \(\emptyset \rightarrow \) /\(\nu\) must be possible juncture insertion rules, but there is an ambiguity which must be clarified. Insertion is into the timing tier, but \(\nu\) is an autosegment, not on the timing tier. What does the environment \(\nu\) mean? If \(\nu\)
is linked to a single timing slot, there is no ambiguity; the meaning is “to the right of the timing slot linked to ν”. In the case of a long vowel or diphthongal nucleus, an ambiguity of the kind familiar from considerations of geminate inalterability arises. Consider:

\[ \begin{array}{c}
\times \\
\times \\
\times \\
\times \\
\times \\
\end{array} \]

The environment ν ___ can be interpreted narrowly to mean “immediately to the right of the set of timing slots linked to a ν”, or interpreted more broadly to mean “immediately to the right of one of the timing slots linked to a ν”. The broad interpretation specifies the locations in (112a) and the narrow interpretation specifies the locations in (112b).

\[(112)\ a. \begin{array}{c}
\times \\
\times \\
\times \\
\times \\
\times \\
\end{array} \quad b. \begin{array}{c}
\times \\
\times \\
\times \\
\times \\
\times \\
\end{array}\]

I assume that both interpretations are available, with the broad interpretation the default and the narrow interpretation (112b) a marked option.

In Chapter 7, the marked option plays a central role in the analysis of Sanskrit and Tohono O‘odham, an indigenous North American language. Nuu-chah-nulth reduplication triggered by Class I-2 affixes, introduced in Section 3.5, provides another straightforward examples. The Class I-2 suffix -ʔałuk produces the following pattern:

\[(113)\ \overset{\text{čapx}}{\rightarrow} \overset{\text{ča-čapx}}{\rightarrow} \overset{\text{ʔałuk}}{\rightarrow} \overset{\text{ʔu-ʔułk}}{\rightarrow} \overset{\text{ʔałuk}}{\rightarrow}
\]

This is straightforward juncture insertion:

\[(114)\ \emptyset \rightarrow [ / \nu ___ (narrow interpretation)\]

A ]-juncture is inserted to the right of the nucleus (i.e. to the right of all of the timing slots associated with the nucleus). (Omission of the suffix below is simply to save space.)
The notation \( \nu \) will be used in the future for the narrow interpretation and \( \mathcal{V} \) for the broad interpretation. More generally, the symbol \( \mathcal{V} \) appearing in the environment of a juncture insertion rules will stand for the predicate which is true of timing slots linked to a nucleus, regardless of the phonemic association of the timing slot. In the same way, the symbol \( C \) will stand for the predicate which is true of timing slots which are not linked to a nucleus.

We are now in a position to propose that juncture insertion rules are always drawn from the array in (115).

(115) Possible juncture insertion rules

\[
\text{Insert } \begin{cases}
\{ \langle \rangle \} & \text{before } \mathcal{V} \times \nu \\
\{ \} & \text{after } \nu \times \mathcal{V}
\end{cases}, \begin{cases}
\text{leftmost } \nu \\
\text{rightmost } C
\end{cases} \text{ in the domain of } \rho
\]

There is one other general issue of rule application that is important for some reduplicative processes. I assume:

(116) Balancing an unpaired duplication juncture, forming a non-trivial duplicant if possible, takes precedence over leftmost or rightmost application.

The significance of (116) is illustrated by the reduplicative process used to realize plurality in Mangarayi, which has been of interest for a long time. The data is from Merlan (1982).

(117) \begin{align*}
\text{root} & \quad \text{plural} \\
\text{a. } \text{galugu} & \quad \text{galahu} \quad \text{‘poor things’} \\
\text{b. } \text{waŋgij} & \quad \text{waŋgagij} \quad \text{‘children’} \\
\text{c. } \text{jimgam} & \quad \text{jimgimgam} \quad \text{‘knowledgeable people’}
\end{align*}

The affix has a null exponent and triggers readjustment:

\[ \emptyset \rightarrow \begin{cases} \mathcal{V} \end{cases} ; \emptyset \rightarrow ] \begin{cases} \mathcal{V} \end{cases} \]

Take (117) to be an ordered list of rules. Consider, for example, its application to (117c), jimgam. First, \( \emptyset \rightarrow \begin{cases} \mathcal{V} \end{cases} \) applies to the stem and produces jimgam. Then \( \emptyset \rightarrow ] \begin{cases} \mathcal{V} \end{cases} \) applies. The leftmost application which forms a nontrivial duplicant is chosen. The result
is therefore \textit{jam}, rather than \textit{jam}. Right transcription then produces \textit{jam}.

### 5.1.1 Creek plural adjective reduplication

Riggle (2004) discusses the unusual pattern of reduplication which is used to realize adjective plurality in Creek, based on data from Haas (1977), Booker (1980), and Martin and Mauldin (2000).

\begin{align*}
\text{sing}ul\text{ar} & \quad \text{plural} \\
\text{fayät}-i: & \quad \text{fayatfak-}i: \quad \text{‘crooked’} \\
\text{cámp}-i: & \quad \text{camcap-}i: \quad \text{‘sweet’} \\
\text{lowáck}-i: & \quad \text{lowáclok-}i: \quad \text{‘soft’} \\
\text{poló:k}-i: & \quad \text{polopok-}i: \quad \text{‘round’}
\end{align*}

This is a particularly clear example of the usefulness of Default Closure in simplifying the specification of complex reduplication processes. There are two juncture insertion rules:

\[
\emptyset \rightarrow [/ \text{Right} \times, \emptyset \rightarrow [/ V \text{ ___].}
\]

Derivations follow:

\begin{align*}
\text{(119)} & \quad \text{IncIns} & \quad \text{DC} & \quad \text{TrScr} \\
\text{a. fayatk } & \quad \text{fa(yat)k} & \quad [\text{fa(yat)}k] & \quad \text{fayat fa k} \\
\text{b. camp } & \quad \text{ca(m)p} & \quad [\text{ca(m)}p] & \quad \text{cam ca p} \\
\text{c. lowack } & \quad \text{lo(wac)k} & \quad [\text{lo(wac)}k] & \quad \text{lowac lo k} \\
\text{d. poló:k } & \quad \text{po(lo:)k} & \quad [\text{po(lo:)}k] & \quad \text{polo: po k}
\end{align*}

Creek uses a special rule if the root ends in certain consonant clusters, as discussed in Section 4.5 (p. 70).

### 5.1.2 Some common juncture insertion rules

It is useful to have names for some of the common juncture insertion rules and the kind of reduplication they generate (if there are no other t-junctures except those inserted by default closure).
(120) C\*V-rule: \( \emptyset \rightarrow [ / V \_ \_ \_ \) (C\*V-reduplication)
C\*v-rule: \( \emptyset \rightarrow [ / v \_ \_ \_ \) (C\*v-reduplication)
\times\)-rule: \( \emptyset \rightarrow [ / \_ \_ \_ \_ \times \) (initial timing slot reduplication)
\times^\ast\)-rule: \( \emptyset \rightarrow [ / \_ \_ \_ \_ \_ \times \) (total reduplication)

5.2 Possible domains of reduplicative affixes

The juncture insertion rules which a reduplicative affix specifies are determined in a composite fashion. Rules drawn from the possibilities enumerated in (115) are specified, but a domain of application of these rules which differs from the stem can also be specified. A rule like

\[ \emptyset \rightarrow [ / \text{Right} V \_ \_ \_ \]

for example, has a very different effect if its domain of application is the initial foot of the stem or it is the entire stem. If an affix does not designate a special domain, the rules are assumed to apply to the stem. In other words, the stem is taken to be the default domain for juncture insertion rules. The designated (or default) domain is called the domain of the affix. The domain of a reduplicative affix can be specified on either the basis of the prosodic structure of the stem or its morphological structure. In all the examples that I am aware of in which the morphological structure of the stem is used in domain specification, a morphological constituent of the stem is designated as the domain of the affix. Most commonly, morphologically based stem designation is the root, embedded in an inflected form.

The theory of prosodically based contraction that I adopt derives from Broselow and McCarthy (1983). They argue that several varieties of reduplication are most insightfully analyzed (in the template concatenation framework that their theory is framed in) by supposing that “reduplicative morphemes may be prefixed not only to morphological but to phonological constituents, as is argued for Warlpiri prefixing reduplication by Nash (1980).” This idea was further developed by McCarthy and Prince within the framework of Prosodic Morphology as the notion of “positive prosodic circumscription.” See the discussion in McCarthy and Prince (1995:340). A key insight of Prosodic Morphology was that only special kinds of prosodic constituents could serve as the locus of affixation; those that had wordlike characteristics.
It was established that if a language imposed a prosodic minimality condition on words, the minimality requirement was that there be sufficient material to form a well-formed foot. In other words, the prosodic constituents that are “wordlike” in the appropriate sense are feet. Since I do not know of any counterexamples, I will assume that specification of a prosodic constituent as the domain of a reduplicative affix is restricted to specifying it to be the first foot: the initial foot in left to right footing, or the final foot in right to left footing.

The Yidiny reduplicative plural affix (Dixon, 1977; Nash, 1979–80) specifies the initial bisyllabic foot as its domain, has a null exponent, and triggers the $\times^*$-rule. This leads to derivations like (121).

\[
\begin{align*}
(\sigma g \times i \times n \times \sigma d \times a \times \times^* \text{-rule} & \rightarrow [\sigma g \times i \times n \times \sigma d \times a \times \\
g i n d a l b a & \rightarrow gindal gindalba)
\end{align*}
\]

Crucially, when DC applies, it must insert the $\times$-juncture in the domain, which is the initial foot. Insertion at the right edge of the domain produces a duplicant with maximal extent.

The Diyari plural affix (Austin (1981)), like the Yidiny plural affix, specifies the initial bisyllabic foot as its domain and a null exponent. Unlike Yidiny, it triggers the rule.

\[
\emptyset \rightarrow [\times \times]_{\text{Right V}}
\]

This leads to derivations like:

\[
\begin{align*}
(\sigma \times \time
Note that $\emptyset \rightarrow [ / \text{Right V } \_ \_ \text{ ]}$ applies rightmost in the domain of the affix, the initial foot.

Both the Yidiny and Diyari reduplicative plural affixes are discussed by McCarthy and Prince (1986).

### 5.2.1 Ulwa possessive
The original analysis and source of subsequent data is Hale and Lacayo Blanco (1989). Other analyses include Bromberger and Halle (1988) and McCarthy and Prince (1995). In Ulwa, various possessive morphemes are realized by affixes which, descriptively, induce infixation of an exponent characteristic of the morpheme. The position of the infix is determined by the foot structure of the stem. Footing is mora based and left to right binary. The paradigm for the 3sg possessive is given in (123). The initial foot is parenthesized.

(123) Ulwa possessive infixation

<table>
<thead>
<tr>
<th>stem</th>
<th>possessed</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(bas)</td>
<td>bas-ka</td>
<td>‘hair’</td>
</tr>
<tr>
<td>(sa.na)</td>
<td>sana-ka</td>
<td>‘deer’</td>
</tr>
<tr>
<td>(su:].lu</td>
<td>su:-ka-lu</td>
<td>‘dog’</td>
</tr>
<tr>
<td>(bas).kar.na</td>
<td>bas-ka-karna</td>
<td>‘comb’</td>
</tr>
<tr>
<td>(si.wa).nak</td>
<td>siwa-ka-nak</td>
<td>‘root’</td>
</tr>
<tr>
<td>ka.(ras).mak</td>
<td>karas-ka-mak</td>
<td>‘knee’</td>
</tr>
</tbody>
</table>

Reasonable people can differ over whether the initial foot in the last example, karasmak, is as shown or includes the first syllable. All that is relevant to the analysis here is the location of the right boundary of the initial foot.

The affix designates the initial foot as its domain, has the suffixal exponent -⟩(ka)⟩ and triggers:

(124) $\emptyset \rightarrow [ / \text{Right } \times \_ \_ \text{ ]}$

The juncture insertion rule is relativized to the designated domain of the affix, but suffixation is to the stem. Suffixation and prefixation are strictly concatenative in DR. There is no infixation per se, although from time to time the term will be used descriptively to refer to a process with a certain surface form.
A typical derivation is shown in (125). Transcription is taken to be to the left. Only the initial foot is shown.

\[ (\sigma^\mu_s \times \sigma^\mu_i \times \sigma^{\mu\mu}_w) \text{ suffix} \rightarrow (\sigma^\mu_{\text{Trscr}}) \]

(125) \[ \begin{array}{cccccccccccc}
\times \times \times \times & \times \times & \times \times & \times \times & \times \\
\text{s} & \text{i} & \text{w} & \text{a} & \text{n} & \text{a} & \text{k} & \text{k} & \text{a}
\end{array} \]

\[ (-\text{Ins} \rightarrow (\sigma^\mu_s \times \sigma^\mu_i \times \sigma^{\mu\mu}_w) \text{ DC} \rightarrow (\sigma^\mu_{\text{Trscr}}) \rightarrow \times \times \times \times \times \times \times \times \rightarrow \text{salaga laga}) \]

Note that exponent of the affix is a suffix, not an “infix” of any kind. It is the t-junctions contained in the prefix and the juncture insertion rule which its insertion triggers that cause ka to show up on the surface as an “infix.” Note also that (124) inserts a [-juncture after the rightmost timing slot of the domain.

5.2.2 Manam final foot reduplication
Manam has an affix which induces total reduplication of the final foot. Footing is quantity sensitive and right to left. The affix takes the final bimoraic foot as its domain, has a null exponent, and triggers the \( \times^* \)-rule. Two derivations follow, one with a bisyllabic final foot and one with a monosyllabic final foot.

(126) a. \[ \text{DC} \rightarrow \text{salaga laga} \]
5.2.3 Exclusion of initial unfooted material

There are many examples in which prosodically defective material at the edges of a word is excluded from the foot structure. It can therefore be excluded from the domain which a reduplicative affix designates.

5.2.3.1. Bella Coola

Bagemihl (1991: 598, 609), gives the following examples of what he calls CV reduplication in Bella Coola:

(127) a. qayt qa-qayt
   b. tqn­kt -qn­k
   c. stn­s-tn­n
   d. t’ksn­t’k-sn­n
   e. st’xwm­ st’-xwm

He argues convincingly that Bella Coola syllable structure admits at most one obstruent into the onset and that the infixing pattern (127) is a consequence of this syllable structure. Clearly, nonvocalic sonorants can be syllable nuclei.

The examples (127) illustrate two features of the discussion above. First, V in the juncture insertion rule ∅ → } / V ___ must be interpreted as being true of syllable nuclei in general, not just vowels. Second, there is domain selection. The domain of the affix which generates (127) excludes the unsyllabified initial obstruents. Derivations of some of the examples in (127) are given in (128). The domain is the initial foot, which excludes the unsyllabified initial obstruents. There is no minimal word condition in Bella Coola. The crucial point is that
Juncture Insertion (JncIns) and Default Closure (DC) are relativized to the selected domain.

<table>
<thead>
<tr>
<th></th>
<th>domain</th>
<th>JncIns</th>
<th>DC</th>
<th>Trscr</th>
</tr>
</thead>
<tbody>
<tr>
<td>qayt</td>
<td>qayt</td>
<td>qa\ yt</td>
<td>[qa\ yt]</td>
<td>qa-qayt</td>
</tr>
<tr>
<td>tqnk</td>
<td>tqnk</td>
<td>tqnk</td>
<td>[tqnk]</td>
<td>tqnk-qnqk</td>
</tr>
<tr>
<td>st'x^{m}</td>
<td>st'x^{m}</td>
<td>st'x^{m}</td>
<td>st'x^{m}</td>
<td>st'x^{m}-x^{m}</td>
</tr>
</tbody>
</table>

5.2.3.2. Orokaiva

Halle and Vergnaud’s (1987:48) discussion of Western Aranda stress showed that excluding initial onsetless syllables from the computation of foot structure is an option that UG makes available. Western Aranda has a bimoraic word minimum, so this exclusion is only available in that language when at least two moras are not excluded. In a language whose metrical structure employs this device, initial onsetless syllables can be excluded from the domain of a reduplicative affix.

Orokaiva (Healy, Isoroembo, and Chittleborough, 1969; McCarthy and Prince, 1999) has a reduplicative affix whose domain is the initial foot, whose exponent is null, and which triggers the C\textsuperscript{*}V-rule. It realizes repetitive verbal aspect. Like Western Aranda, the initial foot excludes an initial onsetless syllable, if there is one. Illustrative derivations follow:

(129) a. \[
\begin{align*}
\sigma (\sigma \sigma) \sigma & \xrightarrow{\text{C}^*\text{V-rule}} \sigma (\sigma \sigma) \sigma \\
\times \times \times \times \times \times & \xrightarrow{\text{DC}} [\times \times] \times \times \times \times \\
\h i \ i \ r \ i \ k \ e & \xrightarrow{\text{DC}} \h i \ h i r i k e \\
\end{align*}
\]

(129) b. \[
\begin{align*}
\sigma (\sigma \sigma) \sigma & \xrightarrow{\text{C}^*\text{V-rule}} \sigma (\sigma \sigma) \sigma \xrightarrow{\text{DC}} \sigma (\sigma \sigma) \\
\times \times \times \times \times & \xrightarrow{\text{DC}} \times \times \times \times \times \\
\u h \ u \ k e & \xrightarrow{\text{DC}} \u h \ u \ k e \\
\end{align*}
\]

\[
\sigma (\sigma \sigma) \sigma & \xrightarrow{\text{DC}} \sigma (\sigma \sigma) \\
\times \times \times \times \times & \xrightarrow{\text{DC}} \times \times \times \times \times \\
\u h \ u \ k e & \xrightarrow{\text{DC}} \u h \ u \ k e \\
\]

\[
\rightarrow \u h \ u \ h u k e \\
\]
5.2.3.3. Imdlawn Tashlhiyt Berber

Dell and Elmedlaoui (1988) discuss the following paradigm from Imdlawn Tashlhiyt Berber.

(130) Imperfective gemination

<table>
<thead>
<tr>
<th>root</th>
<th>imperfective</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. mrz</td>
<td>m:rz</td>
</tr>
<tr>
<td>b. frn</td>
<td>f:rn</td>
</tr>
<tr>
<td>c. rkm</td>
<td>rk:m</td>
</tr>
<tr>
<td>d. kfm</td>
<td>k:f:m</td>
</tr>
</tbody>
</table>

They argue that the contrast between initial gemination and second slot gemination is a precise reflection of syllable structure, with (130a,b) having initial syllables with onsets, (130c) having an initial onsetless syllable, and (130d) having an initial unsyllabified obstruent. Obstruents can be nuclei word internally, but not in word initial or word final position. The syllable structures are:

(131)

<table>
<thead>
<tr>
<th>a.</th>
<th>σ</th>
<th>σ</th>
<th>σ</th>
</tr>
</thead>
<tbody>
<tr>
<td>m</td>
<td>r</td>
<td>z</td>
<td></td>
</tr>
<tr>
<td>b.</td>
<td>σ</td>
<td>σ</td>
<td>σ</td>
</tr>
<tr>
<td>f</td>
<td>r</td>
<td>n</td>
<td></td>
</tr>
<tr>
<td>c.</td>
<td>σ</td>
<td>σ</td>
<td>σ</td>
</tr>
<tr>
<td>r</td>
<td>k</td>
<td>m</td>
<td></td>
</tr>
<tr>
<td>d.</td>
<td>σ</td>
<td>σ</td>
<td>σ</td>
</tr>
<tr>
<td>k</td>
<td>f</td>
<td>m</td>
<td></td>
</tr>
</tbody>
</table>

Descriptively, the first onset geminates.

Under the assumption that these stems have metrical structure (there is no word minimality) and that the leftmost left foot boundary is aligned with the leftmost syllable which has an onset, this pattern is generated by an null affix which designates the initial foot as its domain and triggers the ×-rule, θ → ] / ×__.

Transcription is to the left, the default for left edge duplicants. This is one of the few examples in which a multiply associated phoneme in the output of transcription does not violate the NCC. The imperfective geminate is the direct product of duplication, with no NCC repair. Note also that the example demonstrates fairly clearly the inadequacies of templatic approaches to reduplication. A template can
neither specify what is to be duplicated nor predict that the output is a geminate rather than simply a doubled consonant.

One final point should be noted. Ideally, the correlation between the reduplication patterns that are found in the world’s languages and the reduplication patterns that are easy to describe would be transparent. To a considerable extent, there is such a correlation. The two most widespread patterns are total reduplication and C*V-reduplication, both of which have very simple rules. But the rule which specifies initial gemination is just as simple and it is rare. Why should this be so? Juncture insertion must mesh with the rest of the phonology of the language. If transcription produces a representation which violates the syllable well-formedness conditions of a language, then substantial phonological support is needed to transform the output of transcription into an acceptable form. The implicit phonological support which may be necessary means that the complexity of a reduplication process cannot be evaluated simply on the basis of the simplicity of the juncture insertion rules involved. The reason that initial gemination is rare is not because the juncture insertion rules are complex, but because it is rare to find a language in which initial geminate consonants are allowed. Imdlawn Tashlhiyt Berber happens to be such a language.

5.3 Shortcut Repair at the reduplicant-remnant boundary

So far, this chapter has discussed the variation in reduplicative processes due to the variation in juncture insertion, factored into two components, domain selection and rule specification relativized to that domain. In most cases, NCC repair is simple phoneme fission. There are a number of languages, however, in which special rules are used to repair the transcribed structure, adding further possibilities to the range of possible reduplicative processes. Sanskrit, discussed in detail in Chapter 7, has several specialized rules of repair that contribute to the distinctive character of Sanskrit reduplication. What I call “shortcut repair” is used by several languages.

Echo reduplication in Kolami (Emeneau, 1955, McCarthy and Prince, 1995) is exemplified below:
The pattern is generated by the suffix -(gi)] coupled with the juncture insertion rule $\emptyset \rightarrow [ / \bigwedge \_ \_ \_ \_ \_\bigwedge ]$ and a special mechanism that some languages (including Kolami) use for eliminating crossing violations at the reduplicant-remnant boundary.

Examples (132a, b), with a short final vowel, are straightforward.

Now consider the case of a long final vowel, (133c, d). For sa:, for example:

Fission would yield sa:gia, with vowel hiatus, not the desired sa:gi:.

I suppose, in the case of Kolami, that crossing violations can be removed not only by fission, but also by (135), which not only eliminates a crossing violation but also eliminates vowel hiatus.
If (134) continues by eliminating the crossing violation using (135) the result is the desired:

\[
\begin{array}{cccccc}
\times & \times & \times & \times & \times & \times \\
\mid & \swarrow & \mid & \searrow & \\
\mathrm{s} & a & g & i
\end{array}
\]

Note that no vowel is lost in the final representation. At most an occurrence of a vowel is lost, but one occurrence remains. Informally, the operation can be looked at as hiatus elimination licensed by a kind of recoverability of deletion.

The repair mechanism used by Kolami at the reduplicant-remnant boundary occurs often enough to merit a designation (*Shortcut NCC Repair*) and some discussion. The usual context in which it occurs is given in (136), where a CVC reduplicant has been formed to the left of the remnant. In order to make the shortcut stand out more clearly, the first step has carried out partial NCC repair, leaving only the crossing violation at the boundary between the reduplicant and remnant unresolved. This is simply to make the shortcut operation clearer. The operation removes a crossing violation whether the other crossing violations have been removed or not.

\[
(136) \quad \begin{array}{cccccc}
\times & \times & \times & \times & \times & \times \\
\mid & \mid & \mid & \mid & \mid & \mid \\
\mathrm{C}_1 & \mathrm{V} & \mathrm{C}_2 & \mathrm{C}_1 & \mathrm{V} & \mathrm{C}_2 \\
\end{array} \rightarrow \begin{array}{cccccc}
\times & \times & \times & \times & \times & \times \\
\mid & \mid & \mid & \mid & \mid & \mid \\
\mathrm{C}_1 & \mathrm{V} & \mathrm{C}_1 & \mathrm{V} & \mathrm{C}_2 & \mathrm{C}_2 \\
\end{array}
\]

Hausa pluractional reduplication (Newman, 2000) is the clearest illustration of (136) since in many contexts either Fission or Shortcut Repair can be used, resulting in surface variation. The process copies a CVC to the left. If \(\mathrm{C}_2\) is nonsonorant and noncoronal, Shortcut Repair is obligatory, otherwise there is free variation between Fission and Shortcut Repair. In the examples below, the surface forms, in which
standard Hausa phonological rules apply after transcription, are shown in parentheses.

(137) Hausa pluractional reduplication

<table>
<thead>
<tr>
<th></th>
<th>Fission</th>
<th>Shortcut Repair</th>
</tr>
</thead>
<tbody>
<tr>
<td>fita</td>
<td>fit-fita</td>
<td>fif-fita</td>
</tr>
<tr>
<td>(fif’ita)</td>
<td></td>
<td>(fiff’ita)</td>
</tr>
<tr>
<td>gasā</td>
<td>gas-gasā</td>
<td>gag-gasā</td>
</tr>
<tr>
<td>(gargasā)</td>
<td></td>
<td>(gaggasākira)</td>
</tr>
<tr>
<td>sayā</td>
<td>say-sayā</td>
<td>sas-sayā</td>
</tr>
<tr>
<td>(saišayā)</td>
<td></td>
<td>(sassayā)</td>
</tr>
<tr>
<td>tambayā</td>
<td>tam-tambayā</td>
<td>tat-tambayā</td>
</tr>
<tr>
<td>(tantambayā)</td>
<td></td>
<td>(tattambayā)</td>
</tr>
</tbody>
</table>

‘go out’

‘roast’

‘buy’

‘ask’

In Ponapean heavy syllable reduplication, which is analyzed in detail in Chapter 6, Shortcut Repair applies if C₁ and C₂ are sonorant and C₁ is coronal, otherwise Fission applies.

(138) Ponapean durative reduplication

<table>
<thead>
<tr>
<th></th>
<th>Fission</th>
<th>Shortcut Repair</th>
</tr>
</thead>
<tbody>
<tr>
<td>liro:ro</td>
<td>‘contract’</td>
<td>*lir-liro:ro</td>
</tr>
<tr>
<td>nur</td>
<td>‘protective’</td>
<td>*nur-nur</td>
</tr>
<tr>
<td>tep</td>
<td>‘begin’</td>
<td>tep-tep (&gt;tep-tep)</td>
</tr>
</tbody>
</table>

*lil-lirliro

*nun-nur

*tet-tep
After t-junctures are inserted, operations can apply to the duplicant before transcription applies. In many languages, prosodic desiderata are imposed on the duplicant and rules specified for adjusting the duplicant so that the desiderata are satisfied. It will be important to constrain the set of possible prosodic targets and set of possible adjustment rules, so that the options made available by the theory corresponds to the range of options that are attested. Before we address that issue, however, several examples will be discussed.

6.1 Onset incorporation in Kɪhehe

In (139), ita, lima and imbila are verb roots, and ku- is an infinitival prefix. The examples are from Odden and Odden (1985).

(139) reduplicated

a. kuceéŋa ‘to build’ ku-ceenga-ceéŋa ‘to build a bit’

b. kulima ‘to cultivate’ ku-lima-lima ‘to cultivate a bit’

c. kwíta ‘to pour’ kwíta-kwíta ‘to pour a bit’

d. kwímbila ‘to sing’ kwímbila-kwímbila ‘to sing a bit’

According to O&O, “any high vowel before another vowel becomes a glide, with compensatory lengthening of the following vowel.” This
is responsible for the fusion of the infinitival prefix with the root in (139c, d).

In the theoretical framework which was available to them at the time, Marantz’s template concatenation theory, (139a,b) forced the conclusion that the template is concatenated before the prefix applies. O&O pointed out the problem raised by the duplication of the prefix in (139c,d) if the reduplicative affix is inside the infinitival prefix. Odden and Odden’s solution was to separate the operation of template concatenation from the operation of association with the template. They proposed that association with the template occurred after syllabification fused the prefix with the root and that the rules of association were formulated in such a way that material that was attached syllabically to the root was associated to the template along with the root itself. Although I do not think this analysis withstands detailed scrutiny, particularly on the question of precisely what “concatenation of a template” means, the idea that the immediate changes in the representation induced by the morphology are only a prelude to the ultimate effects that these changes lead to is an important insight which DR has incorporated.

We suppose that there is an unintensive morpheme (UNINT) which is realized after the infinitival prefix has been combined with the stem. It is realized by a reduplicative affix $\rho$ with a null exponent, which specifies the root as its domain and triggers the $\times^\ast$-rule. Nothing further needs to be said in the case of C-initial roots. I assume that transcription is to the right.

\[
\begin{array}{c}
\text{\(\left[\text{klu}\right]\ \left[\text{lima}\right]\)} \\
\text{\(\left[\text{klu}\right]\ \left[\text{lima}\right]\)} \\
\text{\(\left[\text{klu}\right]\ \left[\text{lima}\right]\)}
\end{array}
\]

(140)

With the V-initial root *ita*, for example, juncture insertion (and syllabification of the duplicant) produces (141). There is room for argument about the morphemic association of the first timing slot of
the geminate. Since it does not bear on the issue at hand, I forego discussion.

\[
\begin{array}{c}
\text{\texttt{[ku-] [ita]}} \\
\sigma \sigma
\end{array}
\]

(141)

The initial syllable of the duplicant is is onsetless. Crucially, Kihehe requires well-formed duplicant syllable structure and specifies [-Left as the mechanism to achieve it. There are two potential repairs:

\[
\begin{array}{c}
\text{\texttt{[ku-] [ita]}} \\
\sigma \sigma
\end{array}
\]

(142) a. \[
\begin{array}{c}
\times \times \times [\times \times \times ] \\
\sigma \sigma
\end{array}
\]

\[
\begin{array}{c}
k \ w \ i \ t \ a
\end{array}
\]

b. \[
\begin{array}{c}
[\times \times \times \times \times ] \\
\sigma \sigma
\end{array}
\]

\[
\begin{array}{c}
k \ w \ i \ t \ a
\end{array}
\]

The first repair yields \texttt{kwita-wita} and the second \texttt{kwita-kwita}. I assume that Kihehe chooses to align the duplicant with a morpheme boundary. In the discussion in Chapter 7 of Kinande, another Bantu language, very clear morpheme boundary effects in duplicant adjustment will be evident.

Alternatively, one might propose that Kihehe repair chooses to align the duplicant syllable structure with the stem syllable structure. Juncture insertion itself does not have access to the location of syllable boundaries in the stem in which the duplicant is embedded. But the discussion of Yaqui reduplication, later in this section, will show that prosodic adjustment can be sensitive to the prosodic structure of the whole stem. So it could be that (142b) is the result of a prosodic adjustment process which aligns the duplicant syllable structure with the stem syllable structure.

Duplicant syllabification does not necessarily supplant or obliterate stem syllable structure. They can coexist on separate tiers:
Prosodic adjustment rules are not universal. Different languages use different prosodic adjustment rules to accomplish the same prosodic objectives. Kîhehe used [-Right] to eliminate an onsetless syllable. In Asheninca Campa, discussed in detail later, [-Left] is used in some environments.

\[
\begin{array}{c}
\text{Prosodic adjustment rules are not universal. Different languages use different prosodic adjustment rules to accomplish the same prosodic objectives. Kîhehe used [-Right] to eliminate an onsetless syllable. In Asheninca Campa, discussed in detail later, [-Left] is used in some environments.}
\end{array}
\]
6.2 Augmentation of the duplicant to a heavy syllable

The prototypical heavy syllable reduplication pattern is:

\[(146) \quad \begin{align*}
\text{a.} & \quad \text{lan.tu} \rightarrow \text{lan.lan.tu} \\
\text{b.} & \quad \text{la:.nu} \rightarrow \text{la:.la:.nu} \\
\text{c.} & \quad \text{la.nu} \rightarrow \text{lan.la.nu}
\end{align*}\]

Heavy syllable reduplication has the effect of concatenating a heavy syllable *surface prefix* to the stem, regardless of the weight of the initial syllable of the stem. The term “surface prefix” is used in order to describe the surface effect, but to emphasize that the vocabulary item which results in the surface effect is not itself a prefix.

Heavy syllable reduplication attracted a great deal of attention when reduplication was first examined in a generative framework because it is clear from (146c) that the portion of the stem which is copied is not necessarily a natural constituent of the base, consisting in (146c) of the initial syllable of the stem plus the onset of the following syllable. This played an important role in Marantz’s CV template theory (1982). Subsequently, Levin’s (1985) analysis of heavy syllable reduplication in Mokilese and Hayes and Abad’s (1989) analysis of heavy syllable reduplication in Ilocano were important in establishing the inadequacy of CV templates for analyzing reduplication and supporting McCarthy and Prince’s (1986) theory of prosodic morphology.

Heavy syllable reduplication in four closely related Austronesian languages is analyzed in this section: Ilocano, Agta, Mokilese (two dialects), and Ponapean. A comparison of the differences between these closely related languages is both instructive about the sources of variation from the core pattern given in (146) and, since there has been extensive work on reduplication in these languages, useful in illuminating the special features of the DR theory of reduplication. In addition to Levin’s work on Mokilese and Hayes and Abad’s work on Ilocano, McCarthy’s (1984) and McCarthy and Prince’s (1986) work on Ponapean were important steps in the evolution of Prosodic Morphology. We begin with one of the Mokilese dialects, because the reduplication process in this dialect is the simplest. The source for a description of Mokilese is Harrison (1973, 1976).
6.2.1 Mokilese progressive
We begin with relatively simple cases before considering some complications. The analysis here takes the important analyses of Levin (1985) and McCarthy and Prince (1986) as a starting point.

\[(147)\]

\[
\begin{array}{ccc}
\text{root} & \text{progressive} & \text{source} \\
podok & p\ddot{a}d-podok & \text{‘is planting’} \\
kas\ddot{a} & kas-kas\ddot{a} & \text{‘is throwing’} \\
wadek & wad-wadek & \text{‘is reading’} \\
wia & wi-wia & \text{‘is doing’} \\
pouc\ddot{e} & pou-pouc\ddot{e} & \text{‘is connecting’} \\
da\ddot{u}li & da-da\ddot{u}li & \text{‘is passing by’}
\end{array}
\]

Assuming that the progressive forms are the result of transcribing representations with embedded t-junctures, the pretranscription sources can be deduced without difficulty and are given in the last column.

The exponent of the progressive affix is null and and that it triggers the $C^*V$-rule. Default Closure follows. The duplicant is then adjusted before transcription applies. The mechanics of the adjustment are simply stated. $\text{-Right}$ applies in the context $\text{---C}$, otherwise FCVL (First Conjunct Vowel Lengthening) applies (see Section 4.4, p. 65). Two illustrative derivations follow:

\[(148)\]

\[
\begin{array}{l}
\text{a.} \quad \times \times \times \times \quad \xrightarrow{C^*V\text{-rule}} \quad \times \times \times \times \quad \xrightarrow{\sigma^\mu} \quad [\times \times \times \times] \\
\quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad 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\quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \}
With an understanding of the mechanics, it is possible to understand the coherence of the adjustment process as being driven by a prosodic desideratum: the first conjunct of the duplicant must be a bimoraic syllable. Using the notion of a defect driven rule (DDR) introduced in Frampton (2001), it is possible to incorporate rules driven by prosodic desiderata into a derivational framework. The general form of such a rule is:

\[
desideratum :: repair \text{ rule} ; \text{ higher desiderata list}
\]

The desideratum and the higher desiderata are conditions which may or may not hold of a particular representation. Informally, the DDR

\[
d :: r ; (e_1, \ldots, e_n)
\]

applies to a representation if the representation is is defective with respect to the condition \(d\) and \(r\) can transform it into one that is not without introducing defects with respect to the specified more highly ranked desiderata. More formally, the DDR applies to \(\alpha\) to produce \(\beta\) if:
1) \(\alpha\) does not satisfy \(d\); 2) \(r\) applies to \(\alpha\) to produce \(\beta\); 3) \(\beta\) does satisfy \(d\); and 4) \(\beta\) satisfies \((e_1, \ldots, e_n)\) at least as well as \(\alpha\). The last condition means that for any \(k\) such that \(\alpha\) satisfies \(e_k\) and \(\beta\) does not, there is a \(j < k\) such that \(\beta\) satisfies \(e_j\) and \(\alpha\) does not.

This is an extension of Sommerstein’s (1974) notion of a “phonotactically driven rule”, shorn of the surface orientation of his phonology. It can be generalized to the notion of a desideratum driven rule schema (DDRS):

\[
\text{desiderata list :: repair rule list ; higher desiderata list}
\]

The rules for expanding a DDRS into an ordered list of DDRs are given in Appendix 2. The examples in this paper are simple and an informal approach to the application of a DDRS will suffice. Choose the rule application which makes the best possible repair. If two rule applications make equally good repairs, choose the highest ranked rule. DDRSs apply iteratively, with application stopping when no further repair is possible.

It is often most natural to write a desideratum in bipartite form:

\[
\text{substructure ; condition}
\]
The first term singles out some substructure of the representation and the second term specifies a condition which this substructure may or may not satisfy. In these terms, the Mokilese rule for adjusting the duplicant can be written:

(149) \text{first conjunct} ; \text{bimoraic syllable} :: [\text{-Right} \ FCVL]

There is an imprecision in the terminology which needs to be clarified. The first conjunct, as it has been defined, is a subpart of the post-transcription structure. The schema (149) applies to the pre-transcription structure. The crucial point is that conjuncts can be easily identified and manipulated in the pretranscription structure. The first conjunct is the residue in the duplicant of the left-edge truncate, if there is one, otherwise it coincides with the duplicant. The second conjunct is the residue in the duplicant of the right-edge truncate, if there is one, otherwise it coincides with the duplicant. A nuanced terminology could be introduced, with “first conjunct” distinguished from “first conjunct of the duplicant.” I will refrain from this and rely on the reader to determine the correct referents of uses of the term “first conjunct.”

The rule ordering in (149) is intrinsic. FCVL is always applicable to the result of C∗V-reduplication, since it always has a V-final duplicant and application of FCVL always brings the representation into satisfaction of the desideratum. \text{-Right} applies only in special cases. Before contrasting the formulation (149) with the formulation (148.3), we first must establish that (149) is empirically adequate. In the case of bisyllabic \text{wia}, consider:

\[
\begin{array}{c}
\xrightarrow{\text{\text{w}} \text{i} \text{a}} \\
\xrightarrow{\text{\text{w}} \text{i} \text{a}} \\
\xrightarrow{\text{\text{w}} \text{i} \text{a}}
\end{array}
\]

This is not a repair, because the output does not satisfy the desideratum. The alternative is:

\[
\begin{array}{c}
\xrightarrow{\text{\text{w}} \text{i} \text{a}} \\
\xrightarrow{\text{\text{w}} \text{i} \text{a}} \\
\xrightarrow{\text{\text{w}} \text{i} \text{a}}
\end{array}
\]

This is a repair since the desired prosodic shape results.
The examples with surface diphthongs (pouce, dauli) are less clearcut. McCarthy and Prince speculate that at the relevant level of syllabification the surface vowel-glide sequence is in fact a bisyllabic vowel-vowel sequence. If so, then the same considerations that applied to wia also apply to examples likeouce, which appear at the surface with a diphthong. The “relevant level” here is the syllabification of the duplicant, considered independently from the syllabification of the word it is embedded in. Alternatively, it could be that the vowel sequences are diphthongs at the relevant level, but a somewhat modified DDR itself is responsible for excluding diphthongs from the surface prefix. The modified DDR would be:

```
first conjunct ; bimoraic syllable :: [ ]-Right
               FCVL ; *Diphthong
```

In this formulation, the exclusion of diphthongs from the duplicant is built into the DDR which establishes the material to be copied by transcription.

The use of [ ]-Right in prosodic adjustment to bimoraicity is common, but a language can choose not to use it. Consider, in this context, how reduplication in Mokilese would change if the rule [ ]-Right in (149) were lost. Then, FCVL would always apply, and the surface pattern generated would be:

\[(150) \quad \begin{array}{ll}
\text{stem} & \text{progressive} \\
\text{a.} & \text{p}d\text{ok} \quad \text{p}\tilde{\text{e}}:\text{p}d\text{ok} \\
\text{b.} & \text{ka}s\tilde{\text{e}} \quad \text{ka}:-\text{ka}s\tilde{\text{e}} \\
\text{c.} & \text{wa}d\text{ek} \quad \text{wa}:-\text{wa}d\text{ek} \\
\text{d.} & \text{wia} \quad \text{w}i:-\text{wia} \\
\text{e.} & \text{ouce} \quad \text{p}o:-\text{ouce}
\end{array}\]

This pattern does in fact occur as a recent innovative dialect of Mokilese discussed by Blevins (1996).\(^1\) It is a straightforward example of diachronic change by rule loss. Prosodic adjustment has lost one of its repair options.

### 6.2.2 Complications in Mokilese progressive reduplication

There are a few complications. Only one of them requires any amendment to the analysis above. The others simply require an explication
of the interaction of some particularities of Mokilese phonology with reduplication. We need to start with one of these particularities, however, because an understanding of it is needed before we can discuss the more serious complication.

6.2.2.1. C?-sequences which are not morpheme internal

Although the Austronesian languages studied in this section have occasional morpheme internal C? sequences, such sequences are generally eliminated otherwise. This affects reduplication of ?-initial roots, since the surface prefix that reduplication creates will often be C-final, creating a C? sequence which is not morpheme internal. Several different mechanisms are used for repairing C? sequences that are created derivationally. In Mokilese, the phoneme ? is deleted (not its timing slot) and the consonant spreads to the bare timing slot which remains, creating a geminate. The rule is:

```
  x  x
  C ?
```

In Agta (obligatorily) and Ilocano (optionally), the timing slot associated with the glottal stop is simply deleted. Resyllabification then takes place. In Ponapean, the glottal stop is replaced by a y-glide. Resyllabification then takes place, vocalizing the glide.

The three different strategies that are employed are illustrated in (151), the starting point in each case is the product of heavy syllable reduplication of ?alu:

```
  σ  σ  σ
  x x x x x x
  ? a l ? a l u
```

(151) Varieties of C?-elimination

<table>
<thead>
<tr>
<th>Mokilese-A</th>
<th>Agta, Ilocano</th>
<th>Ponapean</th>
</tr>
</thead>
<tbody>
<tr>
<td>C?-elimination</td>
<td>?al.la.lu</td>
<td>?al.ʃa.lu</td>
</tr>
<tr>
<td>resyllabification</td>
<td>?a.la.lu</td>
<td>?a.li.a.lu</td>
</tr>
</tbody>
</table>
Note the opacity of heavy syllable reduplication process in Agta, Ilocano, and Ponapean. All have light initial syllables on the surface.

As a consequence of $C? \to C$ in Mokilese, we have:

\[(152)\]

<table>
<thead>
<tr>
<th>stem</th>
<th>progressive</th>
<th>gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>?onop</td>
<td>?on-nonop</td>
<td>*?on-?onop</td>
</tr>
<tr>
<td>?alu</td>
<td>?al-lalu</td>
<td>*?al-?alu</td>
</tr>
</tbody>
</table>

I will use “$C?-\text{reduction}$” as a general term for the process, which takes different forms in the different languages.

### 6.2.2.2. Double reduplication

The surface pattern of the progressive forms of monosyllabic roots is strikingly different than the pattern for bisyllabic roots.

\[(153)\]

<table>
<thead>
<tr>
<th>root</th>
<th>progressive</th>
</tr>
</thead>
<tbody>
<tr>
<td>pa</td>
<td>pa:pa:pa</td>
</tr>
<tr>
<td>?ir</td>
<td>?ir-rir</td>
</tr>
<tr>
<td>ca:k</td>
<td>ca:ca:ca:k</td>
</tr>
</tbody>
</table>

It is clear that reduplication is iterated. The issue is how this is enforced by the morphology. I assume that there is allomorphy, with lexical insertion sensitive to the prosodic characteristics of the stem. In the case of a monosyllabic root, juncture insertion $\emptyset \to [\ ] / V$ applies in place of $\emptyset \to [\ ] / V$. Example (152a) is more subtle. It shows that prosodic adjustment can be interwoven with transcription.

\[(154)\]

\[
\begin{align*}
\text{JncIns} & \quad \text{pa} \quad \to \quad [\text{pa}] \\
\text{DC} & \quad [\text{pa}] \quad \to \quad [[[\text{pa}]]) \\
\text{PrAdj (FCVL)} & \quad [[[\text{pa}]]) \quad \to \quad [[[\text{pa}(a)]) \\\n\text{Inner Trscr} & \quad [[[\text{pa}(a)])] \quad \to \quad \text{paa}[\text{pa}] \\
\text{PrAdj (FCVL)} & \quad \text{paa}[\text{pa}] \quad \to \quad \text{paa}[\text{pa}(a)] \\
\text{Outer Trscr} & \quad \text{paa}[\text{pa}(a)] \quad \to \quad \text{paa paa[pa]} \\
\end{align*}
\]

As in the illustrations of nested duplicant transcription in Chapter 4, the duplicant being transcribed is boxed on the left. On the right, the reduplicant is shaded and the remnant (what is left in the box) is boxed.
The interweaving of prosodic adjustment and transcription in (154) suggests that prosodic adjustment should be viewed as a precondition for transcription and that the cyclic structure of the transcription of nested duplicants induces a cycle of prosodic adjustment. Transcription is cyclic, working from the inside out. Inner duplicants are transcribed first. Each cycle of transcription is preceded by prosodic adjustment, if necessary.

This explains the mechanics of double reduplication in Mokilese. There is allomorphy, with a different juncture insertion rule used for monosyllabic roots. Finally, it is worth noting that Mokilese double reduplication sharply illuminates the limitations of OT approaches to morphophonology. It is clear that what is happening in Mokilese double reduplication is that an operation is applying twice. OT has no means for even talking about something happening twice, because it rejects the idea of things happening in sequence.

6.2.2.3. Prenazalized geminates
There is one last example which requires discussion.

(155) stem progressive

?andip  ?an-dandip  *?an-nandip (< ?an-?andip) ‘is spitting’

If nd is taken to be a consonant sequence, the duplicant would extend to the second vowel and the prosodic adjustment rule proposed above would be inadequate. Raimy (2000), however, argued that nd is a prenasalized geminate. We adopt this proposal. The derivation is then straightforward.

(156) \[
\sigma \sigma \sigma \sigma \sigma \sigma \sigma \sigma \sigma \sigma \\
\text{T&R} \quad \text{C?-reduction} \\
\begin{array}{cccc}
\times & \times & \times & \times \\
\text{i} & \text{a} & \text{n} & \text{d} \\
\end{array} \quad \begin{array}{cccc}
\times & \times & \times & \times & \times & \times & \times & \times \\
\text{i} & \text{a} & \text{n} & \text{d} & \text{i} & \text{p} \\
\end{array} \quad \begin{array}{cccc}
\times & \times & \times & \times & \times \\
\text{i} & \text{a} & \text{n} & \text{d} & \text{a} & \text{n} & \text{d} & \text{i} & \text{p} \\
\end{array}
\]
Order on the phoneme tier is not covertly used in the last step. Replacing \(?\) with a link to \(d\) is the only way to satisfy the syllable conditions in Mokilese.

6.2.3 Agta
In Agta, \(C?\)-reduction is simply deletion of the \(?\)-slot. \(C\) becomes an onset after resyllabification.

(157) Agta plural and diminutive

<table>
<thead>
<tr>
<th>root</th>
<th>gloss</th>
<th>reduplicated gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\mathit{?atu})</td>
<td>‘dog’</td>
<td>(\mathit{?at-\text{atu}}) ‘puppy’</td>
</tr>
<tr>
<td>(\mathit{balata\mathchar'26\mkern-1mu\mathchar'46})</td>
<td>‘girl’</td>
<td>(\mathit{bal-balata\mathchar'26\mkern-1mu\mathchar'46}) ‘little girl’</td>
</tr>
<tr>
<td>(\mathit{?ulu})</td>
<td>‘head’</td>
<td>(\mathit{?ul-ulu\ (da)}) ‘(their) heads’</td>
</tr>
<tr>
<td>(\mathit{?uffu})</td>
<td>‘thigh’</td>
<td>(\mathit{?uf-uffu}) ‘thighs’</td>
</tr>
</tbody>
</table>

A representative derivation follows:

(158) \[ \mathit{x \ x \ x \ x} \rightarrow \mathit{[\ x \ x \ ]\ x \ x} \rightarrow \mathit{[\ x \ x \ x]}\ x \]
\[ \mathit{? \ a \ t \ u} \rightarrow \mathit{? \ a \ t \ u} \rightarrow \mathit{? \ a \ t \ u} \]

\[ \mathit{T&R} \rightarrow \mathit{x \ x \ x \ x \ x \ x} \rightarrow \mathit{x \ x \ x \ x \ x} \]
\[ \mathit{? \ a \ t \ ? \ a \ t \ u} \rightarrow \mathit{? \ a \ t \ a \ t \ u} \]

Note the opacity in this derivation. The heavy syllable which is transcribed loses a mora in resyllabification and the output consists of light syllables. The prosodic condition which drives prosodic adjustment is not satisfied at the surface.

6.2.4 Ilocano
Given the discussions above, most of the facts of Ilocano heavy syllable reduplication follow directly. We begin with the straightforward examples.
Prosodic Adjustment

(159) Ilocano plural and verbal progressive

a. kal diŋ ‘goat’
   kal kal diŋ ‘goats’

b. jyanitor ‘janitor’
   jyan-jyanitor ‘janitors’

c. pusa ‘cat’
   pus-pusa ‘cats’

d. trabaho ‘to work’
   trab-trabaho ‘is working’

e. saŋgit ‘to cry’
   saŋ-saŋgit ‘is crying’

f. ?aso ‘dog’
   ?as-aso, ?as-aso ‘dogs’

g. dait ‘to sew’
   da:-da?it ‘is sewing’

Note the variant forms in (159f). C?-sequences arising from transcription are only optionally eliminated. When they are, the derivation proceeds just as in Agta. Note also that J-Right does not apply in (159g). This is the same restriction on J-Right that was seen in Mokilese-A.

Juncture shift is prohibited from bringing a vowel sequence into the duplicant. Instead, FCVL is used to augment the duplicant to a heavy syllable. The root internal glottal stop in (159g) is inserted by a late rule, distinct from cyclic glottal stop insertion at the left edge of vowel-initial stems.

There are two particularities of Ilocano heavy syllable reduplication which need to be discussed. First, as in Mokilese, there is a quirk in prosodic adjustment to a bimoraic syllable duplicant when the stem is monosyllabic.

(160) a. trak ‘truck’
   tra:-trak (*trak-trak) ‘trucks’

b. bas ‘bus’
   ba:-bas (*bas-bas) ‘buses’

c. nars ‘nurse’
   na:-nars (*nar-nars) ‘nurses’

In these examples, J-Right does not apply for some reason, so FCVL is used instead to augment the duplicant to a heavy syllable. The conditions under which J-Right is blocked are clear, but the motivation for blocking J-Right with monosyllabic stems is not.

Second, there is variation for polysyllabic stems with a consonant-glide complex onset.

(161) a. bwaya ‘crocodiles’
   bu:-bwaya, bway-bwaya, bu-bwaya

b. pyano ‘pianos’
   pi:-pyano, pyan-pyano, pi-pyano

c. dwa ‘two’
   du:-dwa (no variation)
The first two examples, with a three way variation in the surface form, are from Boersma and Hayes (2001), who undertake a major study of how variation of this kind can be analyzed in OT terms. Hayes and Abad (1989), from which (161c) is taken, note that there is no variation for monosyllabic stems.

First, we consider the three-way variation in (161a,b). Following Hayes and Abad, I assume that the \( y \)-glides in (161) are melodically identical to \( i \)-vowels. Some of the variation in (161a,b) can be attributed to varying underlying syllabification. Consider (161b), for example, where \( y/i \) orthography will be used to make the syllabic role clearer.

The two possibilities lead to the derivations below.

```
(163) a. \( \sigma \times \times \times \times \sigma \times \times \times \times \sigma \)
\[ p i a n o \]
\( \rightarrow \) \( p i i [p]a n o \rightarrow p i p y a n o \)

b. \( \sigma \times \times \times \times \times \times \times \times \times \times \sigma \)
\[ p y a n o \]
\( \rightarrow \) \( p y a n [p y a n] o \rightarrow p y a n p y a n o \)
```

Note that \( \text{J-Right} \) is blocked in (163a) because its application would produce vowel hiatus in the duplicate.

The third variation, \( p i p y a n o \) in (161b), is the result of complex onset reduction which is independent of reduplication; possible after a heavy open syllable.
Compensatory shortening (like keep + t → kep-t in English verbal morphophonology) follows resyllabification.

Finally, we can address the invariability of the reduplicated form of a monosyllabic stem with a consonantal-glide onset, (161c) above. Ilocano has a bimoraic minimal word phonotactic. This rules out underlying monomoraic (165a), so the reduplicative morpheme combines only with bimoraic (165b). The result is that only du:dwa surfaces.

6.2.5 Ponapean

We now turn to the complexities of durative reduplication in Ponapean, which were unraveled by McCarthy (1984) and McCarthy and Prince (1986), based on the data and analysis of Rehg and Sohl (1981). Again, we temporarily bypass the complexities of V-initial roots (?-initial at the surface) and restrict our attention to C-initial roots. The puzzle is that the duplicant is sometimes bimoraic, sometimes monomoraic.

(166) a. pa pa:-pa ‘weave’
b. mi mii-ma ‘exist’
c. mem mem-mem ‘sweet’
d. kaŋ kaŋ-kaŋ ‘eat’
f. mi:k mi-mi:k ‘suck’ *mi:-mi:k
g. ma:-mn ma-mand ‘tame’ *man-mand
h. leŋk le-leŋk ‘acrophobic’ *leŋ-leŋk, *len-leŋk
The generalization which McCarthy extracted from this was that light monosyllable stems undergo heavy syllable reduplication, and that heavy monosyllable stems undergo light syllable reduplication, with the crucial insight that word final consonants do not count in determining syllable weight. He called this phenomenon “complementarity.”

In DR terms, the difference between (166a–d) and (166e–h) is that in the later examples there is no prosodic adjustment. Specifying the class of stems for which prosodic adjustment is annulled is not straightforward, as the following examples show:

(167)  
a. duːpek duː-ːduːpek ‘starved’ 
b. nɔːroːk nɔː-ːnɔːroːk ‘greedy’ 
c. maːsaːs ma-maːsaːs ‘cleared of vegetation’ 
d. toːroːr to-toːroːr ‘be independent’ 
e. waːntuːke wa-waːntuːke ‘count’ 
f. liaːn liː-liːan ‘outgoing’

McCarthy deduced that the conditions under which the duplicant is monomoraic are related to the foot structure. We do not follow his analysis, but exploit its core idea. If footing is moraic, right to left, and final C is taken to be extraprosodic, as suggested by McCarthy, it is plausible that the foot structures of the examples (168) are as given in the second column. Suppose also that the initial foot is taken to be the domain of the r-affix. The derived prefix which is actually produced by heavy syllable reduplication is given in the last column.

(168)  
<table>
<thead>
<tr>
<th>root</th>
<th>reduplicated</th>
<th>foot structure</th>
<th>initial foot</th>
<th>surface prefix</th>
</tr>
</thead>
<tbody>
<tr>
<td>kaŋ</td>
<td>kaŋ-kaŋ</td>
<td>(ka)ŋ</td>
<td>ka</td>
<td>kaŋ</td>
</tr>
<tr>
<td>mand</td>
<td>ma-maːnd</td>
<td>(maːnd)</td>
<td>ma</td>
<td>ma</td>
</tr>
<tr>
<td>duːpek</td>
<td>duː-duːpe</td>
<td>(duːpe)k</td>
<td>duː:pe</td>
<td>duː:</td>
</tr>
<tr>
<td>maːsaːs</td>
<td>ma-maːsaːs</td>
<td>(maː)(saː)s</td>
<td>maː</td>
<td>ma</td>
</tr>
<tr>
<td>waːntuːke</td>
<td>wa-waːntuːke</td>
<td>(waː)(tuːke)</td>
<td>waː</td>
<td>waː</td>
</tr>
<tr>
<td>liaːn</td>
<td>liː-liːan</td>
<td>(liaː)n</td>
<td>liː:</td>
<td>liː:</td>
</tr>
</tbody>
</table>

When the data is organized in this way, it is easy to see that there is no prosodic adjustment when the initial foot is a heavy syllable. This accounts for all of the examples above. What this accomplishes is to
avoid reduplicated forms in which the two initial feet are prosodically identical. The motivation for this is obscure. If stress were iambic, it might be seen as a way to avoid stress clash. But footing patterns which admit heavy-light syllable feet rarely go along with iambic stress. Since the Ponapean footing and stress system is not well-known, I will leave unresolved the question of why Ponapean reduplication is organized so that sequences of two heavy syllable feet at the left edge are avoided. Note that sequences of two heavy syllables can be generated (du:-du:pek for example), but only when the second heavy syllable is footed with a light syllable to its right.

Ponapean has a number of verb roots with an initial nasal geminate or prenasalized geminate. The first portion of the geminate surfaces as a syllable nucleus. Two derivations follow, with DUR the durative morpheme:

\[
\begin{align*}
\text{(169) a. } & \quad \begin{array}{c}
\sigma \\
\sigma \\
\oplus \text{DUR}
\end{array} \quad \begin{array}{c}
\sigma \\
\sigma \\
\PrAdj
\end{array} \quad \begin{array}{c}
\sigma \\
\sigma \\
\text{PrAdj}
\end{array} \\
\begin{array}{c}
\times \times \times \times \\
\times \times \times \times \\
\times \times \times \times \\
? \quad m \quad e \quad d
\end{array} & \quad \begin{array}{c}
[\times \times] \times \times \\
[\times \times] \times \times \\
[\times \times] \times \times \\
? \quad m \quad e \quad d
\end{array} & \quad \begin{array}{c}
[\times \times \times] \times \times \\
[\times \times \times] \times \times \\
[\times \times \times] \times \times \\
? \quad m \quad e \quad d
\end{array}
\end{align*}
\]

T&R \quad \begin{array}{c}
\sigma \\
\sigma \\
\sigma \\
C?\text{-Repair}
\end{array} \quad \begin{array}{c}
\sigma \\
\sigma \\
\sigma \\
\sigma \\
\sigma
\end{array} \\
\begin{array}{c}
\times \times \times \times \times \times \\
? \quad m \quad ? \quad m \quad e \quad d
\end{array} & \quad \begin{array}{c}
\times \times \times \times \times \times \\
? \quad m \quad y \quad m \quad e \quad d
\end{array}

\begin{align*}
\text{resyllab.} & \quad \begin{array}{c}
\sigma \\
\sigma \\
\sigma \\
\sigma
\end{array} \quad \begin{array}{c}
\sigma \\
\sigma \\
\sigma \\
\sigma
\end{array} \\
\begin{array}{c}
\times \times \times \times \times \times \\
? \quad m \quad i \quad m \quad e \quad d
\end{array} & \quad (\text{?m.mim.med})
\end{align*}

\[
\begin{align*}
\text{(169) b. } & \quad \begin{array}{c}
\sigma \\
\sigma \\
\oplus \text{DUR}
\end{array} \quad \begin{array}{c}
\sigma \\
\sigma \\
\PrAdj
\end{array} \quad \begin{array}{c}
\sigma \\
\sigma \\
\text{PrAdj}
\end{array} \\
\begin{array}{c}
\times \times \times \times \\
\times \times \times \times \\
\times \times \times \times \\
? \quad N d \quad a
\end{array} & \quad \begin{array}{c}
[\times \times] \times \times \\
[\times \times] \times \times \\
[\times \times] \times \times \\
? \quad N d \quad a
\end{array} & \quad \begin{array}{c}
[\times \times \times] \times \times \\
[\times \times \times] \times \times \\
[\times \times \times] \times \times \\
? \quad N d \quad a
\end{array}
\end{align*}
\]

T&R \quad \begin{array}{c}
\sigma \\
\sigma \\
\sigma \\
\sigma \\
\sigma
\end{array} \quad \begin{array}{c}
\sigma \\
\sigma \\
\sigma \\
\sigma \\
\sigma
\end{array} \\
\begin{array}{c}
\times \times \times \times \times \times \\
? \quad N d \quad ? \quad N d \quad a
\end{array} & \quad \begin{array}{c}
\times \times \times \times \times \times \\
? \quad N d \quad y \quad N d \quad a
\end{array}

\begin{align*}
\text{resyllab.} & \quad \begin{array}{c}
\sigma \\
\sigma \\
\sigma \\
\sigma
\end{array} \quad \begin{array}{c}
\sigma \\
\sigma \\
\sigma \\
\sigma
\end{array} \\
\begin{array}{c}
\times \times \times \times \times \times \\
? \quad N d \quad i \quad N d \quad a
\end{array} & \quad (\text{?n.din.da})
\end{align*}
Finally, there are processes at the reduplicant-remnant boundary which must be accounted for. In the examples below, taken from Davis (2002), the root has the form $C_1 VC_2 \ldots$ and, according to the analysis developed up to this point, we expect a reduplicated form:

$$C_1 VC_2, C_1 VC_2 \ldots$$

The expectation is fulfilled if $C_1 = C_2$ and they are both sonorant.

\begin{tabular}{llll}
\hline
root & expected & actual \\
\hline
rer & ‘tremble’ & rer-rer & rer-rer \\
lal & ‘make a sound’ & lal-lal & lal-lal \\
\hline
\end{tabular}

If $C_1$ and $C_2$ are not identical, or if they are not both sonorant, a modification occurs:

\begin{tabular}{llll}
\hline
root & expected & actual \\
\hline
2. If $C_1$ is a coronal sonorant and $C_2$ is a coronal sonorant & liro:ro & ‘protective’ & lir-liro:ro & lil-liro:ro \\
nur & ‘contract’ & nur-nur & nun-nur \\
3. else if $C_1 = C_2$ & tit & ‘build a wall’ & tit-tit & tin-tit \\
kak & ‘able’ & kak-kak & kan-kak \\
4. else if $C_1$ is a coronal obstruent and $C_2$ is a coronal sonorant & tar & ‘strike (of fish)’ & tar-tar & tan-tar \\
tilep & ‘mend a root’ & til-tilep & tin-tilep \\
5. else & tep & ‘kick’ & tep-tep & tepe-tep \\
tep & ‘begin’ & tep-tep & tepi-tep \\
kak & ‘able’ & ker-ker & kere-ker \\
\hline
\end{tabular}

Rehg and Sohl (1981) give an account of (171) that depends crucially on two reduplication specific rules operating at the reduplicant-remnant boundary.² The reduplication specificity suggests that the anomalies may be an aspect of NCC repair. Indeed, if we assume that Shortcut Repair (see Section 5.3) occurs at the reduplicant-remnant boundary in (171.1–4), we can account for all the data in (171). This requires Shortcut Repair to apply if $C_1$ and $C_2$ are identical, or if they are both coronal and $C_2$ is sonorant.
We examine the cases in (171) in turn. First, note that in (171.1), NCC repair produces a geminate coda-onset sequence, rather than a sequence of identical consonants. The examples in (171.2) require no comment, since they are the expected result of Shortcut Repair. In the remaining cases, Ponapean syllable structure repair rules come into play. Ponapean requires codas which are not word final to be sonorants which share place with a following onset. If a coda-onset sequence is a sonorant geminate, as it is in the examples in (171.2), no repair is needed. If it is an obstruent geminate, the syllable structure is repaired by nasalizing the geminate, producing a prenasalized geminate.

\[
\begin{array}{c}
\alpha \times \alpha \\
\times \times \\
\end{array} \rightarrow
\begin{array}{c}
\alpha \\
\alpha \times \times \\
\end{array}
\]

Shortcut repair produces such a geminate in the examples in (170.3) and (170.4). Syllable repair accounts for the surface form. A typical derivation is given below.

(172)  
\[
\begin{array}{c}
\times \times \times \times \times \\
t \times \times \times \\
\end{array} \rightarrow
\begin{array}{c}
\sigma \\
t \times \times \times \\
\end{array} \rightarrow
\begin{array}{c}
\sigma \\
t \times \times \times \\
\end{array}
\]

In the remaining cases, although there is a violation of the syllable well-formedness conditions, Shortcut Repair cannot apply. Instead, repair is vowel epenthesis, as illustrated below:

(173)  
\[
\begin{array}{c}
\times \times \times \times \times \\
t e p \\
\end{array} \rightarrow
\begin{array}{c}
\sigma \\
t e \times \times \times \times \\
\end{array} \rightarrow
\begin{array}{c}
\sigma \\
t e \times \times \times \times \\
\end{array} \rightarrow
\begin{array}{c}
\sigma \\
t e \times \times \times \times \times \times \\
\end{array}
\]

Determining the quality of the inserted vowel is a complex issue, subject to some lexical specification. It is usually, but not always, a copy of the following vowel. See Rehg and Sohl, p. 91. The different outcomes for \textit{tep} ‘kick’ and \textit{tep} ‘begin’ in (171.5) demonstrate the need for at least some lexical specification.
6.3 C-finality as a secondary prosodic desideratum

The core of weight based stress theory is built around mora count. But secondary weight distinctions play a role in some stress systems. The same is true of reduplicative prosodic adjustment. This section discusses C-finality as a secondary prosodic desideratum in Lardil, Yaqui, and Nuu-chah-nulth. It all three cases, coda consonants do not contribute to syllable weight, but reduplicants are C-final when possible.

6.3.1 Lardil iterative reduplication

The key data is given below:

(174) Lardil iterative reduplication

<table>
<thead>
<tr>
<th>root</th>
<th>iterative</th>
<th>gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>kele</td>
<td>kele-kele</td>
</tr>
<tr>
<td>b.</td>
<td>la</td>
<td>la:-la</td>
</tr>
<tr>
<td>d.</td>
<td>pareli</td>
<td>parel-pareli</td>
</tr>
</tbody>
</table>

On the basis of minimal word and stress considerations, Wilkinson (1988) showed that Lardil footing is mora based, with CV(C) syllables monomoraic and CVV(C) syllables bimoraic. The affix which realizes iterative has a null exponent, specifies the initial moraic foot as its domain, and triggers the \( \times^* \)-rule. After juncture insertion and default closure, but before prosodic adjustment, the structures of the examples in (174) are:

(175)  

<table>
<thead>
<tr>
<th></th>
<th>a. ( \sigma^H )</th>
<th>( \sigma^H )</th>
<th>b. ( \sigma^H )</th>
<th>( \sigma^H )</th>
<th>( \sigma^H )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( \times \times \times \times )</td>
<td>( \times \times \times \times \times )</td>
<td>( \times \times \times \times \times )</td>
<td>( \times \times \times \times \times )</td>
<td>( \times \times \times \times \times )</td>
</tr>
</tbody>
</table>
|   | \( \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times \times 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is the same and the repair rules are the same. The one difference is that there is a secondary desideratum, C-finality. Transcription is to the left, the default for left-edge duplicants. The prosodic adjustment rule is:

\[(176) \quad \text{First Conjunct:} \quad \left[ \begin{array}{c} \text{bimoraic} \\ \text{C-final} \end{array} \right] \vdash \left[ \begin{array}{c} \text{}-\text{Right} \\ \text{FCVL} \end{array} \right] \]

Prosodic adjustment in (175) produces:

\[(177) \quad \begin{array}{ll}
\text{a.} & \sigma^{\mu} \sigma^{\mu} \\
\text{k e l e} & \sigma^{\mu} \sigma^{\mu} \\
\text{p a r e l i} & \sigma^{\mu} \\
\text{n a l i} & \langle \rangle \\
\end{array} \]

In (175a), the duplicant is bimoraic, but not C-final. No prosodic adjustment is possible, however, because neither of the repair rules produces a C-final first conjunct. The duplicant satisfies the bimoraicity weight desideratum in (175b) and (175c), but is not C-final in either case. -Right produces the desired C-final reduplicant, as shown in (177b) and (177c), without violating the primary bimoraicity desideratum. The representation (175d) satisfies neither the bimoraicity desideratum nor the C-final desideratum. First Conjunct Vowel Lengthening produces (177d), which satisfies the primary desideratum, but no repair is available which could produce C-finality.

6.3.2 Adjustment to C-finality in Nuu-chah-nulth

The reduplication pattern triggered by Class I-1 suffixes in Nuu-chah-nulth (repeated from Section 3.5; see also (113) in Chapter 5) is illustrated below, with the suffix -λα.

\[(178) \quad yacmil \rightarrow yac-yacmil-\lambda \alpha, \quad ?u\tilde{s} \rightarrow ?u\tilde{u}\tilde{s} \rightarrow ?u\tilde{u}\tilde{s} \rightarrow \lambda \alpha \]
The suffix triggers the $C^*\nu$-rule and, after Default Closure, the duplicant is adjusted to $C$-finality using $]-$Right.

(179)  

<table>
<thead>
<tr>
<th>Rule</th>
<th>Stems</th>
<th>Reduplicated</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C^*\nu$-rule</td>
<td>ya</td>
<td>c</td>
</tr>
<tr>
<td>DC</td>
<td>[ya</td>
<td>c</td>
</tr>
<tr>
<td>PrAdj</td>
<td>[yac</td>
<td>mil-\lam</td>
</tr>
<tr>
<td>Trscr</td>
<td>yac</td>
<td>yac</td>
</tr>
</tbody>
</table>

6.3.3 C-finality in Yaqui light syllable reduplication

In Section 4.4.1.1, various Yaqui reduplicative verbal affixes were introduced. Consideration of one variety, light syllable reduplication, was restricted to stems whose initial syllable is CV, which is doubled by the reduplication process. Some examples are repeated here:

(180)  

<table>
<thead>
<tr>
<th>Stem</th>
<th>Reduplicated</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. vu.</td>
<td>sa</td>
<td>vu.vu.</td>
</tr>
<tr>
<td>b. he.</td>
<td>wi.</td>
<td>te</td>
</tr>
<tr>
<td>c. ko.</td>
<td>a.</td>
<td>rek</td>
</tr>
<tr>
<td>d. chi.</td>
<td>ke</td>
<td>chi.chi.</td>
</tr>
</tbody>
</table>

If a more complete range of stems is considered, there are very interesting complications.

(181)  

<table>
<thead>
<tr>
<th>Stem</th>
<th>Reduplicated</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>CVC initial syllable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. chuk.</td>
<td>ta</td>
<td>chuk.chul.</td>
</tr>
<tr>
<td>b. chep.</td>
<td>ta</td>
<td>chep.chep.</td>
</tr>
<tr>
<td>c. bwal.</td>
<td>ko.</td>
<td>te</td>
</tr>
<tr>
<td>d. vui.</td>
<td>te</td>
<td>vui.vui.</td>
</tr>
<tr>
<td>CVV initial syllable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e. wa</td>
<td>á.</td>
<td>te</td>
</tr>
<tr>
<td>f. kaá.</td>
<td>te</td>
<td>ka-káate</td>
</tr>
<tr>
<td>CVV initial syllable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>g. ká.</td>
<td>a.</td>
<td>te</td>
</tr>
<tr>
<td>h. wá.</td>
<td>a.</td>
<td>te</td>
</tr>
</tbody>
</table>

We first peel away the aspects of (181) that are the consequence of general features of Yaqui phonology and unrelated to the reduplication
process itself. Accent is on the second mora in Yaqui unless the root is lexically specified as initial accenting, in which case it is on the initial mora. Reduplicated forms inherit the accentual type of the stem. This is responsible for the accent placement in (181e-h). Long vowels shorten unless one of their legs is accented, producing a short vowel in the remnant in (181g-h). Finally, the glide status of i in (181d) was confirmed by Demers, Escalante, and Jelinik (1999), on the basis of spectrographic analysis.

What remains for the theory of reduplication to account for is the core paradigm:

(182) \[stem \quad reduplicated\]
   a. chi.ke    chi-chi.ke
   b. chuk.ta   chuk-chuk.ta
   c. kaa.te    ka-kaa.te

On the basis of (182a) and (182b), we can surmise (along with Yaqui children learning their language) that juncture insertion is the C∗V-rule and that (182b) must be the result of prosodic adjustment. On the basis of their analysis of the accentual system, Demers, Escalante, and Jelinik (1999) concluded that CV(C) were light and CVV(C) syllables were heavy. Prosodic adjustment is therefore to C-finality, just as in Lardil and Nuu-chah-nulth Class-1 reduplication. The problem is to account for why J-Right does not apply in (182a).

Prosodic adjustment can be sensitive to the prosodic structure of the stem that the duplicant is embedded in. Examples are rare, but Ponapean provides one clear example. Yaqui provides a second example. Prosodic adjustment is constrained so that duplicant is contained in the initial syllable of the stem. Call the relevant constraint the Initial Syllable Duplicant Condition (ISDC): the duplicant must be contained in the initial syllable of the stem. We can then write the prosodic adjustment rule as:

(183) First Conjunct ; C-final :: J-Right ; ISDC

C-finality as a secondary prosodic desideratum: All the examples of C-finality as a first conjunct prosodic desideratum which were considered above are from languages in which coda consonants are nonmoraic. I
will assume that this is not accidental and follows from the primacy of weight in prosodic adjustment. Specifically, I assume that:

(184) Primacy of weight desiderata in prosodic adjustment

a. prosodic adjustment never alters prosodic weight except to meet a prosodic weight desideratum; and
b. prosodic weight desiderata always take precedence over other prosodic desiderata.

Taken together, these assumptions prevent adjustment to C-finality from playing a role in prosodic adjustment in languages in which coda consonants add syllable weight.

6.3.4 Moravcik’s Generalization reconsidered
Consider a hypothetical “Yaqui-A”, which differs only from Yaqui in that the reduplication process corresponding to Yaqui light syllable reduplication is based on the C∗v-rule rather than the C∗V-rule. The result is first syllable reduplication.

(185) Yaqui-A (hypothetical variant of Yaqui)

\[
\begin{array}{ccc}
\text{C∗V-rule} & \text{PrAdj} \\
\hline
\text{a. } [\text{chi}] \text{.ke} & \text{chi} \text{.chike} \\
\text{b. } [\text{chu}] \text{.k.ta} & [\text{chuk}] \text{ta} \text{ chuk} \text{.chukta} \\
\text{c. } [\text{kaa}] \text{.te} & \text{ka: ka:te} \\
\end{array}
\]

Prosodic adjustment is blocked in (185a,c) by the ISDC.

No examples of first syllable reduplication have been attested, as far as I know. Does the fact that DR allows Yaqui-A present a problem? Yaqui light syllable reduplication (built around the C∗V-rule) is unusual in two respects. In the first place, it employs adjustment of the reduplicant to C-finality, one of only a few languages to do so. In the second place, prosodic adjustment is sensitive to the prosodic structure of the stem that the duplicant is embedded in, one of only a few languages in which prosodic adjustment has this property. Normally, prosodic adjustment incorporates phonemic material into the duplicant without regard for the prosodic structure which that material is found in. Yaqui and Ponapean are the only two examples of this kind that I am aware
Use of the C*ν-rule is also rare. Nuu-chah-nulth, Tohono O’odham and Sanskrit are the only examples in this book. Bear in mind that, for obvious reasons, unusual reduplication processes are significantly over represented among the languages considered in this book. A language like hypothetical Yaqui-A would therefore have to combine an array of highly marked options. It is therefore not a surprise that no reduplication process like the one considered in hypothetical Yaqui-A has, as yet, been uncovered.

It may have occurred to some readers that the unusual FSDC constraint might also permit first syllable reduplication in a language in which coda consonants are moraic. Consider now the possibility of a hypothetical Yaqui-B, which differs from Yaqui in that coda consonants are moraic. Suppose that reduplication is based on the C*V-rule, and that a bimoraic syllable desideratum is imposed on the duplicant, with ]-Right the only repair rule. These assumption would lead to the paradigm:

(186) Yaqui-B (hypothetical variant of Yaqui)

\[
\begin{array}{ccc}
\text{C*V-rule} & \text{PrAdj} \\
a. \ [\text{chi}].\text{ke} & \text{chike} \\
b. \ [\text{chu}].\text{k.ta} & \text{chuk}\text{ta} \\
c. \ [\text{ka}].\text{a.te} & \text{ka:te}
\end{array}
\]

The duplicant does not satisfy the bimoraicity desideratum in (186a), but prosodic adjustment (limited to ]-Right) cannot apply because of the ISDC. As far as I know, no such reduplication system is attested. The reason, I believe, is that FCVL is universally available as a repair option. If so then [ta]ku in (186a) would be adjusted to [ta(a)]ku, which would produce \text{ta: taku}, in compliance with the FSDC.

In place of (186), the paradigm would be:

(187) Yaqui-C (hypothetical variant of Yaqui)

\[
\begin{array}{ccc}
\text{C*V-rule} & \text{PrAdj} \\
a. \ [\text{chi}].\text{ke} & \text{chike} \\
b. \ [\text{chu}].\text{k.ta} & \text{chuk}\text{ta} \\
c. \ [\text{ka}].\text{a.te} & \text{ka:te}
\end{array}
\]
If more languages are uncovered which subject duplicant prosodic adjustment to the ISDC, and in which coda consonants are moraic, we expect that (187) might be found.

These considerations go a long way towards clarifying the status of Moravcik’s Generalization. Moravcik was clear about the fact that she was proposing a hypothesis about mechanism, not an empirical generalization. She realized that in certain cases, reduplicants were always identical to prosodic constituents, CV reduplication in a language in which all syllables were CV, for example. The issue for her was the characteristics of the stem that must be available in the description of the rules which generate the reduplicant. Moravcik concluded that it was possible to specify reduplicants without recourse to stem prosodic constituency. The conclusion reached here is that Moravcik was partially correct. The complication that DR introduces is that the surface shape of the reduplicant is determined by multiple factors: mainly rules of juncture insertion and rules of prosodic adjustment. The former rules have the characteristic that Moravcik pointed to; they do not refer to prosodic constituency, although the domain in which they apply can be determined by foot boundaries. As Yaqui and Ponapean demonstrate, prosodic adjustment does not.5

6.4 Heavy syllable suffixation of left-edge material (Chukchee)

It should be unnecessary to say at this point (but will be repeated so that there are no grounds for confusion) that the term “suffixation” is used in the title of this subsection only descriptively. Morphologically, there is no suffix, which is a term relevant to the concatenation of the exponent of an affix. The surface affix in this case is the product of reduplication.

It is straightforward to express the Chukchee pattern (76) from Chapter 4 in terms of t-junctures.

(188) Chukchee absolutive singular

<table>
<thead>
<tr>
<th>root</th>
<th>reduplicated</th>
<th>pretranscription</th>
</tr>
</thead>
<tbody>
<tr>
<td>jil?e</td>
<td>jil?e-jil</td>
<td>[ jil(?e) ]</td>
</tr>
<tr>
<td>nute</td>
<td>nute-nut</td>
<td>[ nut(e) ]</td>
</tr>
</tbody>
</table>

Transcription is to the right.

Simply writing the pretranscription representation is not sufficient. An account is needed for how it is derived using the mechanisms which
the theories makes available. Prosodic adjustment is necessary. The juncture insertion rules are given in (189a) and the prosodic adjustment rule is given in (189b). The exponent of the reduplicative morpheme is null. Transcription is to the right.

(189) a. \( \emptyset \rightarrow \langle / V \rangle ; \times^*\)-rule
   b. Second Conjunct ; Bimoraic :: \langle -Right

Two derivations follow:

(190)  jilPe nute
   JncIns [ji{l?e} [nu(\{te]
   DC [ji{l?e}] [nu(\{te]
   PrAdj [ji{l?e}] [nu(\{e]
   Trscr jil?e jil nute nute

6.5 Final syllable prefixation (Madurese)

It is remarkable that although initial syllable prefixation is not attested, final syllable prefixation is. If the Madurese pattern (74) from Chapter 4 is expressed in terms of t-junctures, we have:

(191) Madurese plural

\[
\begin{array}{ccc}
\text{root} & \text{reduplicated} & \text{pretranscription} \\
\text{bu.wa?} & \text{wa?-buwa?} & \langle \text{bu}\rangle \text{wa?} \\
\text{ga.ra.dus} & \text{dus-garadus} & \langle \text{garadus} \\
\text{a.bit} & \text{bit-abit} & \langle \text{abit} \\
\end{array}
\]

Transcription is to the left.

The reduplicative affix has a null exponent and triggers \( \times^*\)-rule and \( \emptyset \rightarrow \rangle / \text{Right} \_ \_ \_ \_ V \). Prosodic adjustment follows, with a well-formed syllable structure (WFSS) desideratum imposed on the first conjunct. The single repair rule is \( \langle -\text{Left} \). The derivation in (192) is typical.
Although the effect is duplication of the final syllable, the content of the duplicant is not determined on that basis. Juncture insertion isolates the rime of the final syllable. The first conjunct is augmented in order to eliminate the onsetless syllable in the first conjunct of the duplicant.

6.6 Final syllable suffixation (Kaingang)

Whereas Madurese has final syllable prefixation, Steriade (1988), discusses Kaingang final syllable suffixation, based on Wiesemann (1972).

An illustrative derivation follows:

Just as in Madurese, the final syllable is isolated. But the content of the duplicant is not determined on that basis.
6.7 Korean consecutive syllable reduplication

The following reduplication pattern was discussed in Section 2.2.3.

(195) \[\begin{array}{ccc}
\text{stem} & \text{reduplicated} & \text{pretranscription} \\
\hline
\text{a. cason} & \text{ca-ca-son-son} & [ca][son] \\
\text{b. kikwe} & \text{ki-ki-kwe-kwe} & [ki][kwe] \\
\text{c. hyŏnsak} & \text{hyŏn-hyŏn-sak-s’ak} & [hyŏn][sak]
\end{array}\]

Note in (195c) that the internal junctures fall at the syllable boundary. It is possible that these Sino-Korean words are bimorphemic in a sense that would allow the juncture insertion rules to correctly position the junctures. Juncture insertion can be sensitive to morpheme boundaries, but not syllable boundaries. We shall see in a future section on Kinande that juncture insertion can be sensitive to “frozen morpheme boundaries” in roots that are not obviously formed by combining morphemes that enter into the usual word formation processes. This is not unusual. It is likely that English speakers parse the word cranberry with an internal morpheme boundary in spite of the fact that they have no other access to a morpheme whose exponent is cran.

It is interesting, nevertheless, to consider whether prosodic adjustment can account for (195), without an appeal to polymorphemic stems. Suppose that the specification of the affix which induces Korean consecutive syllable reduplication is that it has a null exponent and induces \( \emptyset \rightarrow \] /Right \[ ] V. Prosodic adjustment of the duplicants to well-formed syllable structure follows, using juncture shift.

The crucial derivational step is:

(196) [\[\sigma \times \times \times \times\][\times \times\]] \rightarrow [\[\sigma \times \times \times \times\][\times \times \times\]] \\
hyŏn hyŏnsak s’ak

6.8 The onset-coda asymmetry and Moravcik’s Generalization

Systematically examining the various examples of prosodic adjustment above has had a dual purpose. First, of course, was to show that
reduplication processes discussed in earlier chapters are consistent with
the restricted framework of juncture insertion and prosodic adjustment
that has been proposed. Second was to show that the possibility of
prosodic adjustment did not inadvertently predict the occurrence of
unattested reduplication patterns.

In the Kaingang, Madurese, and Korean examples above, the final
syllable was isolated by first isolating the final VC*, then adjusting it
to well-formed syllable structure. The initial syllable cannot be isolated
in this way. The initial CV* can be isolated, but it has perfectly well-
formed syllable structure. A coda consonant can be attached to CV*
only on the basis of weight. This yields the heavy syllable (prefixal)
reduplication we analyzed in Mokilese and related languages, on the
one hand, or heavy syllable (suffixal) reduplication we analyzed in
Chukchee. Heavy syllable prefixal reduplication (Mokilese) comes
from isolating initial C*V as the first conjunct of the duplicant and ad-
justing it to be a bimoraic syllable. Heavy syllable suffixal reduplication
(Chukchee) comes from isolating initial C*V as the second conjunct of
the duplicant and adjusting it to be a bimoraic syllable.

6.9 Towards a parametric theory of prosodic adjustment

The discussion of prosodic adjustment has assumed implicitly that
prosodic adjustment is a specific process, not simply a descriptive name
for whatever rules happen to alter the prosodic structure of the duplicant
or one of its conjuncts. A specific form for the rule which carries out
prosodic adjustment was proposed, a defect driven rule schema. The
purpose of this section is to make these assumption explicit, refine them,
and provide some justification for them.

The main justification for thinking that prosodic adjustment is
more than merely a name for what happens, is the narrow range of
possibilities that is encountered. Consider again the rule which was
initially identified as empirically adequate to account for the Mokilese
reduplication paradigm.

(197)   J-Right/ ___C, otherwise FCVL
Suppose that the otherwise clause was dropped, and the rule reduced to J-Right / ___C. The surface paradigm that would result would be:

(198)  
root  reduplicated
pødok  pod-pødok
kasɔ  kas-kasɔ
wia  wi-wia
ko:kɔ  ko-ko:kɔ

As far as I can determine, such a paradigm is unknown in a language which, like Mokilese, distinguishes the syllable weight of C*V and C'VC syllables. This demands some account.

A reasonable conjecture is that over and above the specific rules which alter the prosodic structure of the target of adjustment (the duplicant or one of its conjuncts), there are prosodic conditions which those rules subserve. Given some assumptions about adequate default adjustment rules, the paradigm (198) would then be ruled out because there are no coherent prosodic conditions which govern the adjustment. The matter is entirely analogous to the process which builds syllable structure. Various rules (projecting nuclei, attaching codas, etc.) are bound together in a way that serves a collection of well-formedness conditions imposed on syllable structure. In Frampton (2001) I show how this can be accomplished for syllable structure in a general way by extending ideas of rule schemata in Chomsky and Halle (1968) to the notion of a defect driven rule schema. It will be clear in the case studies that follow that prosodic adjustment must employ an array of rules and that it must be iterative. Defect driven rule schemata offer a means to combine various subrules into a single complex rule which can be iterated.

The specific rules which are designated for prosodic adjustment subserve the prosodic desiderata, but their particular form has a major impact on the form that adjustment takes. We saw this already in the Mokilese example. If juncture shift is available to build a heavy syllable first conjunct, the standard surface pattern results. If it is not, a different surface pattern results: the pattern of the innovative dialect of Mokilese that was illustrated in (150) above.

If we assume that C-finality, in languages in which coda consonants do not contribute to syllable weight, can be taken to be a syllable
structure condition for reduplication, then all the examples of prosodic adjustment considered up to this point have the general form:

\[
\text{(199) target} : \begin{bmatrix}
\text{syllable structure conditions} \\
\text{(weight condition)}
\end{bmatrix}
:: \text{adjustment rule list} ; \text{constraints on adjustment}
\]

The various case studies in the next chapter will not require any revision of (199).

It does little to constrain the system to maintain that there is an option of carrying out prosodic adjustment using an operation of the form (199) unless other rules cannot carry out similar operations. I will assume that the *prosodic adjustment schema (199) is uniquely privileged to manipulate t-junctures* (insert them and shift their position). Prosodic adjustment is, in some sense, an extension of the morphology of t-juncture insertion into the phonology. Manipulating t-junctures is not an option for arbitrary phonological rules. The situation is very much the same with, for example, parameterized theories of footing such as Halle and Idsardi (1995). If other rules were capable of manipulating footing delimiters, outside the context of the tightly parameterized theory which is developed there, the force of the theory would be lost.

The hardest aspect of (199) to constrain is the list of constraints on repair rules. In Yaqui, the duplicant was required to be contained in the first syllable of the stem. In Ponapean, the duplicant can not be heavy if the initial foot of the stem consists of a heavy syllable. We will see in Kinande that t-junctures must be placed at morpheme boundaries. This is a heterogeneous list. All the restrictions are plausible, but it is not easy to find the common thread. A condition like “the duplicant cannot be heavy if the initial syllable of the stem is light” would immediately allow syllable copy reduplication. While it is not hard to draw some distinction between this condition and the condition which contrains Ponapean prosodic adjustment, the distinction remains *ad hoc* without a definition of “possible condition on repair”. I am unable to provide this. Ultimately, this is what is needed, both from the theoretical point of view and from the point of view of the language learner.

If the proposal (199) about the form of prosodic adjustment is correct, then it is a major residue of Prosodic Morphology in DR.
The restriction of the domain of a reduplicative affix to a foot is the second major residue. It is important to emphasize, however, that the DR analysis of most reduplicative processes involves neither domain designation nor prosodic adjustment.
At this point, all the tools are in hand. We proceed to analyze a number of complex examples. The first three, Ndebele and Kinande unintensive reduplication and Asheninca Campa intensive reduplication, were chosen not only because of their intrinsic interest, but because they have been extensively analyzed in very different frameworks. McCarthy and Prince (1998) claim that derivational phonology is an inadequate framework for understanding the complexities of Asheninca Campa intensive reduplication. They rank it with Malay reduplication, which we have already analyzed, as a demonstration of the need for representational theories of phonology. Inkelas and Zoll (2000) claim that Ndebele unintensive reduplication demonstrates that apparently duplicated phonological material is not in fact the result of copying in the phonology. We will show that both of these claims are unfounded.

Three prominent examples from Raimy (2000) are included (from Tohono O’odham plural reduplication, Temiar continuative reduplication, and Chaha intensive reduplication) so that the reader can assess the differences with and similarities to his treatment. A thorough treatment of Sanskrit verbal reduplication is included so that readers can make a similar assessment with respect to Steriade’s (1988) well-known discussion of perfect and intensive reduplication in Sanskrit.
7.1 Ndebele unintensive reduplication

This section relies almost completely on the data and description in Hyman, Inkelas, and Sibanda (1999). The strong point of their analysis is the careful attention they pay to the cyclic morphology and its importance in an analysis of reduplication in Ndebele. But their contention that the Ndebele facts show that reduplication is something other than phonological copying is unsupported.

In Ndebele, verbal reduplication has unintensive semantics. It is translated as ‘a bit’ or ‘here and there.’ Roughly, it is the difference between ‘he ate his food’ and ‘he picked at his food.’ Some preliminary examples are given in (200). The suffix -el is an applicative affix.

(200) a. uku-zi-nambith-el-a ‘to taste for’
    uku-zi-nambi-nambith-el-a ‘to taste for, a bit’

    b. uku-zi-lim-el-a ‘to cultivate for’
       uku-zi-lim-ebel-a
       uku-zi-lima-lim-el-a ‘to cultivate for, a bit’

The structure of the part of Ndebele verb forms which is relevant to reduplication is given in (201a). The possible extension suffixes are causative, applicative, reciprocal, and passive. The parse of (200a) is given in (201b). The verb root in (200b) is lim ‘cultivate’.

(201) a. ... + \[object agreement + root + extension suffixes\] + ...

    b. uku \[u \[zi nambith el\] a
       NONFIN CLASS 10 taste APP FV

The status of the final vowel (FV) in (202) is not clear. It could be the default realization of a morpheme, or perhaps simply an epenthetic vowel inserted for syllabification reasons. Resolution of this question will not be necessary for what follows.

The forms in (200) suggest that juncture insertion is total root reduplication. Subsequently, there is prosodic adjustment to first conjunct bisyllabicity, with variant adjustment rules being responsible for the
variation in (200b). The reduplicated forms in (200) are derived as follows:

(202)  
\[ \begin{array}{ccc}
\text{zi-nambith-el} & \text{zi-lim-el} & \text{zi-lim-el} \\
\oplus \text{UNINT} & \text{zi-[nambith]-el} & \text{zi-[lim]-el} \\
\text{PrAdj} & \text{zi-[nambith]-el} & \text{zi-[lim]-el} \\
\text{Trscr} & \text{zi-[nambi nambith]-el} & \text{zi-[lim]-el} \\
\end{array} \]

If the duplicant is subbisyllabic, Ndebele has the option carrying out prosodic adjustment using either \(-juncture shift or First Conjunct Vowel Epenthesis (FCVE). The latter operation is very similar to First Conjunct Vowel Lengthening in Mokilese and the other Austronesian languages analyzed in Chapter 6. Mokilese and Ndebele are compared below:

(203) a. Mokilese

\[ \begin{array}{c}
\sigma^\sigma \\
[\times \times ] \times \times \times \rightarrow \text{pod podok} \\
\text{PrAdj} \\
\]  

b. Mokilese (innovative dialect, see p. 96)

\[ \begin{array}{c}
\sigma^\sigma \\
[\times \times ] \times \times \times \rightarrow \text{pod podok} \\
\text{PrAdj} \\
\]  

c. Ndebele

\[ \begin{array}{c}
\sigma \\
[\times \times \times ] \times \times \rightarrow \text{limestone} \\
\text{PrAdj} \\
\]  

In Mokilese, the prosodic target is bimoraicity; in Ndebele, it is bisyllabicity. The target prosodic shape in both cases can be achieved either by \(-juncture or epenthesis. In the innovative dialect of Mokilese, a timing
slot is epenthesized, truncated, and its phonemic value is filled in by spreading. In Ndebele, a timing slot is epenthesized, truncated, and its phonemic value is filled in with an epenthetic \( a \). Both repair operations are available in standard Mokilese, but there is rule ordering, so that \(-\text{Right}\) is used where possible. In the innovative dialect, \(-\text{Right}\) is not available, so FCVE is forced. These repair rules are not ordered in Ndebele, so either one can be used for prosodic adjustment.

It is implicit in (202) that UNINT is realized after the the applicative morpheme has been realized by \(-\text{es}\). This assumption is necessary to get \([\text{lim}]\text{-el} \rightarrow [\text{lim-e}]\text{l}\) since we have been assuming that prosodic adjustment and transcription takes place cyclically. We will shortly make the assumptions about the hierarchical position of UNINT more precise.

There is variation in the reduplicated forms in (200b) because the root is sub-bisyllabic. For consonantal roots there is even more variation.

\[
(204) \begin{align*}
\text{uku-zi-dl-is-el-a} & \quad \text{‘to cause to eat for’} \\
\text{uku-zi-dlise-dl-is-el-a} & \\
\text{uku-zi-dlisa-dl-is-el-a} & \\
\text{uku-zidili-zi-dl-is-el-a} & \quad \text{‘to cause to eat for, a bit’} \\
\text{uku-zidla-zi-dl-is-el-a}
\end{align*}
\]

The four-way variation in (204) is easily accounted for if the initial juncture insertion rule is somewhat more general than total root reduplication. Assume that the initial duplicant can include a prefix or suffix which is adjacent to the root, provided that the duplicant is not thereby made super-bisyllabic. Then both \(\text{zi-}\{\text{dl-is}\}-\text{el}\) and \(\text{zi-dl}-\text{is-el}\) are possible initial configurations, and there are two ways of augmenting each duplicant to bisyllabicity, \(-\text{Right}\) and FCVE, producing the four-way variation.

Since it will be important in what follows, we need to make the assumptions about the hierarchical position of UNINT precise. The syntactic structure relevant to the inner portion of an unreduplicated verb form, the boxed part of (201a), is (205).
The morphemes $E_j$ are those which are realized by extension suffixes and Agr is realized by an object agreement prefix (which might be null). The representation (205) does not yet contain the morpheme UNINT whose realization triggers unintensive reduplication. The fact that the object agreement prefix can be brought into the duplicant shows that UNINT can occur higher than Agr. The interaction of passive and applicative will show that a low position of UNINT must be possible as well. I will assume that UNINT can occur at any level in the tree (205a). It is not unusual for a morpheme which has adverbial semantics, as UNINT does, to have considerable freedom in its hierarchical position. Since UNINT can occur no higher than directly above Agr, only material associated with the morphemes in (205a) can undergo reduplication, explaining why only the material in the box in (201a) is involved in reduplication.

The tree structure (205) will usually be represented as

$$\text{root} \oplus E_1 \oplus \cdots \oplus E_n \oplus \text{AGR}$$

The operator $\oplus$ is binary and associates left to right.

7.1.1 Passive/applicative interaction

Certain examples of reduplicated verb forms with both passive and applicative suffixes appear to violate the idea that the initial duplicant consists of contiguous morpheme exponents.

In (206), -w is the passive suffix and -el the applicative suffix. Both are extension suffixes.

\[(206)\]
\[
\begin{align*}
\text{phek-el-w-a} & \quad \text{‘be cooked for/at’} \\
\text{pheke.phek-el-w-a} & \\
\text{pheka.phek-el-w-a} & \quad \text{‘be cooked for/at, a bit’} \\
\text{phekwa.phek-el-w-a} &
\end{align*}
\]
The reduplicants *pheke* and *pheka* are expected, following the pattern in (200b). The reduplicant *phekwa*, however, is unexpected. It appears to combine material from nonadjacent morphemes. The reduplicant *phekwa* seems to somehow be generated from the stem *phek-el-w*.

It is a characteristic of Bantu verbal morphology that the surface positions of the exponents is only partly determined by the syntactic structure (205). Various processes can rearrange the linear order of the exponents of the Ei so that the linear order of the extension suffixes does not mirror the hierarchical position of the morphemes they realize, but adapts itself to conditions on surface morpheme exponent order. In particular, HI&S give examples to show that both underlying [*phek*]⊕APP⊕PASS and [*phek*]⊕PASS⊕APP produce the surface linear order *phek-el-w* ‘were cooked for’. The Bantu languages generally require the surface order applicative-passive. There are various potential analyses of this phenomenon. HI&S assume that there is a process of morpheme metathesis that converts the structure [*phek*]⊕PASS⊕APP to [*phek*]⊕APP⊕PASS at the morphological level. I will make a less radical assumption and assume that the applicative suffix is infixed to the left of the passive suffix, if the latter is present.

The following derivation reveals the source of the problematic verb form *phekwa*. *phek-el-w-a*. At the point in the derivation that UNINT is realized, *phek* and *w* are adjacent.

(207)  
⊕PASS  phek-w  
⊕UNINT  [phek-w]  
  Pradj  [phekw(a)]  
  Trscr  phekwa phek-w  
⊕APP  phekwaphek-el-w  (infixation)

I will not give the details, which are easily established following the model in (207), but it is interesting to see the results for all of the possible orders of combination of APP, PASS, and UNINT. The forms marked with † involve infixation of the applicative affix. Note that in for some orders, there is variation in the output.
According to (208) the reduplicant *phekwa* is impossible if *PASS* is inside *APP*. HI&S provide the evidence that this is indeed the case, distinguishing between passivized applicative constructions and applicativized passives on a semantic basis. The reduplicant *phekwa* is not possible with passivized applicatives. In closing this section, it should be made clear that, in spite of the fact that HI&S cast their discussion in a framework in which cyclic morphology has no role, most of the basic morphophonological insights in the discussion of the passive/applicative interaction come from their analysis.

### 7.1.2 Overapplication of passive palatalization

I have assumed that duplication juncture insertion, duplicant adjustment, and transcription apply in the UNINT-cycle. The issue of NCC repair was intentional left open. A palatalization phenomenon triggered by the passive suffix shows that NCC repair does not take place in the UNINT-cycle.

HI&S show that the passive suffix palatalizes a preceding labial. The result is shown boxed below. The labial can be several syllables away, but only the nearest labial is palatalized.

\[(209)\]

| a. boph-a | tie’ | boph-a[w-a] | ‘be tied’ |
| b. bumb-a | ‘mould’ | bumb-a[w-a] | ‘be molded’ |
| c. gombolozel-a | ‘encircle’ | gombolozel-a[w-a] | ‘be encircled’ |

Combining PASS and UNINT, in the two possible orders, produces the following.
The labial of the reduplicant is always palatalized. This is expected if PASS is inside UNINT and palatalization occurs before combination with the reduplicative affix. But it is not expected if reduplication occurs prior to combination with PASS, since only the closest labial is palatalized.

Consider, for example, the derivation corresponding to

\[[\text{fumbath}] \oplus \text{UNINT} \oplus \text{PASS} \].

If NCC repair takes place in the UNINT-cycle, then we expect:

\[ \text{fumbafumbath} \rightarrow \text{fumbafunjath-w} \]

The reduplicant labial is not palatalized. If, on the other hand, NCC repair has not been carried out at the point that PASS is realized, and passive palatalization is not restricted by geminate inalterability, we expect:

\[ \times \time209

The reduplicant labial is palatalized, in agreement with the empirical data.

For the sake of concreteness, I will assume that NCC repair occurs no earlier than the AGR-cycle and that passive palatalization is not subject to geminate inalterability. Since PASS is inside AGR, this will ensure that the in case UNINT applies before PASS, the crossed structure which produces overapplication will still be present. We now turn to evidence that NCC repair can (optionally) occur even later than the AGR-cycle.
7.1.3 Overapplication of perfective imbrication

The default perfective suffix in Ndebele is -ile. It is not an extension suffix and therefore outside the scope of AGR. If UNINT and PERF are both present, and UNINT is as high as possible (i.e. directly above AGR), the structure is:

```
root ... Agr Unint Perf
```

As predicted by this structure, material from the perfective suffix cannot be incorporated in the duplicant in unintensive reduplication: uku-zi-lima-lim-ile, *uku-zi-limi-lim-ile. Contrast this with the causative suffix -is, which produces both uku-zi-lima.lim-is-a and uku-zi-limi-lim-is-a.

There is affix allomorphy, with a second potential realization of the perfective morpheme, -e. For the purposes of this section, call the roots which take the short suffix Type 1 roots. Most Type 1 roots can take either the long and short perfective suffixes. But there is a subclass of the Type 1 roots which does not allow the long perfective suffix in certain environments (detailed below). Call these roots Type 2 roots. The short perfective suffix induces stem ablaut. If the final vowel of the stem is a, it raises to e. This is called imbrication in the Bantu literature.

(211) Type perfective

<table>
<thead>
<tr>
<th>Type</th>
<th>‘cultivate’</th>
<th>lim-ile</th>
<th>*lim-e</th>
</tr>
</thead>
<tbody>
<tr>
<td>dabul 1</td>
<td>‘tear’</td>
<td>dabul-ile</td>
<td>dabul-e</td>
</tr>
<tr>
<td>dumal 2</td>
<td>‘become depressed’</td>
<td>*dumal-ile</td>
<td>dumel-e</td>
</tr>
</tbody>
</table>

(The perfective forms will actually occur with various prefixes, which are irrelevant to the present point.)

The interaction of perfective suffix choice, imbrication, and unintensive reduplication, is unexpected. There are three different realizations of [[dumal]] ⊕ AGR ⊕ UNINT ⊕ PERF, apparently in free variation: (realization of agreement is omitted for reasons of space):

The variation between (212a) and (212b) can be understood as variation in the timing of NCC repair. If NCC repair follows transcription in the UNINT-cycle, we expect:

\[
\begin{array}{c}
\text{UNINT} \\
\toprule \\
\text{PERF} \\
\mid \\
\text{DUMAL} \\
\bottomrule \\
\text{d} \text{um} \text{a} \mid \\
\text{PERF} \\
\mid \\
\text{DUMAL} \\
\bottomrule \\
\text{d} \text{um} \text{e} \mid \\
\end{array}
\]

But if NCC repair is delayed until the PERF-cycle, then we expect:

\[
\begin{array}{c}
\text{UNINT} \\
\toprule \\
\text{PERF} \\
\mid \\
\text{DUMAL} \\
\bottomrule \\
\text{d} \text{um} \text{a} \\
\text{PERF} \\
\mid \\
\text{DUMAL} \\
\bottomrule \\
\text{d} \text{um} \text{e} \\
\end{array}
\]

The result is overapplication of imbrication. Of course, it must also be assumed (quite plausibly) that imbrication is not blocked by geminate inalterability.

The reason for the appearance of the long perfective suffix in (212c) is much less clear. It is not an explanation, but we can attribute it to the morpheme realization rules (i.e. the lexicon).

(213) 1. PERF → -ile, except / α ⊕ ... ⊕ AGR ___

2. PERF → -e / α (Type1) ⊕ ... ___

This yields the desired outcome because the environment that produces (212c) is ... ⊕ UNINT ⊕ ___, which does not block -ile according to (213.1). Since there is no evidence that the grammaticality of (212c) is other than an idiosyncratic fact about morpheme realization in Ndebele, the issue will not be pursued.²

7.1.4 Yi-epenthesis

Independently of reduplication, Ndebele imposes a bisyllabic minimal word condition. Because verbal prefixation and suffixation is so prevalent, augmentation to minimal word weight occurs only in a narrow
range of examples: imperatives of a consonantal root (\textit{dl} ‘eat’, \textit{m} ‘stand’, etc.).

\begin{align*}
\text{(214)} & \quad \text{uku-dl-a} & \text{‘to eat’} \\
& \quad \text{yi-dl-a (*dl-a)} & \text{‘eat! (imperative)’} \\
& \quad \text{uku-lim-a} & \text{‘to cultivate’} \\
& \quad \text{lim-a (*yi-lim-a)} & \text{‘cultivate! (imperative)’}
\end{align*}

Left edge \textit{yi}-epenthesis is used for augmentation to minimal word weight.

The most straightforward examples of \textit{yi}-epenthesis used for duplicant augmentation are unintensive imperatives.

\begin{align*}
\text{(215)} & \quad \text{yidla-yidl-a, dlayi-dl-a} & \text{‘eat!’ (a bit)}
\end{align*}

There is variation, with \textit{yi}-epenthesis at either the left or right edge of the duplicant.

\begin{align*}
\text{(216)} & \quad \text{dl} & \text{dl} \\
& \quad @\text{UNINT} & \text{[dl]} & \text{[dl]} \\
& \quad \text{PrAdj (WFSS)} & \text{[dl(a)]} & \text{[dl(a)]} \\
& \quad \text{PrAdj (weight)} & \text{[yidl(a)]} & \text{[dl(ayi)]} \\
& \quad \text{Trscr} & \text{yidla yidl} & \text{dlayi dl}
\end{align*}

WFSS is well-formed syllable structure.

Earlier, it was proposed that the choice of the initial duplicant only optionally included prefixes or affixes, assuming that this was possible without making a super-bisyllabic duplicant. This was an oversimplification. There are two dialects. In the conservative dialect, the duplicant is not well-formed if there is a suffix which could augment the duplicant without pushing it over the bisyllabic weight limit. In that dialect, given the stem \textit{zi-dl-is}, juncture insertion can produce \textit{[zi-dl]-is} or \textit{zi-[dl]-is}, but not \textit{zi-[dl]-is}. In the innovative dialect, all are possible. But even the innovative dialect does not allow \textit{zi-[dl]-is-el}. If there are two extension suffixes, the innovative dialect does not allow total root reduplication of a consonantal root. The inner suffix must be included
in the duplicate. With the variation discussed earlier and $yi$-epenthesis, the innovative dialect produces 5 different outputs from $zi$-$dl$-$el$!

\[(217)\]

<table>
<thead>
<tr>
<th>JncIns</th>
<th>PrAdj (WFSS)</th>
<th>PrAdj (weight)</th>
<th>Trscr</th>
</tr>
</thead>
<tbody>
<tr>
<td>$[zi-dl]$-$el$</td>
<td>$[zi-dl-e]l$</td>
<td>$zidle$ $zi$-$dl$-$el$</td>
<td></td>
</tr>
<tr>
<td>$[zi-dl]$-$el$</td>
<td>$[zi-dl(a)]$-$el$</td>
<td>$zidla$ $zi$-$dl$-$el$</td>
<td></td>
</tr>
<tr>
<td>$zi$-$[dl]$-$el$</td>
<td>$zi$-$[dl-el(a)]$</td>
<td>$zi$-$dlela$ $dl$-$el$</td>
<td></td>
</tr>
<tr>
<td>$zi$-$[dl]$-$el$</td>
<td>$zi$-$[dl-e]l$</td>
<td>$zi$-$yidle$ $yidl$-$e$</td>
<td></td>
</tr>
<tr>
<td>$zi$-$[dl]$-$el$</td>
<td>$zi$-$[dl(a)]$-$el$</td>
<td>$zi$-$dl(yi)$-$el$</td>
<td>$zi$-$dlayi$ $dl$-$el$</td>
</tr>
</tbody>
</table>

### 7.2 Morpheme integrity in Kinande

Kinande and Ndebele are related Bantu languages whose inflected verbs have a similar morphological structure. They also have similar unintensive verbal reduplication processes. The semantics of the Kinande unintensive reduplication is usually given a meaning of ‘hurriedly’ or ‘here and there’. The most significant difference between the Kinande and Ndebele systems was uncovered and analyzed by Hyman and Mutaka (1990), which this section is based on. They discovered that there is a whole morpheme effect in Kinande reduplication, which blocks partial morpheme reduplication. They called it the Morpheme Integrity Constraint (MIC) and viewed it as a restriction on templatic association: “If the whole of a morpheme cannot be successfully mapped into the bisyllabic reduplicative template, then none of the morpheme may be mapped.” I take it to be a restriction on where duplication junctures can appear: only at morpheme boundaries.

Besides the MIC, we can identify the following differences between Kinande and Ndebele unintensive reduplication:

\[(218)\]

- a. there is no analog of $yi$-epenthesis;
- b. bare consonantal roots are doubly reduplicated; and
- c. UNINT is always high in the morphological structure.
First consider:

(219)  

<table>
<thead>
<tr>
<th>e-ri-sw-a</th>
<th>‘to grind’</th>
</tr>
</thead>
</table>
|  e-ri-sw

\textit{swaswa}-sw-a  | ‘to grind (hurriedly)’ |

Kinande does not use syllable epenthesis for prosodic adjustment to bisyllabicity. Instead, Kinande uses double reduplication just as it is used in Mokilese in the case of monosyllabic roots (see Section 6.2.2.2). Readjustment rule allomorphy inserts a pair of ]-junctures at the right edge of the stem. The derivation of \textit{swaswa}-sw is almost identical to (154) in Section 6.2.2.2.

(220)  

[[sw]] \rightarrow [[sw\langle a\rangle]] \rightarrow swa-[sw] \rightarrow swa-[sw\langle a\rangle] \rightarrow swa-swa-sw

The evidence that UNINT must be situated high in the hierarchical structure comes from the fact that extension suffixes, if present, are always used to add weight to the reduplicant.

(221)  

a.  e-ri-sw-er-a  ‘to grind for’

b.  e-ri-sw\textit{wera}-sw-er-a  ‘to grind for (hurriedly)’

c.  *e-ri-sw\textit{waswa}-sw-er-a

If UNINT could combine with the root before the applicative suffix, as it can in Ndebele, we would expect

\textit{sw} \rightarrow \textit{swaswa} \rightarrow \textit{swaswa}-es \rightarrow e-ri-\textit{swaswa}-sw-es-a

Since we know that that extension suffixes can reduplicate, (221b) for example, the effect of the MIC is easy to see.

(222)  

a.  e-ri-hum-a  ‘to cultivate’

b.  e-ri-\textit{huma}-hum-a  ‘to cultivate (hurriedly)’

c.  e-ri-hum-er-a  ‘to cultivate for’

d.  e-ri-\textit{huma}-hum-er-a  ‘to cultivate for (hurriedly)’

e.  *e-ri-\textit{hume}-hum-er-a

Under the Ndebele rules, (222e) would be good. But it requires the prosodic adjustment \textit{[hum-er]} \rightarrow \textit{[hum-e]}r, which is blocked by the MIC in Kinande.
The high position of UNINT in the morphological hierarchy is also responsible for the ungrammaticality of (223c). The suffix -w is the passive affix.

(223)  
a. e-ri-hum-w-a  ‘to be cultivated’ 
b. e-ri-**humwa**-hum-w-a  ‘to be cultivated (hurriedly)’ 
c. *e-ri-**huma**-hum-w-a

In Ndebele, (223c) would be grammatical, because UNINT can be realized before the passive morpheme. In Kinande, the passive suffix has already been combined with the root at the point that UNINT is realized. Prosodic adjustment does not allow [hum-w] → [hum]-w because prosodic adjustment is driven by prosodic desiderata and ]-Left does not contribute to satisfying the desiderata. Consequently, the passive suffix is always reduplicated in Kinande.

Overweight (more than bisyllabic) roots pose a problem for the Kinande reduplication system. In Chapter 6, it was proposed that it was highly marked state of affairs for the repair rules available to Prosodic Adjustment to be inadequate to achieve the prosodic desiderata which drive the adjustment rule. Since the MIC does not permit partial reduplication of a verb root, Kinande does not have any way to produce a bisyllabic reduplicant if the root is overweight. Some languages, when faced with a similar problem, simply exclude a prosodically defined class of stems from reduplication. Kinande does not fully solve the problem. Many overweight roots are excluded from the reduplication process, but many are not. This is specified lexically as a property of some roots. About half the overweight roots do not reduplicate. I will call these non-reduplicating roots. Furthermore, no overweight root with an extension suffix reduplicates. Call this the NOEXT constraint on juncture insertion.

**NOEXT:** *[α - extension suffix ... ]*

Somewhat more than half the overweight roots can reduplicate, subject to NOEXT. In (224), *bindul* ‘change’ is non-reduplicating and *bugul* ‘find’ is reduplicating. The starred forms would be good under the Ndebele rules.
(224) Overweight roots

<table>
<thead>
<tr>
<th>Kinande</th>
<th></th>
<th>*binda-</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>bindul</td>
<td>bindul</td>
<td>*binda-bindul</td>
<td>bindul</td>
</tr>
<tr>
<td>bigul</td>
<td>(no reduplication)</td>
<td>*binda-bigul</td>
<td>*binda-bigul</td>
</tr>
<tr>
<td>bindul-er</td>
<td>(no reduplication)</td>
<td>*binda-bindul-er</td>
<td>*binda-bindul-er</td>
</tr>
<tr>
<td>bigul-er</td>
<td>(no reduplication)</td>
<td>*binda-bindul-er</td>
<td>*binda-bindul-er</td>
</tr>
</tbody>
</table>

Kinande has a class of bimorphemic verb forms which act in some ways like roots. Their meaning is idiomatic, not compositional. For convenience, I will call them pseudo-roots. For reasons that are not clear, pseudo-roots are subject to NOEXT. The reduplicating pseudo-root *gund-ul*, for example, reduplicates as *gunda-gund-ul*, with prosodic adjustment to bisyllabicity responsible for *gund-ul* → *gund*-ul → *gunda-gund-ul*. But *gund-ul-er*, with an extension suffix, because of NOEXT, does not reduplicate.

### 7.2.1 Short causatives

The normal causative inflection is bimorphemic -es-y (or -is-y, depending on vowel height harmony).³

(225)  
\[ e-\text{ri-hum-is-y-a} \quad \text{‘to cause to beat’} \]
\[ e-\text{ri-gend-es-y-a} \quad \text{‘to cause to go’} \]

There is a subclass of roots which can appear with only the outer suffix -y, with no semantic difference between the forms with the two suffixes. The root *gend* is such a root, but *hum* is not.

(226)  
\[ *e-\text{ri-hum-y-a} \quad \text{‘to cause to beat’} \]
\[ e-\text{ri-gend-y-a} \quad \text{‘to cause to go’} \quad (= e-\text{ri-gend-es-y-a}) \]

So that a terminology is available, call this subclass of roots the SC-class (Short Causative).

It will turn out to be most consistent with certain reduplication facts that will soon be discussed if we assume that there is an optional readjustment rule associated with -y realization that deletes the inner suffix in the context of certain roots.⁴

(227)  
\[ \text{es/is} \rightarrow \emptyset \quad \alpha \_\_\_\_\_\_y, \quad \alpha \text{ an SC-root} \]
The reduplication data of particular interest is the following three-way variation.

(228)  
   a. e-ri-\textit{gendya}-gend-y-a \quad \text{‘to cause to go (hurriedly)’}
   b. e-ri-\textit{genda}-gend-es-y-a
   c. e-ri-\textit{gendya}-gend-es-y-a

The derivations of (228a) and (228b) are straightforward:

(229)  
\begin{array}{ll}
\text{UNINT} & \text{gend-y} \quad \text{gend-es-y} \\
\text{PrAdj (weight)} & \text{[gend-y]} \quad \text{[gend-es-y]}
\end{array}

The simplest explanation for the occurrence of (228c) is that a variant of the rule (227) is used as a prosodic adjustment rule.

(230) \quad \text{es} \rightarrow \langle \text{es} \rangle / \alpha \quad \text{y}, \quad \alpha \text{ an SC-root}

Recall from Section 4.3 that medial truncation has the effect of reduplicant truncation. The truncated material is not copied to the reduplicant. The effect is first-conjunct deletion. The derivation of (228c) is:

(231)  
\begin{array}{ll}
\text{\@UNINT} & \text{gent-es-y} \\
\text{PrAdj (weight)} & \text{[gent-(es)-y]} \\
\text{PrAdj (WFSS)} & \text{[gent-(es)-y(a)]} \\
\text{Trscr} & \text{gendya gend-es-y}
\end{array}

Further examples which explore the interaction of other extension suffixes with the short causative -y show that the prosodic adjustment rule (230) is further extended.

(232) \quad \alpha \rightarrow \langle \alpha \rangle / \text{SC-root} \quad \text{y ; MIC}
The MIC ensures that t-junctures are only inserted at morpheme boundaries. Truncation (232) is responsible for (233c) and (233d).

(233) \(\text{reduplicated}\)

a. e-ri-bul-y-a \(\rightarrow\) e-ri-\textbf{bulya}-bul-y-a ‘to ask’
b. e-ri-bul-ir-y-a \(\rightarrow\) e-ri-\textbf{bula}-bul-ir-y-a ‘to ask for’
c. e-ri-bul-\textbf{bulya}-bul-ir-y-a
d. e-ri-bul-ir-an-y-a \(\rightarrow\) e-ri-\textbf{bula}-bul-ir-an-y-a ‘to ask for’
e. e-ri-\textbf{bulya}-bul-ir-an-y-a each other’

The derivation of (233e), for example, is:

(234) bul-ir-an-y

\(\@\text{UNINT} [\text{bul-ir-an-y}]\)
PrAdj [bul-(ir-an)-y]
PrAdj [bul-(ir-an)-y(a)]
Trscr \textbf{bulya} bul-ir-an-y

Subsequent morphophonology adds the prefix e-ri- and the final vowel to produce e-ri-\textbf{bulya}-bul-ir-an-y-a.

In summary: Juncture insertion is double stem reduplication for consonantal stems, null for certain lexically specified super-bisyllabic stems, and total stem reduplication otherwise. The syntax specifies where UNINT occurs in the hierarchical structure of the words in which it occurs. Prosodic adjustment is carried out according to:

(235) first conjunct; bisyllabic ::

\[
\left\{ \begin{array}{l}
\text{[Left]} \\
\text{FCVE} \\
\alpha \rightarrow \langle \alpha \rangle \text{ / SC-root \(y\textsuperscript{(CAUSE)}\)}
\end{array} \right\} \text{; MIC}
\]

7.3 Asheninca Campa intensive reduplication

The version of “Asheninca Campa” that is analyzed here is the hypothetical language analyzed in McCarthy and Prince (1998). It is based largely on Payne (1981), an impressive analysis of a single speaker’s language. Secondarily, Spring (1990) is used to fill in many details
of the treatment of unprefixed monosyllabic roots. Her data comes from field work by her and Payne with a second speaker. Since the second speaker’s reduplication data showed significant instability, there are grounds for wondering if a coherent language possibility has been hypothesized. Since an important goal of this paper is to show that McCarthy and Prince’s (1998) claim that a satisfactory analysis of Asheninca Campa is beyond the reach of derivational morphophonology, I put these concerns aside and (for the purposes of this paper) accept the hypothesized language as a valid subject of inquiry.

Asheninca Campa has a productive verbal reduplication process used to signal “excess” and usually glossed ‘more and more’. It frequently occurs in conjunction with the continuative suffix -wai. Verbs usually appear with at least one prefix (commonly a person marker or future tense marker) and one or more suffixes.

Before we consider reduplication in Asheninca Campa, we need to describe some of the basic morphophonology. Syllable structure is straightforward. Codas must be nasal consonants sharing point of articulation with a following consonant. Onsetless syllables are permitted only initially. Syllabification at stem/suffix junctures and word finally is carried out by familiar epenthetic operations. The epenthetic vowel a breaks up impermissable CC sequences and syllabifies final consonants. The epenthetic consonant t breaks up impermissable VV sequences. A few diphthongs are permitted, as in the continuative suffix -wai, but hiatus is generally avoided. In (236), epenthetic segments are underlined.

(236) a and t epenthesis at stem-suffix boundaries

<table>
<thead>
<tr>
<th>Verb</th>
<th>Prefix</th>
<th>Suffix</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>kow</td>
<td>+</td>
<td>a:nɛi</td>
<td>kowa:nɛi ‘to want’</td>
</tr>
<tr>
<td>want</td>
<td>NONFIN</td>
<td></td>
<td>‘want’</td>
</tr>
<tr>
<td>koma</td>
<td>+</td>
<td>a:nɛi</td>
<td>koma:nɛi ‘to paddle’</td>
</tr>
<tr>
<td>paddle</td>
<td>NONFIN</td>
<td></td>
<td>‘paddle’</td>
</tr>
<tr>
<td>kow</td>
<td>+</td>
<td>wai</td>
<td>kowawai ‘has continually wanted’</td>
</tr>
<tr>
<td>want</td>
<td>CONT</td>
<td>PERF</td>
<td>PERF NONFUT ‘has continually wanted’</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
See Payne (1981) for the details. The examples in (237) are typical. At the surface, the first person prefix alternates between \textit{no-} and \textit{n-}. The exponent of the future morpheme is a placeless nasal (\textit{-n} below) which must share place of articulation with a consonant which directly follows it. It deletes if it is not followed by an appropriate consonant.

(237) Prefix readjustment
\[
\begin{array}{c}
\text{no + asi} & \rightarrow & \text{na.si} \\
\text{1st cover} & & \\
\text{no + N + asi} & \rightarrow & \text{na.si} \\
\text{1st FUT cover} & & \\
\text{no + N + koma} & \rightarrow & \text{noŋ.ko.ma} \\
\text{1st FUT paddle} & & \\
\end{array}
\]

With the basics of prefixal and suffixal morphophonology in hand, we can consider reduplication, which is straightforward if the verb root is polysyllabic, C-initial, and V-final. The root is totally reduplicated. This is illustrated in (238) for the trisyllabic root \textit{kawosi} ‘bathe’ and the bisyllabic root \textit{koma} ‘paddle’.

(238) a. no-kawosi-wai ‘I bathe’
    no-kawosi-\textbf{kawosi}-wai ‘I bathe more and more’
 b. no-koma-wai ‘I paddle’
    no-koma-\textbf{koma}-wai ‘I paddle more and more’

Now consider V-initial roots with a C-initial prefix.

(239) a. n-asi-wai ‘I cover’
    n-asi-\textbf{nasi}-wai ‘I cover more and more’
 b. n-osampi-wai ‘I ask’
    n-osampi-\textbf{sampi}-wai ‘I ask more and more’

First note that (239b) provides evidence that transcription is to the right, as we have been assuming. Left transcription would produce \textit{n-o-sampi-sampi-wai}, with the target of copying inside the root.

Onset incorporation occurs in (239a), just as in the Kîhehe example discussed in Section 6.1. The account is the same. The reduplicative morpheme is realized after the prefix has already combined with the stem. It triggers the $\times^*\text{-rule}$, $\emptyset \rightarrow [\ ]$, with the root designated as
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the domain of the affix. Rule application is leftmost, by default, and is followed by Default Closure. Prosodic adjustment follows, with well-formed duplicant syllable structure a prosodic desideratum. Exactly as in Kíhehe, [-Left] is available as a repair rule, so $n-[asi] \rightarrow [n-asi]$.

The duplicant WFSS desideratum drives adjustment in (239b) as well, but [-Right] applies, not [-Left]. What accounts for the difference? Plausibly, because [-Left] in (239a) would result in an underweight duplicant. The next examples bear on this:

(240) Prefixed monosyllabic C-initial roots

a. no-na-wai ‘I carry’
   no-na-\textbf{nona}-wai ‘I carry more and more’

b. no-na:wan ‘I chew’
   no-na:-\textbf{nona}:wan ‘I chew more and more’

In both cases, the prefix is used to augment the duplicant, even though the duplicant syllable structure is well-formed. In (240b) the duplicant is initially bimoraic but is augmented, so one might speculate that augmentation is to bisyllabicity. But (239b), and (238a), together, show that this cannot be correct. The first shows that [-Right] is available for prosodic adjustment. The second shows that it is not used, even when the duplicant is trisyllabic. The conclusion is that the weight desideratum is \textit{polysyllabicity}, not bisyllabicity.

Summarizing: The reduplicative affix which realizes intensive has a null exponent, specifies the root as its domain and triggers the $\times^*$-rule. Prosodic adjustment applies:

```
duplicant ; [WFSS polysyllabic ] :: [ -Right ] [-Left ]
```

The rule ordering above is necessary to ensure that the [-juncture shifts to the right when it is allowed to do so by the weight desideratum. Otherwise, \textit{nosampi}-\textit{nosampi} would result in (239b).

The speaker also needs to know the position of INT in the morphological hierarchy of the verb form. I will assume that INT is realized after all the prefixes and before all the suffixes. Since there are no suffixes at the point that juncture insertion applies, Default Closure will close the duplicant at the right edge of the stem. In the examples considered to this point, the right edge of the stem has coincided with
the right edge of the root. This is not always the case. We will shortly see some examples in which an epenthetic vowel appears at the right edge of the stem.

Nothing further needs to be said about the morphology of Asheninca Campa intensive reduplication. In order to see this, however, it is first necessary to understand a different prosodic augmentation process in Asheninca Campa verbal morphology. It is independent of reduplication.

7.3.1 Stem augmentation induced by C-initial suffixes
C-initial suffixes induce augmentation of light verb stems. The roots p ‘feed’, na ‘carry’, and na: ‘chew’, along with the 1st person agreement prefix no-, are sufficient to demonstrate the effect. The augmentation is shown boxed.

\[(241)\]

\begin{tabular}{lll}
\textit{stem} & \textit{before C-initial suffixes} \\
\hline
a. p & p[\text{a:}] & ‘feed’ \\
b. na & na[\text{t}] & ‘carry’ \\
c. pa: & pa: & ‘chew’ \\
d. no-p & no[\text{p[\text{a:}]}] & ‘I feed’ \\
e. no-na & nona & ‘I carry’ \\
f. no-pa: & no[\text{p[\text{a:}]}] & ‘I chew’ \\
\end{tabular}

Some examples are given below. The C-initial suffixes are \textit{wai} (continuative) and \textit{piro}, which is glossed as ‘verity’. The V-initial infinitival suffix a:ne\textsuperscript{h}i is given for comparison. The epenthetic material added to augment the stem has been boxed, as above, and the epenthetic material (t) used to break up stem/affix hiatus is underlined.

\[(242)\]

\begin{tabular}{lll}
\textit{} & \textit{before C-initial suffixes} \\
\hline
a. p-ame\textsuperscript{h}i & ‘to feed’ \\
b. p[\text{a:}]\text{-piro-\text{-}ta\text{-}ame\textsuperscript{h}i} & ‘to truely feed’ \\
c. no-p[a:wai] & ‘I feed’ \\
d. na-ame\textsuperscript{h}i & ‘to carry’ \\
e. na[\text{t}]\text{-piro-\text{-}ame\textsuperscript{h}i} & ‘to truely carry’ \\
f. no-na-wai & ‘I carry’ \\
g. na-\text{-}ame\textsuperscript{h}i & ‘to chew’ \\
\end{tabular}
h. \( \text{na:-piro-} \text{ta:}n\text{è} \text{i} \) ‘to truly chew’

i. \( \text{no-na:-} \text{wai} \) ‘I chew’

Note that the epenthetic vowel in (242c) is attributed to prosodic adjustment of the stem, not syllable structure repair at the root-suffix boundary.

The one subtlety in stating the augmentation rules is to ensure that \( p \) augments with a long vowel, while \( pa \) is augmented by syllable epenthesis. The following augmentation rule, which is applied to the stem before concatenating a C-initial suffix, accomplishes this:

\[
(243) \quad \text{Stem} : \text{Polymoraic} :: \begin{cases} 
\text{Final Vowel Epenthesis (a)} \\
\text{Vowel Lengthening} \\
\text{Syllable Epenthesis (ta) / root} 
\end{cases}
\]

It is implicit in the prosodic weight desideratum that the stem must be syllabified and is therefore subject to syllable well-formedness conditions. Syllable epenthesis is restricted to the right edge of the root in order to prevent \( p \rightarrow \overline{pa} \rightarrow \overline{pata} \). According to (243), syllable epenthesis applies only at the morpheme boundary.

We can now consider the interaction of stem augmentation with reduplication. Intensive reduplication, although it does not have a suffixal exponent, does almost invariably produce a C-initial derived suffix at the surface. It is therefore not surprising that Asheninca Campa assigns the intensive affix to the class of affixes which trigger stem augmentation.

A number of illustrations are given below. Recall that we are assuming that INT realization takes place before any suffixes enter the computation.

\[
(244) \quad \begin{array}{ccccccc}
\text{stem} & \text{augment} & JncIns & DC & PrAdj & Trscr \\
\hline
a. \quad p & p[\text{a}] & [pa:] & [pa:] & \text{pa: pa:} \\
b. \quad \text{no-p} & \text{no-p[} \text{a}] & \text{no-[pa} & \text{no[pa]} & \text{[nopa]} & \text{nopa nopa} \\
c. \quad \text{na} & \text{na[} \text{a}] & \text{[nata]} & \text{[nata]} & \text{nata nata} \\
d. \quad \text{no-na:} & \text{no-[na:} & \text{no[nat:]} & \text{[nona:]} & \text{nona: nona:} \\
e. \quad \text{èhik} & \text{èhik[} \text{a}] & \text{[èhika]} & \text{[èhika]} & \text{èhika èhika}
\end{array}
\]
A few examples of fully inflected verbs are given in (245). Aside from the root kow ‘paddle’, the roots and suffixes are as in (242). The material used to augment the stem to bimoraicity is boxed, the reduplicant is shaded, and epenthetic used to join the V-initial suffix to the V-final stem is underlined.

(245) a. Ñik Ñik-[piro-ta:ne:i] Ñik[ä] Ñika:ta:ne:i
c. p p-ña:ne:i p[a]-piro-ta:ne:i p[a]:pa:ta:ne:i

Note that in a few cases the repair rules specified for prosodic augmentation of the duplicant to polysyllabicity are not always adequate to achieve the desired weight. But there is only a very narrow range of cases for which this is true, unprefixed C and CV roots, (245c) and (245d) above, and only in the unusual case where there is no prefix.

7.3.2 Copying a word boundary
There is one last feature of Asheninca Campa intensive reduplication to consider. Consider an unprefixed VCV root like asi ‘cover’.

(246) asi-ña:ne:i ‘to cover’
    asi asi-ña:ne:i ‘to cover more and more’

Surprisingly, the reduplicated form has an internal word break. There are two kinds of evidence for this: 1) the phonetic judgments of linguist field workers; and 2) the stress pattern is that of separate words. See Spring (1990, fn. 3, p. 148).

Payne (1981:146), in his careful and insightful study of Asheninca Campa, says:

One of the most striking elements of Asheninca reduplication is that it reduplicates a word boundary into some forms, but not into others. Preferring two-syllable verbs with initial consonants to reduplicate, it appears that in the absence of the initial consonant in VCV-type verbs, *the rule actually copies the word boundary.* (italics added)
Payne’s insight can be formalized in the following way. Suppose that word breaks are represented by timing slots which are associated with some kind of special marker, # is used in (247). Then (246) is the result of the regular application of prosodic adjustment—the rule actually copies the word boundary. Recall as well that the idea that word breaks can occur inside the duplicant was already introduced in the discussion of tasty-shmasty reduplication in Section 4.1.1.

If a vowel is associated with a timing slot which follows a timing slot associated with a word boundary, it satisfies the conditions on WFSS, so [-Left is motivated by the WFSS desideratum imposed on the duplicate.

I take it to be evidence in favor of the theory advocated here that this “striking element” of Asheninca Campa reduplication is so immediately comprehensible in terms of the computational mechanisms which the theory makes available. It is hard to see how a theory which views reduplication as templatic prefixation or suffixation could account for (246) in such a natural way.

### 7.4 Washo plural reduplication

Washo plural reduplication was analyzed by Broselow and McCarthy (1983) in their important study of internal reduplication. Their starting point was the analysis of Winter (1970), based on the data in Jacobsen (1964). It is set in the melody copying framework inherited from Marantz (1982) and depends heavily on the manipulation of long vowels in ways that have since proved untenable. Washo reduplicative pluralization is also the subject of a recent study by Yu (2001), who adds much useful data and discussion of various approaches to Washo reduplication. I rely on Broselow and McCarthy and Yu for the data.

There is allomorphy in Washo reduplicative pluralization, with a special affix used to realize plural on monosyllabic stems and some lexically specified polysyllabic stems. This fits a pattern that we have encountered several times before, with special treatment of monosyllabic stems. I will consider the two affixes in turn, beginning with
straightforward examples of the effects of the default affix, which will be called $\rho_{CV}$, for reasons that will soon be clear.

### 7.4.1 CV-reduplication

First, some examples:

(248)

<table>
<thead>
<tr>
<th>root</th>
<th>plural</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a. haña'akmuw</td>
<td>haña'akmuwewe</td>
<td>‘elks’</td>
</tr>
<tr>
<td>b. baloxat</td>
<td>baloxaxat</td>
<td>‘bows’</td>
</tr>
<tr>
<td>c. da?a</td>
<td>da?a?a</td>
<td>‘mother’s brother’</td>
</tr>
<tr>
<td>d. duwe?</td>
<td>duwewe?</td>
<td>‘to try to, to want to’</td>
</tr>
<tr>
<td>e. moya</td>
<td>moyaya</td>
<td>‘shoulder’</td>
</tr>
<tr>
<td>f. ?elel</td>
<td>?elelel</td>
<td>‘mother’s father’</td>
</tr>
<tr>
<td>g. ?ewši?</td>
<td>?ešiší?</td>
<td>‘father’s brothers’</td>
</tr>
<tr>
<td>h. net’us</td>
<td>net’unt’us</td>
<td>‘old women’</td>
</tr>
<tr>
<td>i. mokgo</td>
<td>mogokgo</td>
<td>‘shoes’</td>
</tr>
</tbody>
</table>

The task for both the linguist and the Washo language is to deduce the pretranscription representations, and then the rules for generating these pretranscription representations. Examples (248g–i) are the most complex, and therefore the most revealing. The simplest way to generate this pattern is left transcription with leading edge truncation. The copy is shaded (as usual) and the remnant is boxed.

(249)

```
ne[⟨n⟩]t’u|s  →  ne[t’u]nt’u|s
mo[⟨k⟩go]  →  mo[go]kgo
?e[⟨w⟩ši]?  →  ?eši[⟨wši⟩]? 
```

We can go on to speculate that the juncture insertion rules are

$$\emptyset \rightarrow [\text{Right } V \overline{\_}], \quad \emptyset \rightarrow [\text{Right } V \overline{\_}]$$

and that prosodic adjustment of the first conjunct results in truncation. Since an increasing sonority requirement on onset consonants is a common well-formedness condition, we can further speculate that the truncation is driven by a well-formed syllable structure desideratum for the first conjunct. These considerations successfully derive all the
examples in (248). Note that the juncture insertion rules are the mirror image of the Mangarayi juncture insertion rules.

Jacobsen (1964:117) observes that the only initial two-consonant clusters that occur in indigenous Washo words are of the type *P* followed by a voiced sonorant. If we assume that this is a syllable well-formedness condition on onsets, the following examples support the idea that the truncation in (249) is driven by first conjunct syllable well-formedness.

(250)

\[
\begin{array}{lll}
\text{root} & \text{plural} \\
\hline
a. & \text{ba?lew} & \text{ba?le?lew} & \text{‘Paiutes’} \\
b. & \text{in?yin} & i?yin?yin & \text{‘varicolored’} \\
c. & i?deb & ide?deb & \text{‘wrinkled’}
\end{array}
\]

The derivations are:

(251)

\[
\begin{array}{llll}
\text{JncIns} & \text{PrAdj} & \text{Trscr} \\
\hline
\text{ba?lew} & \text{ba[?le]w} & \text{ba?le [?le]w} \\
\text{in?yin} & \text{i[n?yi]n} & \text{i{n(yi)n}n} \\
\text{i?deb} & \text{i[?de]b} & \text{i{(?de)b}} \\
\end{array}
\]

In each case, the onset is truncated minimally to a permissible onset using left edge truncation. These examples make the designation “CV-reduplication” for this kind of Washo plural reduplication problematic. I will maintain it in spite of its problematic aspect because it does describe the reduplicant accurately in the large majority of cases and does contrast nicely with the other type of reduplication, “VC-reduplication”, which will be discussed shortly.

V-initial roots display a superficially different surface pattern.

(252)

\[
\begin{array}{ll}
\text{root} & \text{plural} \\
\hline
a. & \text{ileg} & \text{leleg} & \text{‘red’} \\
b. & \text{ipes} & \text{pepes} & \text{‘black’} \\
c. & \text{aNkas} & \text{kaNkas} & \text{‘hollow’} \\
d. & \text{emc’i} & \text{c’imc’i} & \text{‘to wake up’}
\end{array}
\]

Winter (1970) realized that the examples in (252) were the result of vowel syncope of initial unstressed vowels in Washo. Stress is usually
penultimate. Once this is taken into account, the analysis of the examples in (252) is no different than the analysis of the examples in (251).

\[(253)\]

\begin{tabular}{llll}
\text{Trscr} & \text{stress} & \text{syncope} \\
\hline
a. & i[le]g & i le [le]g & iléleg & léleg \\
b. & i[pe]s & i pe [pe]s & ipépes & pépes \\
c. & a\{g\}ka\js & a ka [\ns]\ka\js & akánkas & kánkas \\
d. & e\{m\}c\’i & e c\’i [mc\’i] & ec’ímc’i & c’ímc’i \\
\end{tabular}

There is stem ablaut associated with CV-reduplication, which is evident in the following examples:

\[(254)\]

\begin{tabular}{llll}
\text{root} & \text{plural} & \text{pretranscription} \\
\hline
a. & t’anu & t’anono & ‘person’ & ta[no] \\
b. & ašun & šošon & ‘red’ & a[šo]n \\
c. & albul & bolbol & ‘spherical’ & a{\langle l\rangle}bo\l \\
d. & al?mul & ?ol?mol & ‘big and round’ & a{\langle l\rangle}?mo\l \\
e. & amk’um & k’omk’om & ‘arched’ & a{\langle m\rangle}k’o\m \\
\end{tabular}

Under \(\rho_{CV}\)-reduplication, a high round vowel in the duplicant is lowered if the preceding vowel is low. I will call this \(\rho_{CV}\)-ablaut. This ablaut occurs after juncture insertion, before transcription.

#### 7.4.1.1. Bare timing slots in the underlying representation

Roots with a long penultimate vowel appear to be exceptions to the reduplication rule as developed above.

\[(255)\]

\begin{tabular}{ll}
\text{root} & \text{plural} \\
\hline
a. & wašiw & waši:siw & ‘Washo’ \\
b. & meh:hu & mehu:h:hu & ‘to be a boy’ \\
c. & t’e:liw & t’e:li:liw & ‘to be a man’ \\
d. & memde:wi & memdewi:wi & ‘deer’ \\
e. & ?at’u & ?at’o:t’o & ‘older brother’ \\
f. & ma:qu & ma:qo:go & ‘sister’s child’ \\
g. & i:li:li & i:li:li & ‘pure white’ \\
\end{tabular}
Halle (p.c.) suggests that long vowels can be represented in underlying forms as a single occurrence of the vowel followed by a bare timing slot. This immediately explains the examples in (255). The derivation (256) is typical.

\[(256) \quad \times \times \times \times \times \quad \rightarrow \quad \times \{\times \} \times \times \rightarrow \quad \times \times \times \times \times \times \times \]

\[
\begin{array}{cccccccc}
\text{w} & \text{a} & \text{ś} & \text{i} & \text{w} & | & | & | \\
\text{w} & \text{a} & \text{ś} & \text{i} & \text{w} & | & | & | \\
\text{w} & \text{a} & \text{ś} & \text{i} & \text{w} & | & | & |
\end{array}
\]

\[\rightarrow \quad \times \times \times \times \times \times \times \rightarrow \quad \times \times \times \times \times \times \times \]

\[
\begin{array}{cccccccc}
\text{w} & \text{a} & \text{ś} & \text{i} & \text{w} & | & | & | \\
\text{w} & \text{a} & \text{ś} & \text{i} & \text{w} & | & | & | \\
\text{w} & \text{a} & \text{ś} & \text{i} & \text{w} & | & | & |
\end{array}
\]

\[\rho_{CV}\text{-ablaut applies in (255e) and (255f), as expected.}\]

Finally, there is one last puzzling group of examples of \(\rho_{CV}\)-reduplication, exemplified below:

\[(257) \quad \text{root} \quad \text{plural} \]

\[
\begin{array}{lll}
a. & \text{ayam} & \text{yam} \quad \text{‘to hit with an instrument’} \\
b. & \text{ayuk} & \text{yok} \quad \text{‘parent-in-law’} \\
c. & \text{iyeb} & \text{ye:b} \quad \text{‘to copulate’}
\end{array}
\]

We can account for these examples if we slightly modify the proposal that bare timing slots which are postvocalic are associated with the vowel, producing a long vowel. Suppose that this rule is blocked if the timing slot is also prevocalic, as a hiatus avoidance mechanism. Suppose also that if this rule does not provide phonemic association to a bare timing slot, then phonemic association is provided by epenthetic \(y\).

Assuming that the \(y\)-glides in (257) come from underlying bare timing slots, which induce epenthetic \(y\) because long vowel formation is blocked, the derivation of (257a), for example, begins:

\[(258) \quad \times \times \times \times \quad \rightarrow \quad \times \times \times \times \times \times \quad \rightarrow \quad \times \times \times \times \times \times \times \]

\[
\begin{array}{cccccccc}
\text{JnIns} & \text{Trscr} \\
\text{a} & \text{a} & \text{m} & | & | & | & | & | \\
\text{a} & \text{a} & \text{m} & | & | & | & | & | \\
\text{a} & \text{a} & \text{m} & | & | & | & | & |
\end{array}
\]

If we can find a reason why the second bare timing slot deletes, the other steps in the derivation are clear. The first bare timing slot is realized as \(y\) intervocally, and the unstressed initial vowel syncopates as discussed above. Note that there is a “crossing violation” in the final representation in (258) in the sense discussed in Chapter 2. There
are two timing slots associated with a particular phoneme, but there is an intervening timing slot which is not associated with that phoneme. This provides a motivation for deleting the second bare timing slot. I assume that NCC repair, as a simpler alternative to fission, simply deletes the intrusive timing slot.

All of the examples in (257) are explained in the same way. $\rho_{CV}$-ablaut applies as expected in (257b). This completes the discussion of the mechanics of Washo $\rho_{CV}$-reduplication. We now turn to illustrating VC-reduplication and discussing how the choice between $\rho_{VC}$ and $\rho_{CV}$ is made.

### 7.4.2 VC-reduplication

The juncture insertion associated with $\rho_{CV}$-reduplication does not produce a nontrivial reduplicant if the stem is monosyllabic. We have seen already that it is not unusual for reduplication rules to break down on monosyllabic stems. Recall that the Mangarayi reduplicative plural, which also needs a pair of nuclei in order to demarcate the duplicant, does not apply to monosyllables. The Arrernte Rabbit Talk transformation similarly needs a pair of nuclei. In that case, there is allomorphy, with a different affix combining with monosyllabic roots. Monosyllabic roots in Washo are therefore of particular interest. Some examples follow:

<table>
<thead>
<tr>
<th>root</th>
<th>plural</th>
<th>meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. ips</td>
<td>péps</td>
<td>‘up from a surface’</td>
</tr>
<tr>
<td>b. išl</td>
<td>šéšl</td>
<td>‘to give’</td>
</tr>
<tr>
<td>c. iʔb</td>
<td>řeʔb</td>
<td>‘cry, weep’</td>
</tr>
<tr>
<td>d. im</td>
<td>mém</td>
<td>‘out from’</td>
</tr>
<tr>
<td>e. iw</td>
<td>wéw</td>
<td>‘in a certain direction’</td>
</tr>
<tr>
<td>f. akd</td>
<td>kákd</td>
<td>‘slowly’</td>
</tr>
<tr>
<td>g. sesm</td>
<td>sesésm</td>
<td>‘to vomit’</td>
</tr>
</tbody>
</table>

In general, polysyllabic words are stressed on the penultimate syllable (sáksag, balóxat, malósañ, etc.). Note, however, that in polysyllabic (259g) there is final stress. If it is the case that all reduplicated monosyllables are have final stress, then a simple account of (259) is possible. Assume for the moment that reduplicated monosyllabic roots
have final stress. This will be justified below. The pre-transcription representations of the forms in (259) are given below.

<table>
<thead>
<tr>
<th>(260)</th>
<th>root</th>
<th>IncIns</th>
<th>ablaut</th>
<th>TrScr</th>
<th>stress</th>
<th>syncope</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>ips</td>
<td>[ip]s</td>
<td>[ep]s</td>
<td>ep</td>
<td>epéps</td>
<td>péps</td>
</tr>
<tr>
<td>b.</td>
<td>išl</td>
<td>[iš]l</td>
<td>[eš]l</td>
<td>es</td>
<td>ešéšl</td>
<td>šéšl</td>
</tr>
<tr>
<td>c.</td>
<td>iʔb</td>
<td>[iʔ]s</td>
<td>[eʔ]s</td>
<td>eʔ</td>
<td>eʔéʔs</td>
<td>?éʔs</td>
</tr>
<tr>
<td>d.</td>
<td>im</td>
<td>[im]</td>
<td>[em]</td>
<td>em</td>
<td>emém</td>
<td>mém</td>
</tr>
<tr>
<td>e.</td>
<td>iw</td>
<td>[iw]</td>
<td>[ew]</td>
<td>ew</td>
<td>ewéw</td>
<td>wéw</td>
</tr>
<tr>
<td>f.</td>
<td>akd</td>
<td>[ak]d</td>
<td>akakd</td>
<td>akakd</td>
<td>kákd</td>
<td>kákd</td>
</tr>
<tr>
<td>g.</td>
<td>sesm</td>
<td>s[es]m</td>
<td>sesm</td>
<td>sesm</td>
<td>sesésm</td>
<td>sesésm</td>
</tr>
</tbody>
</table>

Like CV-reduplication, VC-reduplication also triggers stem ablaut, but of a different variety. A high vowel in the duplicant is lowered to a mid vowel. In the examples above, i → e.

Why should the bisyllabic output of reduplicated monosyllables be stressed on the final syllable? It cannot be the case that stress is assigned before duplication, necessarily final for a monosyllabic form, and simply persists. Many examples like móya → moyáya, (248e) above, show that reduplication can shift the location of stress. If stress persisted, we would expect moyáya, not moyáya. The desired result follows, however, if foot delimiters are inserted cyclically and persist, assuming that main stress is assigned to the leftmost element of the rightmost foot.

The persistence of penultimate stress in móya → moyáya, follows because cyclic binary footing can insert another foot delimiter after reduplication.

(261) m o y a m o y a m o y a m o y a
With a monosyllabic root, like (261g), foot delimiter insertion cannot shift main stress off the final syllable.

\[
(\star) \quad x \quad x \quad x \quad \rightarrow \quad x \quad x \quad x \quad x \\
| \quad | \quad | \quad | \quad s \quad e \quad s \quad m
\]

We conclude therefore that in the context of monosyllabic stems, plural is realized by an affix which has a null exponent and triggers the rules:

\[
\emptyset \rightarrow [\ / \ _\ V, \ \emptyset \rightarrow ]/ \ C _\ _\ 
\]

This affix will be called \( \rho_{VC} \).

There are a number of polysyllabic roots which are lexically stipulated to take the \( \rho_{VC} \) plural affix.

\[
(263) \begin{array}{ccc}
\text{root} & \text{plural} & \text{pretranscription} \\
a. \quad \text{maʔsaʔ} & \text{maʔaʔsaʔ} & \text{‘brother’s child’} / m[aʔ]sə̈\text{ʔ} \\
b. \quad \text{mayŋa} & \text{mayayŋa} & \text{‘fawn’} / m[ay]ŋə \\
c. \quad \text{šawlam} & \text{šawwalam} & \text{‘to be a girl’} / s[aw]λəm \\
d. \quad \text{helme} & \text{heleλme} & \text{‘three’} / h[el]me \\
e. \quad \text{hesge} & \text{hesesge} & \text{‘two’} / h[es]ge \\
f. \quad \text{aʔsam} & \text{ʔaʔsam} & \text{‘to lie’} / [aʔ]sam \\
g. \quad \text{baliʔ} & \text{balaliʔ} & \text{‘to shoot’} / b[al]iʔ \\
h. \quad \text{ašiw} & \text{šašiw} & \text{‘clear’} / [aš]iw \\
i. \quad \text{ač’im} & \text{č’ac’im} & \text{‘green, yellow’} / [ač’]im \\
j. \quad \text{ašdim} & \text{šašdim} & \text{‘to hide’} / [aš]dim \\
k. \quad \text{ap’il} & \text{p’ap’il} & \text{‘tail’} / [ap’]il
\end{array}
\]

The roots in (263) are of two types. The first type has the form \((C_1)VC_2C_3V(C_4)\), where the two vowels are identical. The second type is of the form \((C_1)aC_2C_3VC_4\), where \(V\) is a high unround vowel, \(i\) or \(\text{i}\). This is unlikely to be an accident. Some speculation is relegated to a footnote.
7.4.3 The residue

The only examples from Broselow and McCarthy (1983) and Yu (2001) which are still unexplained are given in (264). The results of VC- and CV-reduplication (if applicable) are given in each case.

(264)

<table>
<thead>
<tr>
<th></th>
<th>actual</th>
<th>VC</th>
<th>CV</th>
</tr>
</thead>
<tbody>
<tr>
<td>a.</td>
<td>ḫaːm</td>
<td>ḫaːmim</td>
<td>*ẖaːmaːm</td>
</tr>
<tr>
<td>b.</td>
<td>elːsim</td>
<td>šelːsim</td>
<td>*lelːsim *šilːsim</td>
</tr>
<tr>
<td>c.</td>
<td>emlu</td>
<td>mumlu</td>
<td>*memlu   *lumlu</td>
</tr>
<tr>
<td>d.</td>
<td>aːš</td>
<td>daːš</td>
<td>*šaːš</td>
</tr>
<tr>
<td>e.</td>
<td>iʔib</td>
<td>?eʔib</td>
<td>*ʔeʔib   *ʔiʔib</td>
</tr>
<tr>
<td>f.</td>
<td>iʔiš</td>
<td>?eʔiš</td>
<td>*ʔeʔiš   *ʔiʔiš</td>
</tr>
<tr>
<td>g.</td>
<td>iʔiw</td>
<td>?weʔiw</td>
<td>*ʔeʔew   *ʔiʔiw</td>
</tr>
<tr>
<td>h.</td>
<td>aːt’i</td>
<td>t’aːt’i</td>
<td></td>
</tr>
<tr>
<td>i.</td>
<td>aːm</td>
<td>maːm</td>
<td></td>
</tr>
</tbody>
</table>

I will leave the first group without comment. They are presented in the interest of full disclosure. (264d) may be analogous to Arrernte Rabbit Talk use of a consonantal prefix (y) in case the reduplication rule for polysyllabic stems fails to apply. Yu (2001) argues that the roots in (264e-g) are underlying monosyllables and the i which appears in the singular form is epenthetic. If so, they would be subject to VC-reduplication, explaining why the vowel lowers.9

The most interesting examples are (264h-i). There are two potential explanations, both of which are plausible, but neither of which has supporting evidence. The problem is the assumption which was made above that long vowels in Washo are represented as vowel plus bare timing slot at the point that ρCV juncture insertion applies. The analysis of (264h-i) would go through easily if the long vowel is doubly linked and if unstressed long initial vowels syncopate. The derivation of (264i) would be:
It could be that initial long vowels are treated differently than medial long vowels, or that long vowels in $\rho_{VC}$-reduplication are treated differently than long vowels in $\rho_{CV}$-reduplication. While this is plausible, it is not an explanation.

Another potential solution revolves around the ambiguity of the structural condition $/C/$ in the VC-reduplication juncture insertion rule $\emptyset \rightarrow \emptyset /C/$. In Chapter 4, $C$ was taken to be the contradiction of $V$. However, if $C$ is taken to be false of a bare timing slot, $a:m \rightarrow ma:m$ can be derived.

The result is $a:ma:m$, with the usual final stress pattern of reduplicated monosyllables. If unstressed initial long vowels delete just like unstressed initial short vowels, the desired result is obtained.

### 7.5 Tohono O’odham plural reduplication

In Washo, there is a class of polysyllabic roots which are lexically specified to reduplicate according to the rules for monosyllabic roots. There is extensive lexically specified irregularity in Tohono O’odham reduplication and developing an analysis in which lexically specification is straightforward is the primary concern. Although differing in many significant respects from the analysis of Raimy (2000), the analysis presented here is indebted both to his approach to the problem and organization of the data. The examples are from Saxton, Saxton, and Enos (1983) and Zepeda (1983).
The impressive variation in Tohono O’odham reduplication is evident in the forms below:

(267)  
\begin{align*}
\text{ton} & \rightarrow \text{to-}t\text{on} & \text{‘knee’} & \text{pad} & \text{pa?a-pad} & \text{‘badly’} \\
\text{gimai} & \rightarrow \text{gi-}g\text{imai} & \text{‘braggart’} & \text{sikol} & \text{si?i-skol} & \text{‘circular’} \\
\text{bo:l} & \rightarrow \text{bo-}b\text{ol} & \text{‘a ball’} & \text{lo:ba} & \text{lo-}l\text{ba} & \text{‘dry goods’} \\
\text{da:k} & \rightarrow \text{da-}d\text{k} & \text{‘nose’} & \text{gok} & \text{go?o-gok} & \text{‘(a) two’} \\
\text{gaso} & \rightarrow \text{ga-}g\text{so} & \text{‘a fox’} & \text{ban} & \text{ba-}b\text{an} & \text{‘coyote’} \\
\end{align*}

This includes all the varieties of reduplication which were classified by Raimy, except for a group of forms with an initial consonant cluster which will be discussed below. See his book for many more examples of each type. 

As we have done several times already, we attack the problem from the standpoint of the language learner trying to deduce the rules of juncture insertion which generate these forms. The natural conjecture about underlying forms (and derivations) is:

(268)  
\begin{align*}
a. \text{toon} & \rightarrow [t\text{o}\{o\}]n \rightarrow \text{too to-n} \\
b. \text{gimai} & \rightarrow [g\text{i}m\text{ai}] \rightarrow \text{gi gi-mai} \\
c. \text{daak} & \rightarrow [d\{a\}]k \rightarrow \text{daa d-k} \\
d. \text{gaso} & \rightarrow [g\text{a}]s\text{o} \rightarrow \text{g a g-so} \\
e. \text{ban} & \rightarrow [b\text{a}\{a\}]n \rightarrow \text{baa ba-n} \\
f. \text{bool} & \rightarrow [b\text{o}]l \rightarrow \text{bo bo-l} \\
g. \text{looba} & \rightarrow [l\{o\}]b\text{a} \rightarrow \text{lo l-ba} \\
h. \text{gook} & \rightarrow [g\text{o}\{o\}]k \rightarrow \text{go?o go-k} \\
i. \text{pad} & \rightarrow [p\text{a}\{a\}]d \rightarrow \text{p a ?a pa-d} \\
j. \text{sikol} & \rightarrow [s\{i?i\}]k\text{ol} \rightarrow \text{s i?i s-kol} \\
\end{align*}

The starting point in all cases is left transcription and C*\nu-reduplication with a null exponent. The second conjunct of the reduplicant is always reduced to CV or C. I assume that the default is reduction to CV. Call this operation Default Truncation (DefTrunc). Some roots are lexically specified to undergo Exceptional Duplicant Truncation (XTrunc). This
generates (268a-d), with daak and gaso lexically specified as XTrunc roots.

\[(269)\]
\[
\begin{array}{cccc}
C^\nu-junctures & XTrunc & DefTrunc & TrScr \\
[gi]mai & gi [gimai] \\
[too]n & [to(o)]n too [ton] \\
[ga]so & [g(a)]so ga [gso] \\
[daa]k & [d(aa)]k daa [dk] \\
\end{array}
\]

Aside from XTrunc, there are three other lexically specified adjustments of the duplicant: Exceptional Shortening (XShort), Exceptional Lengthening (XLong), and Exceptional Degemination (XDegem). The effect of each should be clear from the derivations below. I assume that degemination automatically induces ?-insertion to break the resulting hiatus.

\[(270)\]
\[
\begin{array}{lll}
a. \quad \text{[boo]l} & \xrightarrow{\text{XShort}} & \text{[bo]l} \\
& \xrightarrow{\text{Trscr}} & \text{bo [bol]} \\
\hline
b. \quad \text{[ba]n} & \xrightarrow{\text{XLong}} & \text{[baa]n} \\
& \xrightarrow{\text{DefTrunc}} & \text{[ba(a)]n} \\
& \xrightarrow{\text{Trscr}} & \text{baa [ban]} \\
\hline
c. \quad \text{[goo]k} & \xrightarrow{\text{XDegem}} & \text{[go?o]k} \\
& \xrightarrow{\text{DefTrunc}} & \text{[go(?o)]k} \\
& \xrightarrow{\text{Trscr}} & \text{go?o [gok]} \\
\end{array}
\]

Not surprisingly, some roots are specified to undergo more than one exceptional rule.

\[(271)\]
\[
\begin{array}{lll}
a. \quad \text{[loo]ba} & \xrightarrow{\text{XShort}} & \text{[lo]ba} \\
& \xrightarrow{\text{XTrunc}} & \text{[l(o)]ba} \\
& \xrightarrow{\text{Trscr}} & \text{lo [iba]} \\
\hline
b. \quad \text{[pa]d} & \xrightarrow{\text{XLong}} & \text{[paa]d} \\
& \xrightarrow{\text{XDegem}} & \text{[pa?a]d} \\
& \xrightarrow{\text{DefTrunc}} & \text{[pa(?a)]d} \\
& \xrightarrow{\text{Trscr}} & \text{pa?a [pad]} \\
\hline
c. \quad \text{[si]kol} & \xrightarrow{\text{XLong}} & \text{[sii]kol} \\
& \xrightarrow{\text{XDegem}} & \text{[si?i]kol} \\
& \xrightarrow{\text{XTrunc}} & \text{[s(i?i)]kol} \\
& \xrightarrow{\text{Trscr}} & \text{si?i [skol]} \\
\end{array}
\]

Some combinations of lexically specified operations are either incoherent (duplicant shortening and degemination, for example) or
unlearnable (duplicant shortening followed by duplicant lengthening). The only plausible combinations that are not found in the data are illustrated in (272), with fictitious examples. Some ordering is assumed, with XShort or XLong applying first and XTrunc applying last.

\[
\begin{align*}
(272) \quad & a. \ [ka]\text{nlol} \xrightarrow{X\text{Long}} [kaa]\text{nnol} \xrightarrow{X\text{Trunc}} [k\langle aa\rangle]\text{nnol} \xrightarrow{\text{Trscr}} [\text{knol}] \\
& b. \ [noo]\text{kol} \xrightarrow{X\text{Degem}} [no\text{?o}]\text{kol} \xrightarrow{X\text{Trunc}} [n\langle o\text{?o}\rangle]\text{kol} \xrightarrow{\text{Trscr}} [no\text{?o}]\text{nkol}
\end{align*}
\]

It could be the case that compensatory shortening would apply in (272a) to produce \textit{kaknlol}. If so, the combination of XLong and XTrunc might not be learnable. I have no explanation for why examples like (272b) do not occur.

Fitzgerald (2000) claims that the reduplication pattern

\[
CV_1V_2 \ldots \rightarrow CV_1CV_2 \ldots
\]

is obligatory if the vowel sequence \(V_1V_2\) is one of \{io, io, oa, ua\}. For convenience in the discussion, call these vowel sequences Type F vowel sequences and call a root with an initial Type F vowel sequence a Type F root. The following examples are from Fitzgerald (p. 715), who should be consulted for more examples and glosses:

\[
(273) \quad a. \ CV_1V_2 \ldots \rightarrow CV_1CV_1V_2 \ldots \quad b. \ CV_1V_2 \ldots \rightarrow CV_1CV_2 \ldots
\]

\[
\begin{align*}
\text{kui} & \quad \text{ku-kui} \quad \text{hiopˇcig} \quad \text{hi-hopˇcig} \\
\text{hoiki} & \quad \text{ho-hoiki} \quad \text{čioj} \quad \text{či-coj} \\
\text{nia} & \quad \text{ni-nia} \quad \text{doa} \quad \text{do-da} \\
\text{niid} & \quad \text{ni-niid} \quad \text{čuama} \quad \text{ču-čama}
\end{align*}
\]

Raimy (2000:125), however, gives examples to show that not all Type F verb roots behave as the ones in (273b) do.

Assuming that the CVV sequence in the roots in (273) is bisyllabic, the reduplication pattern in (273b) is the result of exceptional truncation.

\[
(274) \quad [\text{cu}]\text{ama} \xrightarrow{X\text{Trunc}} [\text{č⟨u⟩}]\text{ama} \xrightarrow{\text{Trscr}} [\text{cu}][\text{čama}]
\]
In terms of the analysis above, the observations of Fitzgerald and Raimy can be summarized by saying that the default for Type F roots is the class of XTrunc verbs, but there are exceptions.

Fitzgerald develops an OT account of the reduplication properties of Type F roots in terms of hiatus avoidance for these sequences in the output of reduplication. In the theory developed here, avoidance of such sequences may well be the reason that certain verb roots tend to be put in the XTrunc class. But this does not mean that hiatus avoidance must be reflected directly in the form of the rule which achieves it. To the extent that the hiatus avoidance account is correct, it is an account of why these particular roots tend to be put in the XTrunc class. Exceptional truncation itself is quite independent of hiatus avoidance and many roots in the XTrunc class have long initial vowels, for which the issue of hiatus avoidance is moot. There is no imperative to include a mention of hiatus avoidance in the grammar. See Frampton (2002) for some discussion of the distinction between understanding the pressures that phonotactics may exert for including a particular rule in the grammar and understanding what the rule is and how it interacts with the rule system it is embedded in.

Finally, there is one more set of forms to consider. There are some stop-liquid initial consonant clusters in Tohono O’odham. They are associated with a characteristic reduplication pattern which is not so far accounted for.

(275)  
<table>
<thead>
<tr>
<th>verb</th>
<th>reduplication pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>tlamba</td>
<td>tla-lamba</td>
</tr>
<tr>
<td>plamba</td>
<td>plalamba</td>
</tr>
<tr>
<td>kla:wao</td>
<td>klalawao</td>
</tr>
<tr>
<td>plo:mo</td>
<td>plolomo</td>
</tr>
<tr>
<td>tlo:gi:</td>
<td>tlologi:</td>
</tr>
</tbody>
</table>

This is (99) from Raimy.

The simplest account is to suppose that the initial stop is excluded from the domain of the reduplicative plural affix. Presumably, it is unsyllabified, although I have no other evidence for this. All of the verbs in (275) must also be lexically specified as XShort verbs. A typical derivation is:
I have no explanation for why shortening obligatorily applies in these forms. The verb roots in question form a small class with relatively similar form, so it is perhaps not surprising that they all have the same irregularity. If there were no lexically specified adjustment rules (i.e. no irregularities), we would expect, for example, *tlamiba* → *t-laː-la-mba*, with regular prosodic truncation of the second conjunct to CV.

In closing the discussion of Tohono O’odham, it should be noted that it is extremely simple to code the irregularities in the system presented above. There are four exceptional subclasses of verbs: shortening, lengthening, degeminating, and exceptionally truncating.\(^1\) Membership in each of these verb classes has a simple effect, the application of a special duplicant adjustment rule. The Tohono O’odham learner must carry out such coding in some way. A complex system of irregularities like this presents a serious challenge to OT. It is not at all clear that OT approaches to reduplication can carry out this coding in a plausible fashion. If it were the case, for example, that a hierarchy of penalty functions could be developed so that the irregularities were determined by turning off and on particular penalty functions, a system of comparable complexity might be possible. But it is extremely dubious that this can be done. If each class of irregularities requires a reranking of the penalty functions, the complexity of such a system argues strongly against it. Recall that the irregularity classes overlap and a root can be in as many as three different classes. This complicates an attempt to account for the irregularities by reranking. No OT analysis of the complexities of Tohono O’odham reduplication has been attempted, so no comparison can be made at this point.
7.6 Infixed consonant copy: Temiar verbal reduplication and Levantine Arabic perjorative reduplication

Temiar is a Mon-Khmer language spoken in Thailand and Malaysia. Both Levantine Arabic and Temiar realize certain morphemes as infixation of a copy of an edge consonant. The similarity between the two mechanisms was noted by Broselow and McCarthy (1983).

7.6.1 Temiar verbal reduplication

Reduplication in Temiar has attracted a great deal of attention in the literature on reduplication. See in particular Gafos (1999) and Raimy (2000) and the references cited there. The interest stems from the fact that Temiar reduplication patterns are resistant to a plausible treatment in prosodic terms.

A variety of reduplicative affixes in Temiar will be considered in this section. Verb roots in Temiar have the form \((C)CV(V)C\). Various verbal inflections appear as infixation at the left edge of the CVC portion of the root. The infixes below have been boldfaced.

\[(277)\]

\[
\begin{array}{llll}
\text{simultactive} & \text{causative} & \text{continuative} \\
\text{slɔg} \quad \text{(root)} & \text{sa}lɔg & \text{sr}lɔg & \text{sg}lɔg \\
\text{gɔl} \quad \text{(root)} & \text{g}a\text{gɔl} & \text{tr}gɔl & \text{gl}gɔl \\
\text{sr}lɔg \quad \text{(causative stem)} & \text{sr}l\text{a}g & \text{sr}lg & \text{sr}l\text{g} \\
\text{tr}gɔl \quad \text{(causative stem)} & \text{tr}g\text{a}l & \text{t}r\text{g}a\text{l} & \text{t}r\text{g}a\text{l}
\end{array}
\]

The simultactive and causative affixes have exponents, \(a\) and \(r\) respectively. CVC roots (\(g\alpha l\) above) are augmented with an initial consonant prior to infixation. In the causative, epenthetic \(t\) extends the root. Otherwise, the root is extended by geminating the initial consonant. The continuative suffix has a null exponent, but infixes a copy of the final consonant of the stem.

We first address the question of the infixation site, the left edge of the CVC portion of the stem. How is the left edge of the CVC portion of the stem located with the limited resources available in DR? I assume that verbal stems have a natural bipartite prosodic structure:

consonantal extension + CV(V)C kernal
Opinions have varied about the prosodic structure of the consonantal extension in the literature. Some have proposed a category of “minor syllables” for the consonantal extension. Others have proposed that the extension consonants remain unsyllabified. It is consistent with both proposals to assume that the extension is prosodically inferior in some way and that the stem kernel is singled out as the domain of verbal affixation.

We can now address the question of the special treatment of CVC stems. If it is a requirement for affixation that the stem have a nonempty consonantal extension, presumably because there must be a suitable infixation site, roots like goi could not be inflected if no supplementary mechanism is provided. Prosodic requirements on the stem which are imposed by affixes are sometimes met by modification of the stem prior to affixation. CVC stem augmentation in Temiar is such a modification. The modification which is made is 

tepenthesis at the left edge of the stem in the causative and initial consonant gemination in the simulfa
vative and continuative.

Traditional grammars of Senoic, the language family to which Temiar belongs, describe the morphophonology in just this way.

... the most common morphological process in Senoic is infixation of the final consonant between two initial consonants; e.g., ci?ut ‘to choke’ → ci?ut ‘to be choking’. In roots having only a simple initial, e.g. ci?p ‘walk’, the final is inserted between the initial consonant and its reduplication: ci?p → cci?p → cpcip, ‘to be walking’. This is a productive process in verbs which I called elsewhere the Indeterminate mode. Diffloth (1976)

The continuative affix has a null exponent, designates the CVC kernel of the stem as its domain, extends the stem if necessary, and triggers the juncture insertion rules:

$$\emptyset \rightarrow [/, \_ \_ \_ \_ \_ \_ \times, \emptyset \rightarrow ]/_{\text{Right}} \_ \_ \_ \_ \_ \_ \times$$

For example:
The simulferive affix is \(-\text{a}\) and the causative affix is \(-\text{r}\), both with the same domain as the continuative affix and both triggering stem extension, if required. For example:

(279) \begin{align*}
\text{domain} & \quad \text{\textregistered \text{CAUSE}} & \quad \text{domain} & \quad \text{\text{DC}} \\
\times \times \times \times & \rightarrow & \times \times \times \times \times & \rightarrow & \times \times \times \times \times \times \\
 s \quad l \quad o \quad g & & s \quad l \quad o \quad g & & s \quad l \quad o \quad g & & s \quad l \quad o \quad g \\
\end{align*}

\text{Trscr} \rightarrow \times \times \times \times

Note that DC depends heavily on the specification of the domain (the CVC kernel of the root) boundaries to locate the insertion point for the junctures which close the duplicant and truncate.

The continuative pattern is somewhat different in Semai, a closely related language.

(280) \begin{align*}
\text{root} & \quad \text{continuous} \\
b?\text{\textregistered} & \quad \text{blb?}\text{\textregistered} & \quad \text{‘painful embarrassment’} \\
d\text{\textregistered} & \quad \text{dhd}\text{\textregistered} & \quad \text{‘appearance of nodding’} \\
\text{kmr}\text{\textregistered}\text{\textregistered} & \quad \text{kckm}\text{\textregistered}\text{\textregistered} & \quad \text{‘short, fat arms’} \\
\end{align*}

Raimy (2000:149) makes the valid point that an adequate theory of reduplication in Temiar should make clear its connection with Semai reduplication. Two straightforward modifications of the Temiar specifications above give the correct results for Semai. First, there is no special domain specification. Second, all stems are extended by geminating the
initial consonant, not only CVC stems, as in Temiar. The continuative affixes in Temiar and Semai trigger the same juncture insertion; the $\times^*$-rule and $\emptyset \to /\Right$ before it is readjusted by geminating the initial consonant.

Note that the default domain is the stem, *before it is readjusted* by geminating the initial consonant.

### 7.6.2 Levantine Arabic perjorative reduplication

Broselow and McCarthy (1983) called attention to the similarity between continuative reduplication of CCVC (triconsonantal) roots in Temiar and intensive/perjorative reduplication of triconsonantal stems in Levantine Arabic. They give the following examples (and many more):

\begin{align}
\text{stem} & \quad \text{reduplicated} \\
\text{marat} & \quad \text{marmat} & \text{‘cut unevenly’} \\
\text{barad} & \quad \text{barbad} & \text{‘shaved unevenly’} \\
\text{shahta} & \quad \text{shashat} & \text{‘dragged unevenly’}
\end{align}

Descriptively, a copy of the initial consonant is postposed to the position following the second consonant. The semantics above are perjorative, but sometimes the semantics are essential intensive. I will call the morpheme INT in what follows, simply for convenience.

The affix can be described as having a null exponent and triggering the juncture insertion rules $\emptyset \to \langle / \times \rangle$ and $\emptyset \to \rangle / \Right V$. The effect of these rules is illustrated below:
Transcription in (283) is taken to be to the right. The transcription operation is considerably simpler if transcription is to the right, since truncation is then carried out by noncopying. This should be compared with the Temiar continuative in (278a). The output forms are close to being mirror images of each other.

Although this analysis does produce the correct results, it has one problematic aspect. No direct reference to the “second consonant” is made in the juncture insertion rules. The formalism developed to this point does not allow it. The insertion point of the ]-juncture, immediately after the second consonant, is identified as “before the final vowel” (*V). Given the consonant oriented morphology of the Semitic languages, a more direct way of locating this insertion site is desirable. The simplest analysis is that reduplication actually applies to the consonantal root, before vowels are inserted into the representation.

In order for this analysis to go through, the domain of the affix must consist of the initial consonant pair. It stretches usual notions of foot structure, but it is plausible that in a consonant oriented language that footing can take place in the absence of syllable structure, with each consonant taken to be a footable element. The initial consonant pair is an initial binary foot under this interpretation. Assuming that this is possible and that the domain of the intensive affix is this initial foot, then the juncture insertion rules are simply the ×*-rule and \( \emptyset \rightarrow \langle \times \times \rangle \).

Intensive reduplication applies to biconsonantal roots. The biconsonantal root *lf, for example, has the simple verb form *lafaf and the intensive/pejorative form *laflaf. It is suggested in Section 7.10.2 that in Chaha a biconsonantal root like *lf is stored in the lexicon as *lf, with an embedded duplication juncture. This then triggers transcription...
after the root is inserted into the morphophonological computation. If this is true in Levantine Arabic as well, it could be that there is no transcription in the root cycle and intensive/pejorative reduplication applies directly to Iℓf, producing I[ℓf]. Default Closure then yields [I{lf}], with nested duplicates. This is then transcribed as discussed in Section 4.2, producing I[ℓf]. Duplicates are transcribed from the inside out.

![Diagram of transcription process](image)

The resulting representation is identical to the representation produced by totally reduplicating Iℓf.

### 7.7 Sanskrit intensive and perfective reduplication

This section should be read as a revision of Steriade (1988), which carefully unravels the relevant Sanskrit phonology. The major differences are over the reduplication process itself. Most of the phonological insights, organization of the empirical data, and highlighting of crucial examples are due to Steriade.

Various Sanskrit verbal inflectional morphemes trigger reduplication. There are five varieties of prefixal reduplication: perfect stem, desiderative, present stem, aorist, and intensive, and one variety of present stem infixation. This section focuses on perfect and intensive reduplication, both of which are quite productive and reveal all the mechanisms which are employed in Sanskrit reduplication. The particular interest of Sanskrit for the general theory is the extent to which Sanskrit specialization of the NCC repair process shapes the surface form of the reduplicant. The discussion of “Shortcut Repair” in Kolami, Ponapean, and Hausa in Section 5.3 has already introduced the idea of language particular specialization of the repair process. Sanskrit specializations have a much more pervasive effect.

Descriptively, perfective reduplication prefixes a (C)V syllable to the verb root to create what is called the “perfect stem.” Intensive reduplication prefixes a CaX syllable to the verb root. Both kinds of reduplication interact extensively with a widespread process of low...
vowel syncope which many roots are subject to in certain prosodic environments. The syncopated root is called the zero grade form of the root in the Sanskrit literature, contrasting with the full grade form.

7.7.1 Low vowel syncope

The underlying vowel inventory in Sanskrit is \{a, i, u\}. Underlying verb roots are heavy monosyllables. Except for a few roots with long high vowels, the nucleus of underlying roots is the low vowel a. For verb roots which are subject to low vowel syncope, and whose reduced form has a vocalic nucleus, the vowel of the perfect prefix is the nuclear vowel of the reduced form. This is shown in (286). In those roots which do not syncopate, the vowel of the perfect prefix is a. Explaining this relation is the major challenge in analyzing Sanskrit reduplication.

(286) \[ \begin{array}{l|l|l|l|l} \text{full-grade} & \text{0-grade} & \text{perfect stem} \\ \hline a. & \text{suap} & \text{‘sleep’} & \text{svap} & \text{sup} & \text{su.svap} \\ b. & \text{suaj} & \text{‘embrace’} & \text{svaj} & \text{sa} & \text{svaj} \\ c. & \text{miaks} & \text{‘be situated’} & \text{myakṣ} & \text{mikṣ} & \text{mi.myakṣ} \\ d. & \text{tiaj} & \text{‘forsake’} & \text{tyaj} & \text{ta} & \text{tyaj} \\ e. & \text{uas} & \text{‘shine’} & \text{vas} & \text{us} & \text{u.vas} \\ f. & \text{uas} & \text{‘clothe’} & \text{vas} & \text{va} & \text{va.vas} \end{array} \]

Underlying u surfaces as a \(v\) aspirant in syllable initial onset position (as in German) and as a round labial glide in noninitial nonnuclear position. Sanskrit orthography uses “\(v\)” in both cases. A “\(y\)” is used for nonnuclear occurrences of underlying \(i\). All sonorants can be nuclear in Sanskrit and syncopated roots frequently have a nonvocalic nucleus. Roots of this kind invariably have the vowel a in the perfect prefix.

The puzzle is to explain why, for those roots which syncopate and whose syncopated root has a vocalic nucleus (286a,c,e), the vowel of the perfect prefix is the same as the nuclear vowel of the reduced root, and for those roots which do not syncopate (286b,d,f), the vowel of the perfect prefix is invariably a. Solving this puzzle led Steriade to conclude that the computation of the perfect prefix was accomplished by first copying the entire root, then computing its 0-grade reduction, then identifying the eventual prefix as a subpart of this 0-grade reduction and deleting the superfluous material. For roots whose syncopated form has a vocalic nucleus, this gives the correct results. For roots whose reduced
form has a syllabic liquid, the proposal makes the wrong prediction. Steriade predicts derivations such as those in (287). For roots with a syllabic nasal in the reduced form, tan in (287), the correct surface form is obtained because syllabic nasals in Sanskrit surface as the low vowel a. For roots with a syllabic liquid in the reduced form, mard in (287c), Steriade’s analysis produces the incorrect outcome, as she notes. She is forced to stipulate a rule converting such syllabic liquids to a in certain reduplicative contexts.

(287)  
<table>
<thead>
<tr>
<th>root</th>
<th>tan</th>
<th>mard</th>
</tr>
</thead>
<tbody>
<tr>
<td>full copy</td>
<td>tan.tan</td>
<td>mard.mard</td>
</tr>
<tr>
<td>0-grade</td>
<td>tŋ.tan</td>
<td>mṛd.mard</td>
</tr>
<tr>
<td>truncation</td>
<td></td>
<td>mṛd.mard</td>
</tr>
<tr>
<td>surface form</td>
<td>ta-tan</td>
<td>mṛ-mard</td>
</tr>
</tbody>
</table>

Even more serious than this empirical problem is the fact that the analysis relies on an incorrect assumption about the accentual conditions under which low vowel syncope applies. Steriade assumes that low vowel syncope applies in all unstressed syllables. Studies of Sanskrit stress, however, conclude that the environment for low vowel syncope requires an unstressed syllable which is followed directly by a stressed syllable. See Halle (1997:292), for example. We can see why this should be so from one of Halle’s examples. The noun svāsar ‘sister’ bears inherent stress on the first syllable. When it combines with a stressed suffix, the singular dative suffix -ē, for example, low vowel syncope applies and svās.re (svāsare) results. (Only the leftmost stress surfaces.) When it combines with an unstressed suffix, the singular accusative suffix -am, for example, low vowel syncope does not apply. Instead, svās.ar.am → svā.sā.ram. (Compensatory lengthening accompanies the recruitment of the root final consonant to be the onset of the following syllable). The deciding factor excluding svās.ram (parallel to svās.re) must be the absence of inherent stress on the suffix, not simply the absence of stress on the final syllable of the root.

Without the assumption that low vowel syncope applies in all unstressed syllables, the derivations which Steriade proposes do not
From Chapter 7

According to Steriade (p. 123), the derivation of the 3sg perfect form *bu-budhúś*, from the root *baudh* ‘know’, is:

\[
\begin{align*}
\text{full copy} & \quad \text{baudh-baudh-úś} \\
\text{low vowel syncope} & \quad \overbrace{\text{bud}}^-\text{-bud-úś} \\
\text{truncation} & \quad \text{bu-bud-úś}
\end{align*}
\]

As we have seen, however, there is no justification for the boxed outcome since the following syllable is unstressed.

An account of the interaction of low vowel syncope and reduplication in the DR framework requires an underlying structural difference which leads, on the one hand, to the syncopated root or, on the other, to the correct reduplicant. The starting point is the observation that although a certain accentual environment is certainly required, some condition on the ease of resyllabification is also in force. The root *pat* ‘fly’, for example, syncopates if it is an environment in which the onset and coda can be incorporated into adjacent syllables, but not otherwise. So *pat* has the inflected perfect form *pa-pt-úś*, with syncopation, but the root does not syncopate in the form *pat-í-ta*. The same is generally true of CaC roots. For another example, the root *nau* ‘praise’ syncopates to *nu* before C-initial stressed suffixes, but not in forms like *nau-ánti* → *na.vánti*, in which *u* is recruited as an onset to the following syllable.

The root *suap* syncopates to *sup*, but the root *suaj* does not syncopate. How can this difference be related the possibilities of resyllabification? I assume that the difference is in the nuclear structure of the two roots. *suap* has a long nucleus (the diphthong *ua*) and *suaj* has a short nucleus. Furthermore:

\[
\text{(289) Resyllabification Condition: Syncope requires the possibility of resyllabification without altering nuclear structure.}
\]

Since *suap* has a long nucleus, syncope simply shortens the nucleus. No resyllabification is necessary. The root *suaj*, on the other hand, has a short nucleus. Syncope removes the nucleus, leaving three unsyllabified consonants. There is no context which can absorb all three consonants into the existing syllable structure. The only possibility for resyllabification is promotion of *u* to be a new nucleus, but this alteration of nuclear structure is not allowed by (289).
What accounts for the difference in nuclear structure? One might speculate that the phoneme features of $u$ in $suaj$ differ from the phoneme features of the $u$ in $suaj$, somehow preventing it from becoming nuclear. Steriade argues convincingly that this cannot be the case. The crucial fact is that for roots like $duais$, with both a pre-$a$ vocoid and a post-$a$ vocoid, it is invariably the post-$a$ vocoid which becomes the nucleus of the syncopated root. It is impossible to explain this if vocoids can bear an underlying feature which prevents them from becoming nuclear.

I assume that roots with a potential falling diphthong syllabify with long nucleus, unless there is lexical marking to the contrary. Other roots syllabify with a short nucleus, again unless there is lexical marking to the contrary. Crucially, the lexical marking $\{\pm$ long nucleus\} (or simply $\{\pm$LN\}) makes no mention of particular phonemes which should be included in the nucleus. In these terms, $suap$ is marked $\{+$LN$\}$ and $suaj$ is unmarked for $[LN]$. The root $duais$ is unmarked for $[LN]$ and therefore syllabifies with a long falling nucleus, $dves$. If it were marked $\{-LN\}$, it would syllabify with a short nucleus. There is no marking which causes it to syllabify with a rising nucleus.\(^{12}\)

In terms of lexical marking for $[LN]$, we analyze the examples in (286) as:

\[
\begin{array}{cccc}
\text{nucleus} & \text{full-grade} & 0\text{-grade} \\
\text{(290)} & & \\
a. & suap [\text{+LN}] & \text{‘sleep’} & \underline{suap} & svap & sup \\
b. & suaj & \text{‘embrace’} & suaj & \underline{svaj} \\
c. & miakš [\text{+LN}] & \text{‘be situated’} & miakš & myakš & \underline{mikš} \\
d. & tiaj & \text{‘forsake’} & tiaj & \underline{tyaj} \\
e. & uas [\text{+LN}] & \text{‘shine’} & \underline{uas} & vas & us \\
f. & uas & \text{‘clothe’} & \underline{uas} & vas \\
\end{array}
\]

Long nuclei have been underlined. Several additional examples follow:

\[
\begin{array}{cccc}
\text{nucleus} & \text{full-grade} & 0\text{-grade} \\
\text{(291)} & & \\
a. & mard & \text{‘crush’} & mard & \underline{mard} & mrd \\
b. & nard [\text{−LN}] & \text{‘bellow’} & nard & \underline{nard} \\
c. & skand & \text{‘leap’} & skand & \underline{skand} & skṇḍ \\
d. & siand & \text{‘move on’} & siand & \underline{syand} & syṇḍ \\
e. & mand [\text{−LN}] & \text{‘exhilarate’} & \underline{mand} & mand \\
\end{array}
\]
With an analysis of low vowel syncope in hand, we are now in a position to analyze perfective and intensive reduplication.

### 7.7.2 Perfective reduplication
The morpheme which induces perfect stem formation triggers $C^\nu$-reduplication. Prosodic adjustment applies after juncture insertion, with a CV reduplicant (first conjunct) target.

\[
\text{(292) First conjunct: } \begin{cases} 
\text{CV} \\
\text{vocalic nucleus} \\
\text{nonlow nucleus} \\
\text{obstruent C} \\
\end{cases} :: \\
\text{]-Left} \\
\text{medial truncation} \\
\text{edge truncation} \\
\end{cases}
\]

First, a vocalic nucleus is preferred to a nonvocalic nucleus, so $]-Left$ is used in (293a) to shorten the nucleus, but medial truncation is used in (293b).

\[
\text{(293) a. } [\nu m\backslash a\nu]d \rightarrow [\nu m\backslash a\nu]rd \rightarrow ma\overline{ma}rd
\]
\[
\text{b. } [\nu g\backslash r\nu]b\nu h \rightarrow [\nu g\langle r\rangle a\nu]b\nu h \rightarrow ga\overline{gra}bh
\]

The final forms above are supposed to represent the post-transcription structure. We will see below that some further reduplication specific modification of the reduplicant takes place in the course of NCC repair. The surface form on (293b) is $ja-grabh$, for example.

A nonlow vocalic nucleus is preferred to a low vocalic nucleus, so $]-Left$ is used in (294a) to shorten the nucleus, but medial truncation is used in (294b).

\[
\text{(294) a. } [\nu s\backslash u\nu]p \rightarrow [\nu s\backslash u\nu]ap \rightarrow su\overline{su}ap
\]
\[
\text{b. } [\nu b\backslash u\nu]d\nu h \rightarrow [\nu b(a)e\nu]d\nu h \rightarrow bu\overline{bau}dh
\]
An obstruent onset is preferred to a non-obstruent onset, so medial truncation trims the onset in (295a), but edge truncation is used in (295b).

\[(295)\]
\[
\begin{align*}
\text{a. } [k\text{ran}]d &\rightarrow [k\text{ra}]nd \rightarrow [k\langle r\rangle \text{a}]nd \rightarrow \text{ka}[\text{ra}]nd \\
\text{b. } [sk\text{an}]d &\rightarrow [sk\text{a}]nd \rightarrow [s\langle k\rangle \text{a}]nd \rightarrow \text{ka}[sk\text{a}]nd 
\end{align*}
\]

One final example shows that medial truncation is preferred to edge truncation.

\[(296)\]
\[
\begin{align*}
\text{mnaa} &\rightarrow [m\text{na}]a \rightarrow [m\langle n\rangle \text{a}]a \rightarrow \text{ma}[m\text{na}]a
\end{align*}
\]

The repair rule ordering in (292) is crucial in (296). Medial truncation is ordered before edge truncation. If it were not, it would be possible to produce na-mnaa.

### 7.7.3 Sanskrit specialization of NCC repair

When copies of root consonants appear in the reduplicant, velar consonants are palatalized and aspirated consonants are deaspirated. Steriade (p. 106) argues convincingly that this should be seen as dissimilation. How and when in the derivation is it carried out? The simplest assumption is that it is carried out at the point that fission creates a separate reduplicant phoneme in the course of NCC repair. The repair of the form produced by transcription after C*\text{y} juncture insertion and perfect prosodic adjustment is illustrated in (297) for the roots skand ‘leap’, dhar ‘hold’, and kh\text{\textbar d} ‘chew’. 

\[(297)\] NCC repair, with dissimilation

\[
\begin{align*}
\text{a. } x x x x x x x x &\rightarrow x x x x x x x x \rightarrow x x x x x x x x \\
&\text{s k a n d} \text{ c s k a n d} \text{ c a s k a n d} \\
\text{b. } x x x x x &\rightarrow x x x x x \rightarrow x x x x x \\
&\text{d h a r} \text{ d d h a r} \text{ d a d h a r} \\
\text{c. } x x x x x x x x &\rightarrow x x x x x x x x \rightarrow x x x x x x x x \\
&\text{k h a d} \text{ c k h a d} \text{ c a k h a d} \text{ c a k h a d}
\end{align*}
\]
In (297c) there is both palatalization and deaspiration.

7.7.4 Intensive reduplication
Like perfect reduplication, the process of intensive reduplication begins with $C^*\nu$ juncture insertion. The reduplicant onset is shaped by prosodic adjustment and NCC repair exactly as in perfect reduplication. For roots with a falling diphthong or long $a$, this is all that needs to be said.

(298)\[\begin{array}{lcc}
\text{transcription} & \text{surface} \\
a. baudh & bau-baudh & bo-bodhi \\
b. mard & mar-mard & mar-mard \\
c. duais & dai-duais & de-dves \\
d. xaxd & xas-xaxd & xax-xaxd \\
e. gau & gau-gau & jo-gop \\
f. sphant & xphant & po-sphant \\
\end{array}\]

The onset is truncated in (298c,f) just as in perfective reduplication. NCC repair, which follows transcription, also carries out dissimilation and deaspiration.

Consideration of roots with a short nucleus show that there is prosodic adjustment of the reduplicant to a bimoraic syllable. The roots in (299b,c) are lexically specified $[−LN]$, so they syllabify with a short nucleus in spite of the fact that a post-$a$ sonorant is present.

(299)\[\begin{array}{lcc}
\text{$C^*\nu$-junctures} & \text{intensive} \\
a. pat & [pa]t & pa-pat \\
b. nard & [na]rd & na-nard \\
c. tan & [ta]n & tan-tan \\
\end{array}\]

The first two examples use FCVL (First Conjunct Vowel Epenthesis, as in Mokilese) to achieve a bimoraic duplicate, but the last uses $[−Right]$. Illustrative derivations are given in (300). The full first conjunct syllable structure is given.
The choice between FCVL and J-Right is not completely predictable, although there are some clear tendencies. Obstruents are never incorporated into the duplicate. Since post-a vocoids (u or i) almost always syllabify into a long nucleus, the issue of J-Right vs. FCVL arises only in the case of post-a liquids and nasals. Nonnuclear post-a nasals are much more likely to be drawn into the intensive reduplicant than nonnuclear post-a liquids, (299c) vs. (299b), for example. Furthermore, root nonnuclear post-a sonorants are more likely to be drawn into the intensive reduplicant if they are root final, as in (300c), so that the reduplicant and root are coextensive. I will not explore the issue further, but note that some lexical specification is needed to cover the examples which counter the general tendencies noted above. It is also worth noting that this variation, which in DR is a variation between choice of prosodic adjustment strategies, has no natural explanation in Steriade’s theory of whole stem copying and reduction. It is not easy to understand why nā-nard should result in that theory rather than nar-nard.

The prosodic adjustment rule, which has been discussed somewhat informally to this point, can be now be stated precisely:

(301) First conjunct : \[ \begin{array}{c} \text{CVX, X sonorant} \\ \text{obstruent onset} \end{array} \] :: \[ \begin{array}{c} \text{J-Right, FCVL} \\ \text{medial truncation} \\ \text{edge truncation} \end{array} \] 

Medial and edge truncation are relevant to determining the onset, just as in perfect reduplication.
We have not yet considered roots with rising diphthongs. The predictions made by the theory as developed to this point are incorrect. The roots are the left have long nuclei, which are underlined.

(302) prediction actual
a. suap sua-suap saa-suap
b. grabh jra-grabh jaa-grabh
c. kriid cii-kriid cai-kriid

It is relatively straightforward to describe the effect: the nucleus of the reduplicant is always a-initial. It is less straightforward to specify the mechanism by which this comes about.

I assume that this is part of the NCC repair process; a further Sanskrit particular interpenetration of the repair process and ordinary phonological processes. Unlike dissimilation, it is morpheme specific, triggered only by realization of the intensive morpheme. Illustrative derivations are given below:

(303) Intensive NCC repair (dissimilation, deaspiration, lowering)
7.7.5 Low vowel syncope and intensive reduplication

Although there are no examples in the literary record, the Sanskrit grammarians claimed that the intensive prefix of those roots which we have identified as having a long rising nucleus (ia, ua, ra, etc.) depended on whether or not the root appeared in the full grade or zero grade. The root svap/sup, for example, has present active intensive forms sāsvapmi (1sg) and sosupmás (1pl). This indicates that the intensive morpheme is realized late, after the morpheme whose realization induces low vowel syncope. The domain of the intensive reduplicative affix is the root. Two illustrations of intensive reduplication applying after syncope are given below.

(304) a. \( \times \times \times \ldots \rightarrow [\times \times] \ldots \rightarrow [\times \times(\times)] \ldots \)
\( s \ u \ p \)
\( s \ u \ p \)
\( s \ u \ p \)

b. \( \times \times \times \ldots \rightarrow [\times \times] \ldots \rightarrow [\times \times(\times)] \ldots \)
\( g \ r \ bh \)
\( g \ r \ bh \)
\( g \ r \ bh \)

7.8 Cyclicality and double reduplication in Lushootseed

This section is based on Urbanczyk (2000). The examples and basic generalizations are all hers. The theoretical framework, hence the analysis, is different. Lushootseed has three kinds of verbal reduplication. The particular interest of Lushootseed for the general theory is that there are many examples of verb forms in which two different kinds of reduplication have applied.
7.8.1 Diminutive reduplication

In surface form, diminutive inflection is a CV-prefix whose C is the initial C of the stem and whose vowel is either the initial V of the stem or, in certain contexts, the vowel i. In several examples below, irregular ? coda epenthesis in a stressed open syllable results in a C? prefix at the surface. I assume this is part of post-reduplication phonology.

The examples below are from Urbanczyk (1996).

(305) CV-initial stems (V ≠ a)
   a. čálǝs  hand  čá[ca]lǝs  little hand
   b. s-dukʷ  bad  s-ðuʔ[du]kʷ  ruff-raff

Cǝ-initial stems
   c. tałáw-il  run  tı[li]law'-il  jog
   d. ĺɔc-bid  afraid  xíʔ[ʃ]ɔc-bid  a little afraid of it

CCV-initial stems
   e. č'λ'áʔ  rock  čýʔ[ʃ']λ'áʔ  little rock
   f. c'qáysǝb  flower  s-č'i[ʃ]qáysǝb  flower

CVː-initial stems
   g. s-duːkʷ  knife  s-diʔ[du]kʷ  small knife
   h. buːs  four  bıʔ[ʃ]uːs  four little items

Particularly straightforward examples have been chosen above. The overall corpus is not as clearcut as these examples might indicate because there are a significant number of irregularities and extensive vowel syncope. See Urbanczyk for a careful discussion of all of these issues. There are only a few examples in the data of diminutive reduplication of the later two varieties, but many examples of diminutive reduplication of Cǝ-initial stems.

Urbanczyk gives arguments that initial consonant clusters are broken up by what she terms a “voiceless schwa.” Something along those lines is forced by the Optimality Theory theoretical framework she adopts since that theory does not admit intermediate levels. But her arguments translate into arguments that at some intermediate level, the apparent CC cluster is actually CǝC and the vowel later syncopates. I assume that the CCV-initial stems in (305) are CǝCV-initial at the point
of juncture insertion. The examples categorized as CCV-initial above therefore fall together with those classified as C\(\text{C}\)-initial.

Pretranscription forms can be easily identified, assuming left transcription.

\[(306) \quad \text{Exceptional cases} \quad \text{pretranscription form} \]

\[
\begin{align*}
\text{C} & \quad \text{talaw} \rightarrow \text{ti-}\text{talaw} \quad [t(i)\text{talaw}] \\
\text{CV:} & \quad \text{bu:s} \rightarrow \text{bi-}\text{bu:s} \quad [b(i)\text{u:s}] \\
\text{Otherwise} & \quad \text{duk}' \rightarrow \text{du-}\text{duk}' \quad [\text{du}]k' \\
\end{align*}
\]

The pretranscription forms suggest that juncture insertion is initial consonant reduplication, since the initial consonant is the element common to the duplicant in all cases. Additionally, there must be prosodic adjustment with a CV target prosodic shape and both \(-\text{Right}\) and FCVE (First Conjunct Vowel Epenthesis) prosodic adjustment repair rules, with epenthetic vowel \(i\).

\[(307) \quad \text{a.} \quad [t]\text{alaw} \rightarrow [(t(i)]\text{alaw} \quad \text{FCVE} \\
\text{b.} \quad [b]u:s \rightarrow [b(i)]u:s \quad \text{FCVE} \\
\text{c.} \quad [d]uk' \rightarrow [du]k' \quad \text{-Right} \]

An explanation is needed for the choice of FCVE in (307a) and (307b).

Stress in Lushootseed diminutive forms is on the reduplicant. Stressed schwa, while it occasionally occurs in Lushootseed, is uncommon. The prosodic adjustment rule for diminutive reduplication is designed to avoid stressed schwa by employing FCVE rather than \(-\text{Right}\) when the stem-initial vowel is schwa. Technically, a \(^9\text{C}\) constraint is imposed on the duplicant in prosodic adjustment. The idea that a rule is “designed” in a certain way merits some discussion because there is widespread confusion about this idea. If one views stressed schwa as something that the Lushootseed phonological system tries to avoid, we can ask at what level the solution is found. It could be that in those instances in which stressed schwa occurs, some corrective action is taken. Alternatively, it could be that operations which produce a stressed schwa in an environment in which they are liable to be stressed are disfavored (in the space of possible operations) and therefore modified so that they avoid producing schwas in those environments.\(^{13}\) The statement that the prosodic adjustment rule is designed to avoid stressed
schwa should be taken to mean that Lushootseed solves the stressed schwa problem in reduplication by choosing its reduplication rules in a certain way.

It is harder to understand why diminutive reduplication treats CV: stems as a special case: \(duck \rightarrow di-duck\), using FCVE, not \(du-duck\), using \(J\)-Right. It could be that dissimilation with distributive reduplication (at the level of design) is responsible. Distributive reduplication generally produces a CVC prefix, but in cases where there is initial CV:, a CV prefix results, \(duck \rightarrow du-duck\), for example. Since there are only two examples of distributive reduplication in the data with a long vowel, this matter will be left without further comment.

Note the similarity to Mokilese reduplication. Juncture shift is used where possible and First Conjunct Vowel Epenthesis is used where juncture shift does not obtain the desired form. The same is true in Mokilese, except that only a timing slot is epenthesized, yielding a long vowel in the first conjunct.

### 7.8.2 Distributive reduplication

Generally, distributive inflection is accomplished by prefixing a copy of the initial stem CVC.

\[(308)\]

<table>
<thead>
<tr>
<th>Stem</th>
<th>Transcription</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. (saqw)’</td>
<td>fly (saqw)’ (saqw)’</td>
<td>fly here and there</td>
</tr>
<tr>
<td>b. (g@lk)’</td>
<td>entangle (g)-(\varphi) (g@lk)’</td>
<td>all tangled up</td>
</tr>
<tr>
<td>c. (pas)t(d)</td>
<td>Caucasian (pas) (p) (t) (d)</td>
<td>many white folks</td>
</tr>
</tbody>
</table>

Note the modification of \(\varphi\) under stress in (308b).

There are two environments in which the distributive prefix is not CVC. If the stem is CV: initial, the prefix is CV. This suggests that juncture insertion is \(\emptyset \rightarrow J / V\) and prosodic adjustment is driven by C-finality, with repair limited to \(J\)-Right. In the case of CV: initial stems, C-finality via \(J\)-Right is impossible, so there is no adjustment. Urbanczyk (1996:180) makes the important observation that in the special case that the stem is \(C_1VC_2\ldots\), with \(C_1 = C_2\), then the surface reduplicant is \(C_1V\), not \(C_1VC_2\).
Urbanczyk also observes that sequences of identical phonemes (either
geminate or not) are quite rare in Lushootseed and attributes the departure
from the CVC shape requirement to avoidance of this configuration.

The simplest way to incorporate this idea into the present analysis
is to suppose that elimination of the sequence of identical phonemes is
carried out as part of the NCC repair process. For (309c), for example:

\[
\begin{align*}
\text{(310)} & \quad [x \times x] \ldots \xrightarrow{\text{Trscr}} x \times x \times x \times \ldots \xrightarrow{\text{L}} x \times x \times x \times \ldots \\
& \xrightarrow{\text{L}} x \times x \times x \times \ldots \xrightarrow{\text{L}} x \times x \times x \ldots
\end{align*}
\]

Distributive reduplication of stems which (on the surface) begin
with a consonant cluster support the idea that there is an intervening
schwa at some level of representation.

### 7.8.3 “Out of control” (OC) reduplication

First, some examples:

\[
\begin{align*}
(311) & \quad ?ib\circ \quad \text{walk, travel or journey over land by any means} \\
& \quad ?\bar{ib} \circ \quad \text{pace back and forth, walk without achieving} \\
& \quad \quad \text{a destination} \\
& \quad saq^{w} \quad \text{fly} \\
& \quad s[aq^{w}] aq^{w} \quad \text{fly around, wheeling in the sky} \\
& \quad d\bar{z}ok^{w} \quad \text{fall, topple over} \\
& \quad d[ok^{w}] ok^{w} \quad \text{totter, teeter back and forth, stagger}
\end{align*}
\]

The initial VC of the stem is copied. Right copy avoids internal copying
in the many examples in which the stem is CVC, so I assume that this
is the direction of copy. Above, the copy is shaded and the remnant is boxed.

### 7.8.4 Double reduplication

Given the basics of diminutive, distributive, and OC reduplication, we are in a position to examine their interactions. It is anticlimactic. Once Urbanczyk’s insights into the phonology are incorporated into the analysis, the interaction of diminutive and distributive reduplication is exactly what we expect. Both orders of application are possible.

#### (312) Lushootseed (Central Coast Salish)

| a. bədáʔ | child, offspring |
| b. bí-bədáʔ | young child DIM |
| c. bəd-bədáʔ | children DIST |
| d. bí-bəd-bədáʔ | young children DIM after DIST |
| e. bí-bí-bədáʔ | litter (of animals) DIST after DIM |

Derivations are given below:

#### (313)

| 1. | [b]ədaʔ ⊕ DIM | [b]ədaʔ ⊕ DIST |
| 2. | [b ⟨i⟩ ] ədaʔ PrAdj\(^1\) | [b]əd[aʔ] PrAdj |
| 4. | [b⟩ bədaʔ ⊕ DIST | [b]odbədaʔ ⊕ DIM |
| 5. | [bib]ədaʔ PrAdj | [b ⟨i⟩ ] ədbədaʔ PrAdj\(^1\) |
| 6. | bib [bib]ədaʔ Trscr | bi [b]odbədaʔ Trscr |
| 7. | bibbibədaʔ NCCR\(^2\) | bibodbədaʔ NCCR |

**Note 1:** *Cə blocks }-Right, which forces FCVE.

**Note 2:** Exceptional NCC repair to avoid bb.

There are a few examples in which OC reduplication combines with distributive or diminutive reduplication.

#### (314)

| bálí | forget |
| bálal’bálí | suddenly […] forgetting |
| čál(a) | chase, pursue, catch |
| čaʔčál’l’, čičłal’ | almost caught |
The derivations are given below:

\[(315) \quad \text{bali} \quad \text{čal} \]

1. \([\text{ba}]\text{li} \oplus \text{DIST} \quad [\text{čal}] \oplus \text{OC}
2. \([\text{bal}]\text{i} \quad \text{PrAdj} \quad [\text{čal}] \quad \text{Trscr}
3. \text{bal } [\text{bal}] \text{i} \quad \text{Trscr} \quad [\text{čal}] \oplus \text{DIM}
4. \text{b[al]}\text{bali} \oplus \text{OC} \quad [\text{čal}]\text{al} \quad \text{PdAdj}
5. \text{b[al]}\text{al bali} \quad \text{Trscr} \quad [\text{čal}]\text{al} \quad \text{Trscr}

Discussion of the various processes which yield čaʔčol’ or čičol’ from ča-čal-al are beyond the scope of this discussion. See Urbanczyk for discussion.

### 7.9 CVC reduplication in Chumash

The analysis of CVC reduplication in Chumash has a prominent place in McCarthy and Prince’s (1995) “Faithfulness and Reduplicative Identity.” Since McCarthy and Prince claim that Chumash CVC reduplication gives evidence for overapplication and Inkelas and Zoll’s (2004) “Reduplication as Morphological Doubling” denies that overapplication exists, I&Z go to some lengths to show that M&P’s analysis of Chumash is incorrect. I follow Inkelas and Zoll, up to a point, accepting their conclusions about prefixal morphology and the hierarchical position of the morpheme which induces CVC-reduplication, as well as their conclusion that Chumash does not provide evidence for overapplication. But the mechanism which they propose for the computation of reduplicated forms is unconvincing, as I will try to show. A DR analysis of the data will be given.

CVC-reduplication is associated with intensive, distributive, repetitive, or continuative semantic force. We begin with a few typical forms. In the reduplicated form, the remnant is boxed.

\[(316) \quad \text{reduplicated} \]

<table>
<thead>
<tr>
<th>(\text{reduplicated})</th>
<th>(\text{s-kitwon})</th>
<th>(\text{kit})\text{won}</th>
<th>‘it is coming out’</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\text{b. k-ni-č’eq})</td>
<td>(\text{k-ni- č’eq}) (\text{č’eq})</td>
<td>‘I’m tearing it up’</td>
<td></td>
</tr>
<tr>
<td>(\text{c. s-ikuk})</td>
<td>(\text{sik}) (\text{ik})\text{uk}</td>
<td>‘he is chopping, hacking’</td>
<td></td>
</tr>
<tr>
<td>(\text{d. s-iš-expeč})</td>
<td>(\text{s-ex})\text{peč}</td>
<td>‘they two are singing’</td>
<td></td>
</tr>
</tbody>
</table>
The verb root is on the right and \textit{s-} and \textit{k-} are agreement prefixes. It is common for various other prefixes (\textit{ni-} and \textit{iš-} above) to appear between the root and the agreement prefixes.

M&P conclude on the basis of (316a, b) that the morpheme responsible for the reduplication (\(\rho\) in what follows) is hierarchically adjacent to the root. This leads to a mystery for M&P, since it implies that the final consonant of the exponent of a hierarchically dominating morpheme in (316c) and (316d) is copied by reduplication. M&P advocate a theory of base-reduplicant correspondence to solve the mystery. Quite sensibly, I&K fail to see a mystery and conclude on the basis of (316c, d) that \(\rho\) combines with the stem after the agreement prefix. Chumash CVC-reduplication is then a variety of internal reduplication, in which a stem internal substring is duplicated. From this perspective, the problem is to specify a principled mechanism by which the CVC subsequence of the stem is singled out for copying, not to explain apparent counter-cyclicity.

I&K examine a wider range of examples than (316) and show that the surface structure of unreduplicated verb forms is:

\[
\text{outer prefixes} + \text{agreement prefixes} + \text{inner prefixes} + \text{root} + \text{suffixes}
\]

Only agreement prefixes and inner prefixes can be involved in reduplication. The inner prefixes split into two lexical classes, reduplicating inner prefixes and non-reduplicating inner prefixes. They can occur in arbitrary linear order. The descriptive generalization about the content of the duplicant is that the \textit{V} of the CVC reduplicant is the leftmost vowel which is in a reduplicating inner prefix or the root, along with the flanking consonants. They can be drawn from any inner prefix, agreement prefix, or the root. Some of the examples that Inkelas and Zoll give to illustrate this, taken from Applegate (1972), are given in (317). In the pre-reduplication form, the reduplicating inner prefixes and root are boldfaced. In the reduplicated form, the remnant is boxed.
The generalization translates directly into a DR mechanism. Junc-
ture insertion is straightforward, using the common /V\ (left-
most, by default) insertion site, complicated only by avoiding non-
reduplicating (NR) pre

<table>
<thead>
<tr>
<th>reduplicated</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>k-su-towič</td>
<td>k-su-towič</td>
<td>I’m doing it fast</td>
</tr>
<tr>
<td>š-wati-k’ot</td>
<td>š-wati-k’ot</td>
<td>. . is broken to pieces</td>
</tr>
<tr>
<td>k-sili-pi-wayan</td>
<td>k-sili-pi-wayan</td>
<td>I want to swing</td>
</tr>
<tr>
<td>?al-aqša-n</td>
<td>?al-aqša-n</td>
<td>the dead</td>
</tr>
<tr>
<td>k-xu-ni-yiw</td>
<td>k-xu-ni-yiw</td>
<td>I am looking all</td>
</tr>
<tr>
<td>s-iš-expeč</td>
<td>s-iš-expeč</td>
<td>they two are singing</td>
</tr>
</tbody>
</table>

The default is to close the duplicant. The second juncture insertion
rule therefore applies rightmost among those positions which close the
duplicant.

Inkelas and Zoll’s story is considerably more complicated. A
morphological doubling operation is followed by three cycles of rules.
Cophonology_1 derives the reduplicant and Cophonology_2 (the “standard
concatenative morphophonology”) derives the stem. The reduplicant is
then infixed into the stem by the third cycle of rules, Cophonology_3,
which operates on the results of the first two cycles. The computation is
sketched below:

\[
\begin{align*}
(317) & \quad \text{reduplicated} \\
  & \quad k-su-towič \quad k-su-towič \quad I’m \ doing \ it \ fast \\
  & \quad š-wati-k’ot \quad š-wati-k’ot \quad . . is \ broken \ to \ pieces \\
  & \quad k-sili-pi-wayan \quad k-sili-pi-wayan \quad I \ want \ to \ swing \\
  & \quad ?al-aqša-n \quad ?al-aqša-n \quad the \ dead \\
  & \quad k-xu-ni-yiw \quad k-xu-ni-yiw \quad I \ am \ looking \ all \\
  & \quad s-iš-expeč \quad s-iš-expeč \quad they \ two \ are \ singing \\
\end{align*}
\]
This is an considerable expansion in the machinery available to morphophonology. Putting that aside and accepting the machinery, we can ask if it manages to give a satisfactory analysis of the issues at hand, which is a minimal requirement. There are two core issues; the extraction of the CVC reduplicant in Cophonology₁ and the positioning of reduplicant in Cophonology₃.

For both tasks, I&Z introduce the notion of an extended prosodic root. The idea is that reduplicating inner prefixes “cohere” (their terminology) prosodically to the root and non-reduplicating prefixes do not. The root and its cohering inner prefixes are supposed to form a prosodic constituent. Presumably, agreement prefixes which provide onsets for syllables anchored in the root or cohering prefixes also cohere and are incorporated into the extended prosodic root. Reduplication is then simply CVC-prefixal reduplication of the extended prosodic root. In DR terms, one would say that the domain of the reduplicative affix is the root, augmented by the pre-root material which coheres to it prosodically. The fatal flaw in this idea is that non-cohering prefixes can occur inside cohering prefixes, preventing a cohering prefix from cohering either to the root or a prefix which coheres with the root. One is then forced to simply stipulate that the extended prosodic root consists of the minimal string of syllables which contains the root and all the reduplicating prefixes. That stipulation is sufficient for I&Z’s analysis,
but it is hard to escape the conclusion that it is simply an ad-hoc device
to abide by the rules of the Prosodic Morphology game, which must
give a prosodic identity to the locus of infixation.

Even though the stipulation yields the correct result in Chumash,
the separation of the extraction of the reduplicant in Cophonology\textsubscript{1} and
its placement in Cophonology\textsubscript{3} makes it an accident that the reduplicant
is placed adjacent to material that it happens to be identical with phono-
logically. It is equally simple to specify that the initial C\textsuperscript{*}VC of the stem
(boldfaced below) is infixed at the left edge of the prosodic stem (boxed
below). The infix is underlined in the output.

(320) a. s-\textit{ik}uk \quad \textit{sik} \text{ s-ikuk}
  b. s-i\textit{š}-exp\textit{c} \quad si\textit{šiš} \textit{š}-exp\textit{c}
  c. k-ni-\textit{č}eq \quad k-ni-\textit{knič} \textit{č}eq

In (320b), \textit{siš} is infixed inside itself, as is \textit{knič} in (320c). As far as I
know, this behavior is unattested. It is impossible in DR. The problem
stems from the disconnect between the process which generates the
reduplicant and the process which positions the reduplicant in the stem.
This disconnect is not only possible in I&Z’s theory, it is part of the core
architecture of the theory.

The conclusion that can be drawn from this is not novel. When the
machinery available for computation is expanded in order to compute
some recalcitrant example, the likely result is that not only can the
recalcitrant example be computed, but a great many other undesirable
things can be computed as well. The big problem in linguistics is not a
few recalcitrant examples, but overgeneration.

7.10 Chaha reduplication

Chaha, one of the Semitic languages of Ethiopia, has been a rich source
of phenomena which provide insights into autosegmental phonology.

7.10.1 Overapplication of impersonal labialization and
palatalization

Chaha has impersonal verb forms alongside verb forms which are in-
flected for person, number, and gender. Impersonal inflection is realized
by labialization of the rightmost labial or velar consonant in the root and palatalization of the rightmost consonant in the root, provided that it is a coronal obstruent. The following examples (taken from Hudson, 1995:789 and Banksira, 2000:207) are illustrative:

(321) 2sg masc impersonal

a. fìrx fìrx* (*f"ìrx*) ‘Tolerate!’
b. kìft kìft*č (*k*ìft*č*) ‘Open!’
c. gìroż g"ìroż ‘Age!’
d. nìfìr nìfìr* (*ničìr) ‘Separate (from the teats)!’

Rounding is indicated by, for example, f → f” and palatalization is indicated by, for example, s → š. (321a-c) show that initial, medial, and final consonants can be rounded. (321a) and (321b) show that rounding applies only to the rightmost consonant which is subject to rounding. (321b) shows that both palatalization and labialization can apply. Finally, (321d) shows that palatalization is restricted to the final consonant.

In certain cases, labialization or palatalization appears to apply to a consonant which is not the rightmost potential target.

(322) Personal Impersonal

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a. sòkòk</td>
<td>sòk<em>òk</em></td>
<td>‘plant in the ground’</td>
</tr>
<tr>
<td>b. gamøm</td>
<td>gam<em>øm</em></td>
<td>‘chip the rim’</td>
</tr>
<tr>
<td>c. botòt</td>
<td>b*øčèč</td>
<td>‘be wide’</td>
</tr>
<tr>
<td>d. sòkòk</td>
<td>sòk<em>òk</em></td>
<td>‘place a peg’</td>
</tr>
</tbody>
</table>

Insightfully, McCarthy realized that overapplication in (322) is related to the C1C2C2 consonant structure and proposed a theory in which the identical consonants were two occurrences of the same phoneme, a long-distance geminate, as such nonadjacent paired phonemes came to be called. This structure was achieved by supposing adjacent consonants were barred from consonantal roots and the particular way in which a biconsonantal root associates with a CVCVC-template. If association is right to left, then we expect:
McCarthy placed the vocalism on a separate tier in order to avoid an NCC violation. Combination with the affix IMP which realizes the impersonal morpheme takes place while multiple association still persists, so that mutation occurs while the final consonant is still spread over multiple timing slots. The result is apparent “overapplication” of labial mutation.

\[ gm \rightarrow \times \times \times \times \times \times \rightarrow g@m^{\prime}m^{\prime} \]

It is assumed that the labialization rule is not subject to geminate inalterability. Only one of the timing slots linked to \( m \) is in the proper environment for labialization. If the labialization rule were subject to geminate inalterability, in place of the overapplication illustrated in (324), \( m \) would resist labialization and underapplication would result.

There is another class of biconsonantal roots, the so-called 1212 roots, which exhibit similar overapplication. The following examples are from Hudson (1995:794).

\[
\begin{array}{cc}
\text{Personal} & \text{Impersonal} \\
(a) & \text{bitobot} & b^{\prime}i\tilde{c}ob^{\prime}o\tilde{e} \quad \text{‘dissolve’} \\
(b) & \text{sibosob} & sib^{\prime}o\tilde{a}ob^{\prime}w \quad \text{‘gather’} \\
(c) & \text{nik\'ona\'k} & nik^{\prime}o\tilde{n}a\tilde{k}^{\prime}w \quad \text{‘shake’} \\
\end{array}
\]

Imitating the analysis of 122 roots would lead to a derivation like:

\[
\begin{array}{cc}
\text{sb} & \rightarrow \times \times \times \times \times \times \times \times \rightarrow sib^{\prime}o\tilde{a}ob^{\prime}w \\
\end{array}
\]
In (326), there is no escape from crossing violations by putting the offending elements on a separate tier. Since the NCC was considered sacrosanct, McCarthy considered a representation like (326) to be impossible and proposed that 1212 roots were reduplicative, so that the overapplication in (325) was an effect of Wilbur’s Identity Constraint, rather than the presence of long-distance geminates (LDGs). It was clearly untenable to claim that 122 overapplication was due to the presence of an LDG, but that 1212 overapplication was due to reduplication. There was resistance, however, to a uniform account, because 122 reduplication does not fit easily into the mold of Prosodic Morphology, which was held to govern reduplication. Eventually, however, opinion shifted to favor a uniform account of 122 and 1212 roots, with overapplication phenomena attributed to a Wilbur type Identity Condition (in a modern Correspondence Theory form) operating between the source and target of reduplication. See Gafos (1999), for example. The long-distance geminates in (324) and (326) were abandoned. I think this was a mistake. From the standpoint of DR, the debate pitting LDGs against reduplication is a false debate rooted in the Correspondence Theory of reduplication which OT has adopted. Representations with LDGs like (326) and (324) are exactly what DR predicts as a consequence of reduplication.

7.10.2 Inherently reduplicated roots
There has been ongoing discussion among experts in Semitic morphology about whether reduplication is somehow encoded in the root, or the root is simply biconsonantal (consider 122 roots for example) and reduplication is coded in (somehow) or triggered by (somehow) a template. Hudson (1995) proposed that reduplication was coded in the root as, for example:

\[ g[m]_α, \quad \text{or} \quad [s \ b]_α \]

The notation for coding reduplication into the root proposed by Hudson is remarkably similar to the idea of inserted t-junctures that DR proposes as the trigger for reduplication. Exploiting default closure, we can write the roots in the DR formalism as:

\[ g[m] \quad \text{or} \quad [sb] \]
If we suppose that roots consist of consonants, with an optional embedded [-juncture, we have a uniform account of the full range of reduplicative roots which are found in various Semitic languages. McCarthy’s insight that identical adjacent consonants are barred from the root is maintained.

(327) a. \( C_1C_2 \rightarrow C_1C_2C_2 \)  
    b. \( [C_1C_2 \rightarrow C_1C_2C_1C_2 \)
    c. \( C_1C_2C_3 \rightarrow C_1C_2C_3C_3 \)  
    d. \( C_1[C_2C_3 \rightarrow C_1C_2C_3C_2C_3 \)

I suppose that the vocalism is epenthetic, inserted in the process of syllabification, subject to morphophonological conditions on the choice of vowel. By morphophonological, I mean that both the morphological and phonological environments can influence the choice of vowel. These assumptions lead to derivations roughly like the following:

(328) \[ \text{sb} \rightarrow [x] \rightarrow [x] \rightarrow [x] \rightarrow [x] \rightarrow [x] \]
    \( \text{s b} \rightarrow \text{s b} \rightarrow \text{s b} \rightarrow \text{s b} \rightarrow \text{s b} \rightarrow \text{s b} \)

There is some uncertainty in the order of the various operations. NCCR (NCC Repair) must follow combination with IMP, but syllabification could be much earlier. It is difficult to find evidence in Chaha, but there is evidence from other Semitic languages that syllabification is late. So-called Classical Arabic Metathesis has a relatively straightforward explanation under the assumption of late syllabification. It would be a distraction from the main argument to go through an analysis here, but one is provided in Appendix 3.

7.10.3 Chaha Continuant Dissimilation
There is a dissimilation process in Chaha whose interaction with reduplicative roots gives further evidence of the presence of long-distance geminates. Banksira (2000) gives extensive evidence that \( k \) does not occur in underlying representations and that surface \( k \) is the result of
either devoicing of underlying g or the dissimilation of x to k because of the rule:

(329) \[ x \rightarrow k / \ldots [\text{-sonorant, +continuant}] \]

The [−sonorant, +continuant] phonemes are f, s, z, x, and ɾ. For the present discussion only, call such a phoneme a “triggering phoneme.” There is no adjacency requirement in (329), so dissimilation can be long-distance. Later, we will see that dissimilation is blocked by at least some morpheme boundaries, so that (329) must be amended. It certainly applies morpheme internally.

Rule (329) is not subject to geminate interpretability. \( x \rightarrow k \) requires only that one timing slot associated with \( x \) be followed by a timing slot associated with a triggering phoneme. It is not required that all timing slots linked to \( x \) be followed by a timing slot linked to a triggering phoneme. Consequently, geminate \( x \) will always dissimilate to geminate \( k \). The first timing slot of \( x \) is followed by a timing slot linked to \( x \), a [−sonorant, +continuant] phoneme. Since adjacency is not required in (329), long-distance geminate \( x \) will also dissimilate to \( k \).

Kenstowicz and Banksira (1999) analyze the interaction of \( x \rightarrow k \) dissimilation with reduplication in Chaha and show that it overapplies in very much the same way that impersonal labialization/palatalization overapplies. A few representative illustrations are given below. See Kenstowicz and Banksira for further examples, most of which are less transparent than the ones given here because of various interacting morphophonological processes.

(330) a. /sx/ sikik ‘drive a peg’
    b. /xt/ kɔtkit ‘crush’

Naively, one might expect /sx/ \( \rightarrow sikix \), with the medial \( x \) dissimilating to \( k \) because there is a [−sonorant, +continuant] phoneme to its right, the final \( x \). But the fact is that the final \( x \) also changes to \( k \)
in (330a), even though there is no [−sonorant, +continuant] phoneme to its right.

The analysis of 122 and 1212 roots given above makes it clear why there is overapplication.

\[ \begin{align*}
(331) & \quad \text{a. } \begin{array}{c}
\times[\times] \\
\text{Trscr} \\
\xrightarrow{x-Dissim} \\
s \times \\
s \times \\
\rightarrow \text{sikik}
\end{array} \\
\text{b. } \begin{array}{c}
[\times \times] \\
\text{Trscr} \\
\xrightarrow{x-Dissim} \\
x \times \\
x \times \\
\rightarrow k\text{t}k\text{i}t
\end{array}
\end{align*} \]

7.10.4 Chaha frequentative reduplication

We begin with frequentative reduplication in Tigre, another Ethiopian Semitic language which is closely related to Chaha. The morphophonology of Tigre is more transparent than the morphophonology of Chaha, making it easier to see the basic pattern. Frequentative reduplication is found in all the Ethiopian Semitic languages. The facts are from Rose (2001).

\[
\begin{array}{lll}
\text{Root type} & \text{Regular} & \text{Frequentative} \\
A & d\text{aqm-a:} & d\text{aqa}m\text{-a:} \quad \text{‘tell’} \\
B & w\text{a}l\text{a}b-a: & w\text{a}l\text{a}b\text{-a:} \quad \text{‘look both ways’} \\
C & b\text{a}r\text{a}\text{k-a:} & b\text{a}r\text{a}k\text{-a:} \quad \text{‘bless’} \\
122 & m\text{a}z\text{z-a:} & m\text{a}z\text{a}z\text{-a:} \quad \text{‘give responsibility’} \\
Quadriliteral & d\text{a}n\text{g}a\text{s-a:} & d\text{a}n\text{g}a\text{g}a\text{s-a:} \quad \text{‘be scared’} \\
1212 & n\text{\acute{a}}k\text{n\acute{a}k-a:} & n\text{\acute{a}}k\text{n\acute{a}k-a:} \quad \text{‘shake in hysterics’} \\
1233 & d\text{\acute{a}nz\acute{a}z-a:} & d\text{\acute{a}nz\acute{a}z-a:} \quad \text{‘be numb’}
\end{array}
\]

Rose notes that the vocalism of the frequentative form is invariant. The same observation is made about Chaha by Banksira (2000:37), who states that “vowels of the unreduplicated base . . . are not retained when reduplicated.” This supports the proposal that syllabification and vowel insertion are late, after the affix which generates frequentative reduplication combines with the stem.
The morphology of the stem modification in (332) is clear. The penultimate consonant is geminated and \( a:\) is infixed between the legs of the geminate. Formally, there are two ways in which this can be implemented. One possibility, is that gemination applies first, then \(-\{a:\}\) is suffixed, with the final consonant pair designated as the domain of the affix.

\[
\begin{align*}
\text{(333)} & \quad \times \times \times \xrightarrow{\text{gemination}} \times \times \times \xrightarrow{\text{domain}} \times \times \times \times \times \\
\text{d g m} & \quad \text{d g m} & \quad \text{d g m a}
\end{align*}
\]

\[
\begin{align*}
\text{DC} & \quad \xrightarrow{\text{domain}} \times \times \times \xrightarrow{\text{Trscr}} \times \times \times \times \\
\text{d g m a} & \quad \text{d g m a}
\end{align*}
\]

Alternately, there is no separate gemination operation. Instead, \(-\{a:\}\) is suffixed, with the final consonant pair designated as the domain of the affix, and juncture insertion \( \emptyset \rightarrow \) \( / \times \) applies. Nested duplicants result and transcription is carried out in two cycles, as in Section 4.5.

\[
\begin{align*}
\text{(334)} & \quad \times \times \times \xrightarrow{\text{domain}} \times \times \times \times \xrightarrow{\text{DC}} \times \times \times \times \\
\text{d g m a} & \quad \text{d g m m a}
\end{align*}
\]

\[
\begin{align*}
\text{inner} & \quad \xrightarrow{\text{transcription}} \times \times \times \times \\
\text{d g m a} & \quad \text{d g m a}
\end{align*}
\]

\[
\begin{align*}
\text{outer} & \quad \xrightarrow{\text{transcription}} \times \times \times \times \\
\text{d g m a} & \quad \text{d g m a}
\end{align*}
\]

The derivation (333) or (334) continues to:

\[
\begin{align*}
\text{(335)} & \quad \times \times \times \xrightarrow{\sigma} \times \times \times \times \times \times \\
\text{d ō} & \quad \text{a g ō m}
\end{align*}
\]

\( (dga:gm) \)
Finally, NCC repair takes place. Alternatively, NCC repair takes place before syllabification.

Recall that the devices for specifying the domain are limited. The penultimate consonant must be located by designating a domain, which requires constructing a foot at the right edge of the root. I assume that consonants are moraic in the root cycle, so that the domain is simply a final binary foot.

\[
\begin{align*}
\ast & \ast & \ast \rightarrow \ast (\ast & \ast) \\
\times & \times & \times \rightarrow \times & \times & \times \\
&& d & g & m & d & g & m
\end{align*}
\]

7.10.5 The interaction of frequentative reduplication and \(x\)-dissimilation

There are some subtleties in the interaction of frequentative reduplication and \(x\)-dissimilation in Chaha which are discussed by Kenstowicz and Banksira (1999). Some preliminaries are necessary. Banksira (2000) carefully establishes a number of relevant facts about Chaha morphophonology: 1) the morpheme realizing perfect aspect readjusts the root by geminating its penultimate consonant; 2) geminates devoice if they are followed in the root by a sonorant; and 3) geminates in Chaha systematically degeminate (by deletion of one of the twins). This synchronic phonology of Chaha is made clear by comparing Chaha with some of its sister Ethiopian Semitic languages.

(337) Gemination and devoicing in the perfect (root /βdr/, ‘be first’)

<table>
<thead>
<tr>
<th></th>
<th>Imperative</th>
<th>Imperfect</th>
<th>Perfect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ezha</td>
<td>yə-βdɔɾ</td>
<td>yi-βɔdir</td>
<td>bɔɔdɔɾ-ɔm</td>
</tr>
<tr>
<td>Endegen</td>
<td>yə-βdɔɾ</td>
<td>yi-βɔdir</td>
<td>bɔɔtɔɾ-ɔm</td>
</tr>
<tr>
<td>Chaha</td>
<td>yə-βdɔɾ</td>
<td>yi-βɔdir</td>
<td>bɔɔtɔɾ-ɔm</td>
</tr>
</tbody>
</table>

Ezha has transparent penultimate consonant gemination in the perfect. Endegen adds the geminate devoicing rule. Chaha renders the process opaque by adding a late rule of degemination.

Penultimate gemination, which is triggered in all roots by the perfective morpheme, is also triggered by the imperfective morpheme,
but only for quadriliteral roots. Banksira (2000:32) gives the template $C_1C_2\delta C_3C_4$ for the imperfect form of quadrilaterals. Triliteral roots are not subject to imperfect penultimate gemination. With respect to their perfective and imperfective morphology, forms produced by reduplication are treated in the morphophonology as if they were roots. Roots which become quadriliteral as the result of either inherent reduplication (called 1212 roots earlier) or frequentative reduplication are therefore subject to imperfect penultimate gemination. To illustrate, frequentative forms of the triliteral root /sbr/ are given in (338). Devoicing, $\beta \rightarrow p$, is the surface sign of underlying gemination in Chaha. The final sonorant $r$ licenses geminate devoicing. In Tigre, the infixed exponent of the frequentative morpheme is $a$. In Chaha it is $a$, which generally shows up on the surface as $a$.

(338)  
\[
\begin{array}{cccc}
\text{root} & \text{imperative} & \text{imperfect} & \text{perfect} \\
/sbr/ & siβɔbir & ti-βɔpIR & siβɔpər-x̌-m \\
\end{array}
\]

These forms are derived as follows:

(339)  
\[
\begin{array}{cccc}
\text{Imperative} & \text{Imperfect} & \text{Perfect} \\
\text{fission} & \text{devoicing} \\
\end{array}
\]

Syllabification follows. The penultimate consonant devoices $(\beta \rightarrow p)$ in the context of the final sonorant. Since the initial $\beta$ does not devoice, it must be that devoicing follows NCC repair, as assumed in (339), so that $\beta$ has already undergone fission into separate phonemes by the time that devoicing applies.

We now are in a position to consider the interaction of frequentative reduplication and $x$-dissimilation. Kenstowicz and Banksira (1999) give the examples in (340). For each root, the first line gives the regular forms and the second line gives the frequentative forms. (I assume that
the vowel quality and syllable structure variation in the forms below is secondary to the issue at hand.) The forms in which x-dissimilation applies are marked with †.

(340) | Imperative | Imperfect | Perfect |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>/sxr/</td>
<td>sixɔr</td>
<td>yi-sxɔr</td>
</tr>
<tr>
<td>tɔ-sxaxɔr</td>
<td>yi-t-sikakɔr †</td>
<td>tɔ-skakɔr †</td>
</tr>
<tr>
<td>/mxr/</td>
<td>mixir</td>
<td>yi-mɔxir</td>
</tr>
<tr>
<td>tɔ-mxaxɔr</td>
<td>yi-ti-mkakɔr †</td>
<td>tɔ-mkakɔr †</td>
</tr>
<tr>
<td>/txβ/</td>
<td>nixɔβ</td>
<td>yi-tɔxιβ</td>
</tr>
<tr>
<td>tɔ-txaxɔβ</td>
<td>yi-ti-rkɔkɔβ †</td>
<td>tɔ-rkɔkɔβ †</td>
</tr>
</tbody>
</table>

The consonantal structure of the roots involved above is illustrated below for the root /mxr/.

(341) | Imperative | Imperfect | Perfect |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>regular</td>
<td>x x x</td>
<td>x x x</td>
</tr>
<tr>
<td></td>
<td>m x r</td>
<td>m x r</td>
</tr>
<tr>
<td>mixir</td>
<td>mɔxir</td>
<td>mɔkɔr †</td>
</tr>
<tr>
<td>freq.</td>
<td>x x x x</td>
<td>x x x x x</td>
</tr>
<tr>
<td></td>
<td>m a x r</td>
<td>m a x r</td>
</tr>
<tr>
<td>tɔ-mxaxɔr</td>
<td>yi-ti-mkakɔr †</td>
<td>tɔ-mkakɔr †</td>
</tr>
</tbody>
</table>

If x-dissimilation were restricted by adjacency, the explanation for the dissimilation pattern in (340) would be trivial. The forms in which x-dissimilation applies are precisely the forms with a geminate whose two occurrences are adjacent. The dissimilation of the initial occurrence of x in the frequentative perfect and imperfect forms is an overapplication effect, a side-effect of the dissimilation of the medial occurrence of x.

The issue is more complex, however, because x-dissimilation does not require adjacency. B&K give /xβs/ → kβaβs ‘make dirty’ and /xtf/ → ktif ‘hash’, for example. In both cases, the dissimilation...
trigger is the final nonsonorant continuant consonant (s in one case and f in the other). Consequently, if the failure of x-dissimilation is to be attributed to the intervention of a, the argument requires some subtlety. One obvious difference between potential long distance dissimilation in the frequentative imperative form in (341) and the examples given by B&K is that a is a copy of the exponent of the frequentative morpheme.

Banksira (2000:33) provides evidence that x-dissimilation does not apply across a root boundary. He gives two relevant examples. In (342a), x-dissimilation applies between occurrences of x in the exponents of two different morphemes. But neither is the root. They are closely related agreement morphemes, one a subject agreement morpheme and the other an object agreement morpheme. In (342b), on the other hand, an occurrence of x in the exponent of an agreement morpheme does not trigger dissimilation of an occurrence of x in the root, even though the two occurrences are adjacent.

(342) a. \text{səpərkəm} ‘I have broken you (2sg. m.)’
\text{səpər} x xə m
break 1sg subject 2sg. m. object perfect

b. \text{naxxinəm} (*nəknam) ‘I sent her’
\text{nax} xi n a m
send 1sg subject object case 3sg. f. object perfect

We can account for (342) by constraining the dissimilation rule

\[
x \rightarrow k \bigg/ \begin{array}{c}
\times \\
\text{sonorant} \\
\text{continuant}
\end{array}
\]

so that it applies to root phonemes only if it applies root internally. That is, if the target is root internal, the trigger and any intermediate timing slots must also be root internal. Of course, it must also part of the description of the rule that it not be subject to geminate inalterability.

This brings us closer to an explanation for why there is no x-dissimilation in the imperative frequentative form, which is repeated below:
Plausibly, the target of dissimilation is a root phoneme, but $a$ is not. In order for this to be true, two assumptions are sufficient.

1. The morphemic association of the exponent of a reduplicative affix is maintained under transcription.
2. Other root internal timing slots which result from morphophonological operations associate with the root morpheme. This includes timing slots produced by root internal epenthesis and gemination.

This leads to the derivation:

\[
\begin{array}{c}
\text{MXR} \quad \text{FREQ} \\
| \quad \text{gemination} \\
m \ x \ r \ a \\
\end{array}
\]

This completes the discussion of the $x$-dissimilation pattern in (341). The fact that the initial $x$ does not dissimilate in the frequentative imperative is due to the intervention of the exponent of the frequentative morpheme, as shown in (345). Dissimilation of the initial $x$ in the frequentative imperfect and perfect is due to the overapplication of dissimilation of the medial occurrence of $x$.

**7.10.6 Kenstowicz and Banksira’s analysis of $x$-dissimilation**

B&K is valuable in presenting the basic facts of $x$-dissimilation and its relation to reduplication since clear examples of overapplication are fairly rare. Their analysis, however, is untenable. Since Chaha phonology is particularly opaque and B&K attempt an analysis in the framework of Correspondence Theory, which is known to break down
in analyzing opaque processes, it is not surprising that Correspondence Theory proves inadequate to the task.

Two illustrations will suffice to make clear the problem.

1. B&K claim that x-dissimilation is due to a phonotactic constraint:

(346)  *x...[+continuant, −sonorant]

This cannot be correct. The 3sg Jussive form of triliteral root \( fxY \) ‘escape’ is \( y\omega-fka \) (B&K, ex. 5a). In the surface representation, there is no trigger for x-dissimilation. x-dissimilation cannot be the consequence of a surface phonotactic.

Derivationally, the surface form is no mystery. The \( \gamma \)-trigger for dissimilation deletes after it triggers dissimilation.\(^{14}\)

(347)  \( fxY \xrightarrow{x\text{-dissimilation}} fkY \xrightarrow{\text{syllabification}} fk\omega Y \xrightarrow{\gamma\text{-assimilation}} fka \)

2. One of the objectives of the analysis is to account for the interaction of frequentative reduplication and penultimate devoicing in the perfective and imperfective. This is impossible unless there is a coherent account of penultimate devoicing (imperative \( si\beta or \) versus perfect \( sap\omega r \) ‘break`). B&K’s account is not. Banksira (2000) has a carefully worked out derivational analysis of the origin of penultimate \( p \) which relies on morphologically conditioned gemination (template satisfaction), followed by geminate devoicing, followed by degemination. The geminate which triggers devoicing is opaque, present only at an intermediate stage in the derivation. This analysis is not available to an OT account. B&K appear to forget this, saying that “the template for the perfective of the derived frequentative verbs requires the penultimate radical to be a geminate “which surfaces [my emphasis] as a stop if nonstrident.”

In addition to providing an additional example of overapplication of the Malay variety, B&K intend their analysis to support McCarthy and Prince’s contention that generative phonology is descriptively inadequate. They say:

As observed originally by Wilbur (1973), the traditional derivational model in which reduplication is expressed by a copy rule applying at some fixed point in the derivation is unable to describe this phenomenon adequately.
We have shown this claim to be false by providing a detailed derivational analysis of the interaction of x-dissimilation and reduplication. A copy rule (transcription) applies at some fixed point in the derivation. Crucially, timing slots and their associations with phonemes are copied, but not phonemes. In addition to showing this claim to be false, we have shown that the Optimality Theory model which B&K’s analysis is intended to confirm is not even capable of adequately describing the core facts of x-dissimilation and penultimate devoicing. Instead of supporting the idea that derivational phonology is descriptively inadequate, B&K succeed only in giving further evidence that opaque processes in phonology are pervasive and that Optimality Theory is unable to properly account for them.
Appendix A

The NCC and the Retraction Condition

Sagey (1988) argues that it follows from the logic of temporal simultaneity that the NCC is an interface condition. This is not convincing. Phonological representations, even at the interface with phonetics, are not representations of physical events. They are instructions for creating physical events. More accurately, they are once removed from such instructions. Phonological representations are blueprints for creating motor instructions. The explanation for the NCC as an interface condition must be found in the structure of representations employed by the motor system, not directly in the structure of the physical world. Output interface conditions reflect the demands of the system which is being fed, in this case the motor system leading to articulation. In what way might the motor system cause the imposition of the NCC as an output condition on phonology? Under the plausible assumption that the lexicon is optimized for space efficiency, it is implausible to suppose that exponents are stored as autosegmental representation. I therefore suppose that exponents are stored as simple phoneme/juncture sequences and that timing slots are supplied in the process of transcription from the lexicon to the phonological workspace. I suppose that geminates are recorded by some diacritic which is removed in the process of transcription: perhaps a [+long] feature in the phoneme itself which is translated into autosegmental terms and removed in the process. I suppose that autosegmental representation is the privilege
of phonology, used in its internal computation, but that autosegmental representation is unintelligible to both the input and output systems.

Suppose further that the interface mapping from phonology to the motor system, which translates the output of phonology into the language of the motor system, has limited resources. In particular, suppose that copying is not available to the interface mapping. Autosegmental representations contain tiers of three types: the timing tier, phonemic tiers, and prosodic tiers. The point is controversial, but I assume that phonemic tiers and the prosodic tiers have rather different properties, with the timing tier serving as a kind of interface, and the only interface, between phonemic tiers and prosodic tiers.

Phonemic tiers in autosegmental representations are, in many cases, easily converted into sequential representations by a simple retraction operation, with the help of a few special symbols (diacritics).

\[
\begin{array}{cccc}
\times \times \times \times \times \times & \rightarrow & t \; i \; k \; : \; a \; :
\end{array}
\]

This is just the reverse of the process which mapped lexical items to autosegmental representations.

Multiple segmental tiers translate into multiple parallel (aligned) retractions onto the timing tier. See Eisner (1997), who works out such a representational theory for autosegmental phonology as a way to provide a representational foundation for Optimality Theory. The picture of the output of phonology that this gives is multiple streams of motor instructions, aligned in time (representational temporal simultaneity). The mapping (349), in which a separate nasal tier is assumed, suggests what is involved.

\[
\begin{array}{cccc}
N \mid \times \times \times \times \times \times & \rightarrow & \mid \; \mid \; t \; i \; k \; : \; a \; : \;
\end{array}
\]

(tįŋkaɪ)

Retraction onto the timing tier is not sensitive to linear order on the phoneme tier. Consider the \textit{abani} → \textit{albani} Choctaw passive example
(102a). The structure that is produced by transcription retracts onto the timing tier without accessing phoneme tier order.

(350) \( \times \) \( \times \times \times \times \) \( \rightarrow \) \( a l b a n i \)

Phoneme tiers are unordered. Some implications of this are that there can be no floating elements on phonemic tiers and no junctures on phonemic tiers. Both of these predictions are correct, as far as I can see. Note that if phoneme tiers are unordered, many standard formulations of the NCC are inadequate since they rely on comparison of phoneme order with the order of associated timing slots.

In general, reduplication produces autosegmental representations which cannot be retracted. The retraction of the representation (78) produced in Yoruba nominalization, for example, fails:

(351) \( \times \) \( \times \times \times \) \( \rightarrow \) \( d i u n \)

Two copies of \( d \) are needed for retraction to be successful, but the interface mapping cannot carry out copying. The requisite copying in (351) must be done in phonology, prior to the output interface. This copying is what we have been calling fission.

\[
\text{phonology} \\
(352) \times \times \times \times \rightarrow \times \times \times \times \\
\text{Fission} \\
\text{interface mapping} \\
\text{Retraction} \rightarrow \text{d i d u n}
\]

I will suppose that the output of phonology must be retractable, with the actual retraction part of the interface between phonology and
phonetics. This imposes the output condition (353) on autosegmental representations.

(353) Retractability Condition (RC): The set of timing slots associated with a segment is connected.

A few examples will clarify the import of the RC. First, note that (354a) and (354b) are equivalent with respect to the RC, since the sets of timing slots associated with the two phonemes are identical in the two examples. Both satisfy the RC.

(354) a. \( \times \times \times \)  
    \( b \ a \)  

(354) b. \( \times \times \times \)  
    \( a \ b \)

In (355a), on the other hand, the set of timing slots associated with a is not a connected sequence of timing slots, so (355a) violates the RC in exactly the same way that (355b) does.

(355) a. \( *\times \times \times \)  
    \( \_\_\_\_\_ \)  
    \( a \ b \)  

(355) b. \( *\times \times \times \)  
    \( \_\_\_\_\_ \)  
    \( a \)

The RC and the NCC impose different conditions. There are several advantages to the RC. Most importantly, it can be derived from the assumption that autosegmental representations are the privilege of phonology and plausible assumptions about the representations employed by the motor system and the mapping from phonological representations to motor system representations. With respect to reduplication it also has the advantage that then melodic tiers can be considered to be unordered, with the order of segments in motor system representations derived entirely from order on the timing tier. This has the important consequence that no RC repair is needed in representations like (102) and the output of infixation-type reduplication in general. Minimal RC repair (fission) is needed in examples like (352) and similar products of transcription. Note that if phonemic tiers are considered to be ordered and NCC repair were needed in examples like (352), not only fission but multiple metathesis operations would be required as well.
Finally, note that the RC makes metathesis comprehensible as an RC violating preposing operation followed by timing slot deletion which removes the RC violation.

\[(356) \quad \begin{array}{c|c|c}
\times \times & \text{prepose} & \times \times \times \\
\hline
| | & | & | \\
\hline
a & b & a & b & a & b
\end{array} \rightarrow \times \times \]
The purpose of this appendix is to specify when and how a schema of the form (357) applies to a representation $\alpha$.

\[(357) \text{ desiderata-list :: rule-list ; higher-desiderata} \]

We first need to the notion of a desideratum driven rule which is constrained by a list of higher desiderata (CDDR, Constrained Desideratum Driven Rule):

\[
\text{desideratum :: rule ; higher-desiderata}
\]

If $\alpha$ and $\beta$ are representations and $K$ is a condition on representations, we say $\alpha >_K \beta$ if $K(\alpha)$ is true and $K(\beta)$ is false; and we say $\alpha =_K \beta$ if neither $\alpha >_K \beta$ nor $\beta >_K \alpha$ is true. If $(K_1, \ldots, K_n)$ is a list of representations, we say that $\alpha >_{(K_1,\ldots,K_n)} \beta$ if $\alpha >_{K_1} \beta$, or if $\alpha =_{K_1} \beta$ and $\alpha >_{(K_2,\ldots,K_n)} \beta$; and we say $\alpha =_{(K_1,\ldots,K_n)} \beta$ if neither $\alpha >_{(K_1,\ldots,K_n)} \beta$ nor $\beta >_{(K_1,\ldots,K_n)} \alpha$.

Now, suppose $d :: r ; (K_1, \ldots, K_k)$ is a CDDR. We say that it applies to a representation $\alpha$ to produce the representation $\beta$ if:

1. $r$ applies to $\alpha$ to produce $\beta$;
2. $\alpha >_d \beta$; and
3. $\alpha \geq_{(K_1,\ldots,K_n)} \beta$. 
Informally, a rule applies if it can bring an undesirable representation into satisfaction of the desideratum without degrading its satisfaction of the more highly ranked desiderata.

Application of (1) is specified by expanding the schema into a list of CDDRs by recursively applying the expansions (358).

\[(d_1, d_2, \ldots, d_n) :: R; (e_1, \ldots, e_k) \] \rightarrow \[
\begin{cases}
(d_1 & d_2, \ldots, d_1 & d_n) :: R; (e_1, \ldots, e_k) \\
(d_1 :: R; (e_1, \ldots, e_k) \\
(d_2, \ldots, d_n) :: R; (d_1, e_1, \ldots, e_k)
\end{cases}
\]

2. \(d :: (r_1, \ldots, r_n); E \rightarrow \[
\begin{cases}
d :: r_1 ; E \\
d :: (r_2, \ldots, r_n); E
\end{cases}
\]

It is implicit in the formulation that expansion is done on desiderata before expansion on rules.

For example:

\[(d_1, d_2) :: (r_1, r_2); \emptyset \rightarrow \[
\begin{cases}
d_1 & d_2 :: r_1 ; \emptyset \\
d_1 & d_2 :: r_2 ; \emptyset \\
d_1 :: r_1 ; \emptyset \\
d_1 :: r_2 ; \emptyset \\
d_2 :: r_1 ; (d_1) \\
d_2 :: r_2 ; (d_1)
\end{cases}
\]

**B.1 Late syllabification in Arabic**

It is difficult to find evidence in Chaha, but there is evidence from other Semitic languages that syllabification is late. So-called Classical Arabic Metathesis is easily accounted for under the assumption of late syllabification. In Classical Arabic, there is an affix dependent alternation in syllabification patterns for 122 roots in Arabic. Contrast the syllabification of an ordinary triconsonantal root in (359a,b) and a 122 reduplicative root in (359c,d).
Defect driven rule schemata

(359) /ktb/

a. ya-ktud-na ‘they (f) write’
b. ya-ktud-a ‘he writes’

/m[d]/
c. ya-mdud-na ‘they (f) extend’
d. ya-mudd-a ‘he extends’

The examples are from Gafos (2001), with the roots expressed according to the analysis developed in Section 7.10.

The two forms of the root /m[d] which are embedded in (359c) and (359d), mdud and mudd, are the puzzle that must be accounted for. Theories which assume that the affixes are attaching to a form which has already undergone syllabification are more or less forced to take one or the other to be the preaffixation form and have needed some variety of metathesis to derive one of the outputs. The question has an extensive history and Gafos should be consulted for the extensive background.

Under the assumption that syllabification does not take place until after the affixes and root have been concatenated, the syllabification pattern (359) can be understood as a syllabification/geminate interaction, not as affix induced metathesis of an already syllabified root. Although the intuition is clear, how it should be implemented is not entirely so. The reason that epenthesis follows the initial root consonant in (359d), but the penultimate root consonant in (359b), cannot be the consequence of an outright prohibition on epenthesis into a geminate, because there is just such epenthesis in (359c).

Two factors are at work, avoidance of epenthesis into a geminate and avoidance of epenthesis at the root-suffix boundary. The formalism of DDRs allows for just such competition between avoidance constraints. Frampton (2001) uses this formalism to develop a theory of syllabification and footing in which the structure starts with multiple unsyllabified elements or unfooted stressable elements. The order in which the defects are targeted for removal is determined by an ordered list of preferences. For syllabification, sonority and directionality are the key preferences. For a language like Arabic, vowels are syllabified before consonants, and elements to the right syllabified before elements to left, with the vowel/consonant distinction more important. The other ingredient is a list of repair rules and an ordered list of constraints, avoidance of which is to be avoided, to the extent possible. The highest
ranked repair rule which incurs the minimal violation of the constraints is used. For Arabic, the repair rule schema would be:

(360)

The derivations of the forms in (359) are given below. A hyphen indicates an affix/root boundaries and, at each point in the derivation, the most prominent defect, determined by sonority (reduced to the vowel/consonant distinction in Arabic) and “most right,” is boxed.

(361)  

<table>
<thead>
<tr>
<th></th>
<th>(a)</th>
<th>(b)</th>
<th>(c)</th>
<th>(d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>ya-k t b-n</td>
<td>ya-m d d-n</td>
<td>ya-k t b</td>
<td>ya-m d d</td>
</tr>
<tr>
<td></td>
<td>a</td>
<td>[a]</td>
<td>[a]</td>
<td>[a]</td>
</tr>
<tr>
<td></td>
<td>ya-k t b</td>
<td>ya-m d d</td>
<td>ya-k t b</td>
<td>ya-m d d</td>
</tr>
<tr>
<td></td>
<td>[a]</td>
<td>[a]</td>
<td>[a]</td>
<td>[a]</td>
</tr>
<tr>
<td>2.</td>
<td>ya-k t b</td>
<td>ya-m d d</td>
<td>ya-k t b</td>
<td>ya-m d d</td>
</tr>
<tr>
<td></td>
<td>[a]</td>
<td>[a]</td>
<td>[a]</td>
<td>[a]</td>
</tr>
<tr>
<td>3.</td>
<td>ya-k t b</td>
<td>ya-m d d</td>
<td>ya-k t b</td>
<td>ya-m d d</td>
</tr>
<tr>
<td></td>
<td>[a]</td>
<td>[a]</td>
<td>[a]</td>
<td>[a]</td>
</tr>
<tr>
<td>4.</td>
<td>ya-k t b</td>
<td>ya-m d d</td>
<td>ya-k t b</td>
<td>ya-m d d</td>
</tr>
<tr>
<td></td>
<td>[a]</td>
<td>[a]</td>
<td>[a]</td>
<td>[a]</td>
</tr>
<tr>
<td>5.</td>
<td>ya-k t b</td>
<td>ya-m d d</td>
<td>ya-k t b</td>
<td>ya-m d d</td>
</tr>
<tr>
<td></td>
<td>[a]</td>
<td>[a]</td>
<td>[a]</td>
<td>[a]</td>
</tr>
</tbody>
</table>
Except for the representations marked with †, the choice of repair rule is determined by repair rule ordering, since in all other cases the highest ranked rule whose structural conditions are met does not produce a violation of any of the avoidance constraints. For the boxed representations, the highest ranked rule which applies is Rule 4, but in the † instances, it produces a violation of one or the other avoidance constraint. Rule 4 is passed over in the first two columns in favor of Rule 5 because application of Rule 5 does violate either of the constraints. Rule 4 is passed over in the last column in favor of Rule 5 because, although its application violates the constraint against splitting a geminate, there is no better alternative. Application of Rule 4 violates a more highly ranked constraint.

For the sake of comparison, perfect forms are given below. There is no prefix and the epenthetic vowel is a. The boxed representations are the ones to which the highest ranked rule whose conditions of application are satisfied does not apply, because of one or the other avoidance constraint. These are the forms which force epenthesis to the left of the unsyllabified consonant instead of the more highly ranked epenthesis to the right. Avoiding constraint violations takes precedence over rule ordering.

\[
\begin{array}{cccc}
(362) & (a) & (b) & (c) & (d) \\
\hline
ktb-tu & m\text{d-d-tu} & ktb-a & m\text{d-d-a} \\
1. & \overset{\sigma}{k}\overset{b}{\text{tu}} & \overset{\sigma}{m\text{d-d-tu}} & \overset{\sigma}{k}\overset{b}{\text{a}} & \overset{\sigma}{m\text{d-d-a}} \\
& \overset{\sigma}{k}\overset{\sigma}{\text{tu}} & \overset{\sigma}{m\overset{\sigma}{\text{d-d-tu}}} & \overset{\sigma}{k\overset{\sigma}{\text{b-a}}} & \overset{\sigma}{m\overset{\sigma}{\text{d-d-a}}} \\
2. & \overset{\sigma}{k\overset{\sigma}{a-b-tu}} & \overset{\sigma}{m\overset{\sigma}{d-a-d-tu}} & \overset{\sigma}{k\overset{\sigma}{a-b-a}} & \overset{\sigma}{m\overset{\sigma}{a-d-d-a}} \\
3. & \overset{\sigma}{k\overset{\sigma}{a-b-tu}} & \overset{\sigma}{m\overset{\sigma}{d-a-d-tu}} & \overset{\sigma}{k\overset{\sigma}{a-b-a}} & \overset{\sigma}{m\overset{\sigma}{a-d-d-a}} \\
4. & \overset{\sigma}{k\overset{\sigma}{a-b-tu}} & \overset{\sigma}{m\overset{\sigma}{d-a-d-tu}} & \overset{\sigma}{k\overset{\sigma}{a-b-a}} & \overset{\sigma}{m\overset{\sigma}{a-d-d-a}} \\
\end{array}
\]
Appendix C

Raimy’s theory of
R-representations

The theory of juncture insertion and transcription which DR is based on was developed as a means of overcoming certain conceptual and empirical problems with the theory proposed by Raimy (2000). This section is devoted to outlining Raimy’s theory, explaining what its problems are, and contrasting it with DR. Raimy proposes that over/underapplication effects (many of them, at least) in reduplication are a consequence of phonological rules applying to a representation with a nonlinear timing tier. Since the remainder of this appendix is devoted to explaining why I think Raimy’s proposal should be rejected, it is important to first acknowledge my debt to Raimy for reconnecting the theory of reduplication with the core questions of phonology: What phonological structures does UG make available? What is their architecture and vocabulary? What operations on these structures are possible and how is their relative complexity evaluated?

C.1 R-representations

Raimy proposes that phonological representations are structures in which phonological adjacency is represented explicitly by linking rather than implicitly by adjacency in a linearly ordered structure. The proposed representation of *kat* ‘cat’, for example, is (363a), rather than (363b).
I will call representations like (363a) R-representations. It will be clear shortly why explicit start (#) and stop (%) symbols are necessary.

In the interests of typographical convenience, Raimy writes R-representations on a line, to the extent possible. So (363a) would be written as:

\[(364) \quad # \rightarrow k \rightarrow a \rightarrow t \rightarrow %\]

Raimy’s intention, however, is to divorce the structure from any implicit linearity. The reader should be careful in what follows not to invest representations like (364) with more structure than is justified by the explicit links which are given.

Since the links between phonemes are represented explicitly by pointers, there is no formal obstacle to structures with loops. Raimy proposes that Malay example from Section 1, for example, has the representation (365) at an early stage in the derivation.

\[(365) \quad # \rightarrow a \rightarrow n \rightarrow e \rightarrow m \rightarrow %\]

Although Raimy pictures R-representations without timing slots, as above, this is also a typographical convenience and (365) should be taken to represent:

\[(366) \quad # \rightarrow \times \rightarrow \times \rightarrow \times \rightarrow \times \rightarrow %\]
The loop structure in (366) makes it clear why R-representations must have explicit start (#) and (%) symbols. Without them, the structure would be (367), with no indication of either where to enter or where to exit the loop.

\[(367)\]

Raimy proposes that phonological rules can apply in R-structures, with predecessor and successor contexts for rule application established by the pointer relations on the timing tier. Under this assumption, if the structural conditions for nasalization require only that the target have some nasal predecessor, then nasalization applies in (366) and produces:

\[(368)\]

\[\hat{a} \rightarrow \hat{n} \rightarrow \hat{e} \rightarrow m \rightarrow \%\]

\[a\] nasalizes because one of its predecessors is nasal.

Finally, a linearization operation maps the R-representation (368) to the R-representation:

\[(369)\]

\[\hat{\#} \rightarrow \hat{\hat{a}} \rightarrow \hat{n} \rightarrow \hat{\hat{e}} \rightarrow \hat{m} \rightarrow \hat{\hat{a}} \rightarrow \hat{n} \rightarrow \hat{\hat{e}} \rightarrow \hat{m} \rightarrow \%\]

There are two serious problems with this approach to reduplication. First, a linearization operation which is adequate for the full range of R-representations which must be considered turns out to quite complex. In fact, Raimy does not even attempt to provide a linearization algorithm which proceeds by modifying the input representation. Instead, Raimy resorts to a Correspondence Theory account of linearization to select a linear representation which best corresponds to the input representation. Even with this peculiar intrusion of nontransformational phonology into an otherwise transformational theory, the linearization algorithm which Raimy provides is empirically inadequate.\(^1\) Second, although segmental phonology extends easily to R-representations, prosodic phonology does not. Raimy does not even attempt it.\(^2\) This cuts an R-representation analysis of reduplication off from some prosodic considerations which seem to be essential in the theory of reduplication.
C.2 Linearization

Raimy presents the linearization algorithm informally, so we need to make it somewhat more precise before it can be discussed. This runs the usual risk of misconstruing the author’s intention, but it cannot be avoided. Raimy views the linearization as an optimization process. The ranked list of desiderata given in (371) was culled from various places in Raimy (2000). Two different kinds of pointers are recognized: pointers that are already present in the lexicon and pointers that are introduced either in attaching the exponent of an affix to a stem or by readjustment rules acting on the stem. For convenience, call the former l-pointers (lexical pointers) and the latter m-pointers (morphological pointers). In pictorial representations, heavy arrowed lines are used to represent m-pointers. The representation

(370) \[
\begin{array}{c}
\# \\
t \\
a \\
p \\
\%
\end{array}
\]

for example, underlies \textit{tap} $\rightarrow$ \textit{tatap}.

(371) Optimal linearization

1. Spell out as many phonemes as possible.
2. Use as many of the m-pointers as possible.
3. Use m-pointers as early in linearization as possible.
4. Use as many of the l-pointers as possible.
5. Use as few steps as possible.

Although Raimy says “use as many of the m-pointers as possible”, this does not appear to be intended to mean that the new representation should contain as many of the m-pointers of the old representation as possible. If the linearization (370) contained the m-pointer, that would mean that \textit{t} and \textit{a} are metathesized in the process of linearization. Rather, what Raimy appears to intend is that identifying which elements of the input representation persist and appear in the output representation is a mute point; the output representation is constructed \textit{ab ovo}. Conditions like “use as many m-pointers as possible” is interpreted to mean that as many m-pointers as possible should have a \textit{correspondent} in the output.
Consider, for example, the input below:

\[
\begin{array}{c}
\text{(372) } \# \rightarrow t \rightarrow a \rightarrow p \rightarrow \% \\
\end{array}
\]

The pointers are indexed so that correspondence to the input representation can be represented by coindexing. The list of candidates in (373) is then considered. It is not hard to write down the conditions that a linear representation in correspondence with (372) must satisfy in order to be included in (373).

\[
\begin{array}{c}
\text{(373) } 1. \# \rightarrow t \rightarrow a \rightarrow p \rightarrow \% \\
2. \# \rightarrow t \rightarrow a \rightarrow t \rightarrow a \rightarrow p \rightarrow \% \\
3. \# \rightarrow t \rightarrow a \rightarrow t \rightarrow a \rightarrow t \rightarrow a \rightarrow p \rightarrow \% \\
\vdots
\end{array}
\]

Finally, the optimal candidate is chosen on the basis of (371), with “use” suitably reinterpreted.

The conceptual problem that is posed by a linearization process of this sort is that it introduces a completely new kind of rule into derivational phonology. The problem is not that ranked desiderata are used to choose the output from some candidate set. The problem is that the candidate outputs are not modifications of the input, so that correspondence relations must be introduced into the phonology.

Since the list of disambiguating criteria used to pick out the optimal linearization grows as one progresses through Raimy’s book, it is not surprising that most of the nonlinear representations he proposes are successfully linearized. But gaps remain. (374) is (31c) from Raimy (p. 33). All the pointers are lexical.

\[
\begin{array}{c}
\text{(374) } \# \rightarrow k \rightarrow i \rightarrow t \rightarrow \% \\
\end{array}
\]
Linearization is ambiguous. Either (375a) or (375b) is possible.

(375)  a. \# \xrightarrow{11} k \xrightarrow{12} i \xrightarrow{13} t \xrightarrow{17} k \xrightarrow{15} \sigma \xrightarrow{16} t \xrightarrow{14} %

b. \# \xrightarrow{11} k \xrightarrow{15} \sigma \xrightarrow{16} t \xrightarrow{17} k \xrightarrow{13} i \xrightarrow{13} t \xrightarrow{14} %

In all likelihood, the optimality criteria can be patched up by the additions of a suitable “*Do-the-wrong-thing” constraint of some kind, or justification can be found for stipulating that a suitable pointer in (374) is lexical. (In some other examples, Raimy needs to stipulate that pointers added for template satisfaction are l-pointers, not m-pointers, so it certainly is not obvious how the required stipulation can be made in this case.) The intent here is not to provide a refutation of the proposal on the basis of empirical inadequacy but to illustrate its complexity. This is important because Raimy claims a conceptual advantage for his theory of R-representations based on the claim that the theory requires no reduplication specific devices. A reasonable definition of a reduplicative structure in Raimy’s theory is one which has a nontrivial linearization. Since the linearization algorithm has no other use than linearizing such representations, it is hard to avoid the conclusion that the linearization algorithm is reduplication specific. If the linearization algorithm were more or less straightforward and conceptually obvious, it would be fair to claim that nothing new is introduced into the theory. But, as we have seen, linearization in Raimy’s theory is far from being either obvious or straightforward.

C.3 Prosodic structure and nonlinear R-representations

Recall that the analysis of Asheninca Campa in Section 7.3 relied on the ill-formed syllable structure of forms like:

\[ \begin{array}{c}
\times \times \times \times \\
\text{a m i n}
\end{array} \]
The unsyllabified final consonant triggered final vowel epenthesis and the ill-formed onsetless initial syllable triggered [-Right, resulting in a duplicant with well-formed syllable structure.

\[
\begin{array}{c}
\hat{\sigma} \\
[\times \times \times \times] \\
\text{a m i n}
\end{array} 
\rightarrow 
\begin{array}{c}
\hat{\sigma} \\
[\times \times \times \times \times] \\
\text{a m i n a}
\end{array} 
\rightarrow 
\begin{array}{c}
\sigma \\
[\times \times \times \times \times] \\
\text{a m i n a}
\end{array}
\]

This produces a contrast between \textit{amin-\text{a}n\text{e}h\text{i}} (‘look’, nonfinite) and the corresponding continuative form \textit{a-mina-mina-t-\text{a}n\text{e}h\text{i}}, with \textit{t} epenthesized to join the V-final stem and the V-initial suffix.

It is not at all clear how Raimy can deal with phenomena of this kind. Although segmental phonology can be extended to R-representations, the prosodic phonology of R-representations is obscure at best. The R-representation analog of (375) is:

(377) \[\# \rightarrow \text{a} \rightarrow \text{m} \rightarrow \text{i} \rightarrow \text{n} \rightarrow \%\]

The backpointer indicates actual precedence, not simply an instruction to repeat certain material. What then is the syllable structure of (377)? Does the “final” \textit{n} syllabify as the onset of the “initial” \textit{a}? Raimy does not have anything to say about the syllabification of R-representations.

In Chaha, for example, Raimy proposes the structure on the right below, but does not have anything to say about how it is derived from the consonantial root.

(378) \[\# \rightarrow \text{k} \rightarrow \text{t} \rightarrow \%\]

Since templatic syllable structure conditions are generally assumed to be involved in inserting the vowels into the consonantal root, there is a gap in Raimy’s analysis. Some new theory of template satisfaction is required, since it is implausible that there is a theory of R-representation syllabification adequate to the task.

C.4 Concatenative versus nonconcatenative morphology

In the R-representation theory, there is no difference in kind between prefixation and suffixation, on the one hand, and infixation, on the other.
In Distributed Reduplication, there is a difference in kind. Prefixation and infixation are concatenative, while infixation involves both concatenation and t-juncture insertion. Although there are no crucial examples which give evidence one way or the other, the difference is noteworthy enough that is worth reviewing.

Consider, for example, the combination of the stem *taki* and an affix with the exponent *ga* in Raimy’s theory. Prefixation, forming *gataki*, is shown in (379a); suffixation, forming *takiga*, is shown in (379b); and infixation before the final syllable, forming *tagaki*, is shown in (379c). The three R-representations that result are:

\[(379)\]

a. 
\[
\begin{array}{c}
\# \rightarrow t \rightarrow a \rightarrow k \rightarrow i \rightarrow \% \\
g \rightarrow a
\end{array}
\]

b. 
\[
\begin{array}{c}
\# \rightarrow t \rightarrow a \rightarrow k \rightarrow i \rightarrow \% \\
g \rightarrow a
\end{array}
\]

c. 
\[
\begin{array}{c}
\# \rightarrow t \rightarrow a \rightarrow k \rightarrow i \rightarrow \% \\
g \rightarrow a
\end{array}
\]

Given the fact that there is no difference in kind in his theory between infixation, suffixation, and prefixation, Raimy must account for the relative rarity of infixation. He attributes it to the greater complexity in specifying the source and target positions in the stem for the attachment of links between the exponent of the affix and the stem.

The corresponding DR structures are:

\[(380)\]

a. 
\[
\begin{array}{c}
\times \times \times \times \times \\
g \ a \ t \ a \ k \ i
\end{array}
\]

b. 
\[
\begin{array}{c}
\times \times \times \times \times \\
t \ a \ k \ i \ g \ a
\end{array}
\]

c. 
\[
\begin{array}{c}
\times \times \langle \times \times \times \times \rangle \\
\times \langle \times \times \times \times \rangle \\
t \ a \ k \ i \ g \ a
\end{array}
\]

or

\[
\begin{array}{c}
\langle \times \times \times \times \rangle \times \times \\
\times \times \times \times \times \\
g \ a \ t \ a \ k \ i
\end{array}
\]
A prefix or a suffix is joined to the stem by concatenation. An infix is an underlying concatenated prefix or suffix, coupled with the insertion of t-junctures whose ultimate effect is to prepose a suffix or postpone a prefix into the stem.
Chapter 1
1. I call it “copying-like” because it combines copying with translation. Bases are mapped to complementary bases.
2. The translation of a phonological representation/score into a physical performance is not direct. A phonological representation is first translated into a phonetic score, which can undergo further processing before it in turn is translated into a physical sound signal.

Chapter 2
1. Transcription generally produces crossed structures, but there are circumstances in which it does not. If an initial consonant is reduplicated, for example, a geminate is produced, with no crossing. This occurs in Imldawn Tashlhiyt Berber:

\[
\sigma \times \sigma | \rightarrow \times \times \times
\]

\[
| \times \ \\
\times \ \\
| \times
\]

f r n f r n

2. See Frampton and Gutmann (1999, 2000) for a development of essentially the same point of view in syntax. We argue against Chomsky’s early Minimalist Program idea of massive overgeneration and filtering by economy conditions.
3. Certainly, one of the more bizarre aspects of OT’s conception of the language faculty is that a complex calculation is needed to move dog out of the lexicon and into a phonological computation.
4. This oversimplifies the extensive discussion in Halle (1995). In some cases, only marked features block feature spreading.
Chapter 3

1. It is possible to entertain the idea of a more complex theory, in which triggered rules are interspersed among the cyclic rules, but this possibility is not considered here.

2. Zoll uses this fact to demonstrate that McCarthy and Prince’s (1995) Correspondence Theory analysis of the absence of root vowel reduction in intensive reduplication is flawed. While I believe that Zoll’s counteranalysis is needlessly stipulative, this does not detract from the insightfulness of her criticism of the Correspondence Theory account.

3. Associating the timing slots generated by transcribing a reduplicant with a morpheme has been taken to be a repair operation. It was proposed above that the association is with the morpheme which initiates the cycle in which the transcription occurs. It could be that there is language or even morpheme particular variation on how the repair is carried out. If Klamath transcribes both the intensive and the distributive reduplicants to the left, but takes the reduplicant generated by intensive reduplication to be a root extension, rather than derived affixation. Repair would proceed as in (i). If this is so, root vowel reduction would not apply because the initial vowel of the root remains the initial vowel of the word after reduplication.

4. It may be the case that templates can be shown to be only descriptive and can be removed altogether from the ontology of phonology.

Chapter 4

1. This is slightly inaccurate, since I assume that t-junctures are timing tier junctures and assume that lexical entries are not autosegmental. More accurately, lexical entries contain symbols which translate into t-junctures (in an obvious way) when the lexical entry is translated into an autosegmental representation upon entering the morphophonological computation.

2. Healy doesn’t give any examples with initial consonant clusters, so it is possible that the stem adjustment rule is $\emptyset \rightarrow [\text{Left } \times \text{_____}]$.

3. The frequentative stems are simplified somewhat. The length the second vowel is inconsistently long in Wilbur’s data.
Chapter 5

1. McCarthy and Prince (2001:126) note the reduplication pattern in Nuu-chah-nulth (which they call Nootka) and a similar one in Nitinaht, a related language, based on Stonham 1990 and Shaw 1992. They account for patterns by assuming that a “heavy syllable template” is imposed, but that penalties against syllables with codas outrank the penalties against nonmaximal copying. This account is implausible, even on OT terms, since the possibility of a penalty on the presence of a coda outranking penalties against nonmaximal copying can easily produce unattested reduplication patterns. The following unlikely variant of total reduplication results if NoCoda is elevated over the constraint which penalizes nonmaximal copying.

   (i) a. da ti kun → da ti ku - da ti kun
   b. da tin ku → da ti - da tin ku
   c. dan ti ku → da - dan ti ku

   Max(B,R) forces as much material to be reduplicated as possible, but is stopped by the more prominent NoCoda. NoCoda is, in turn, outranked by the usual array of correspondence constraints which ensure that BR-correspondence imitates faithful copying. As far as I know, such a pattern is completely unattested.

2. I assume here that it is sufficient that left transcription to be simpler for many stems (i.e. those which begin with a syllable with an onset) for the grammar to choose uniform left transcription for all roots. It would be a complication for the direction of transcription to depend on the particular stem.

3. It is worth noting that a CVC is copied to the left even if the initial vowel of the stem is long, so ka:ma: → kamka:ma:/kakka:ma:. The source is [k⟨a⟩am]maa. An account is given in Chapter 6.

Chapter 6

1. Blevins analyzes the transition from Mokilese-A to Mokilese-B as a diachronic instance of “the emergence of the unmarked.” In particular, the elevation of NoCoda in the penalty function hierarchy. This account is implausible for the reasons given in Chapter 5 fn. 1.

2. Davis (2002) avoids an appeal to reduplication specificity by using Sympathy Theory and proposals concerning the moraicty of geminates.

3. The discussion of syllable weight in Hayes (1995:270) is useful. He suggests that the notion weight should be restricted to mora count, and that it is more useful to analyze what I call secondary weight distinctions as prominence distinctions. That may be correct.

4. Lardil roots are often written with a final laminal consonant θ. This consonant is supposed to surface when a V-initial suffix is concatenated, otherwise to delete because the syllable well-formedness conditions in Lardil do not allow this consonant as a coda. But it could be that roots are minimized to reduce redundancy and that θ is added by rule to eliminate vowel hiatus. I assume that this is the case.

5. Haugen (2003:79) takes Yaqui to demonstrate that Moravcik was simply wrong. This is an overly harsh judgment. There remains a kernel of Moravcik’s insight that an adequate theory of reduplication must account for. Syllable copy is still an unattested form of reduplication, which still demands an account. Haugen is incorrect in claiming...
that “Yaqui illustrates a pattern of reduplication which has been repeatedly claimed not to exist: the pattern of so-called ‘syllable-copy’.” This is not entirely true; if the initial syllable is bimoraic, it is not copied.

Chapter 7

1. It is supplemented by very helpful personal communication with Galen Sibanda.
2. Another approach might be to relate the occurrence of -ile to the fact that multiply associated phonemes may be present at the point that PERF combines with the stem.

(i) root causative reduplication

| ot  | mo-tu-a-ot-es-es-y-a | ‘we caused someone to light’ |
| sw  | eri-sw-es-es-y-a     | ‘to cause to grind’         |
| hi  | eri-hi-is-is-y-a     | ‘to cause to burn’          |
| kohol | eri-kohol-es-es-y-a | ‘to cause someone to cough’ |

The meaning is emphasis of causation rather than the unintensive meaning of bisyllabic reduplication. The straightforward explanation is that -esy is actually bimorphemic -es-y and causative reduplication targets the exponent of its inner morpheme. If -esy were monomorphemic, the MIC would prevent partial reduplication of the suffix.

4. Inkelas and Zoll (2004) claim (p. 12) that the short causative is not produced by truncation in the phonology because “such an analysis would predict the Short causative to be possible whenever the Long causative is possible, but it is not.” Implicit is the assumption that phonological rules cannot be morphologically conditioned. But it is impossible to get very far in understanding morphophonology under this assumption. Inkelas and Zoll themselves only manage to get three pages before they claim on p. 15 that the fact that causative -y floats to the right past extension suffixes is due to a rule operating in the phonology. This rule must know that the phoneme y is the exponent of the causative morpheme. The phonological rule is conditioned by the morphological structure in which it operates, just as short causative formation by truncation is sensitive to whether or not the root is a SC-root. (In fact, we claimed that es-deletion was a readjustment rule, not a rule of the phonology. But the point remains.)

5. See footnote 2 (p. 147) in Spring’s thesis for some discussion of the instability in her informant’s reduplication rules.

6. Needless to say, this carries some risk. If the hypothesized language turns out not to a possible human language, the fact that DR can model it is evidence of the inadequacy of DR.

7. In DR, melody copying is incoherent, because copying requires linear order and the melodic tiers have no intrinsic order.

8. For roots of the first type, the difference between VC-reduplication and CV-reduplication is minimal: (C1)VC2VC2C3V(C4) versus (C1)VC3VC2C3V(C4). This is unlikely to be an accident. Unfortunately, without a theory of how verb irregularities of this kind are learned (the irregularity being affix selection), it is impossible to transform this observation into a theoretical proposal. Roots of the second type might reflect an earlier stage in the language in which the roots were monosyllabic, ending in a consonant cluster. Later, after i or i broke up the consonant cluster, irregular assignment
to the VC-reduplicating class might have been made in order to minimize the change in the reduplicated forms.

9. If true, this would be related to the existence of a sizable number of roots of the form (C)aC/C or (C)aC\text{1}C which undergo VC-reduplication rather than CV-reduplication, which is the expected variety of reduplication for polysyllabic roots.

10. The vowel inventory is \{i, i, u, o, a\}. There are nine \textit{V}_1\textit{V}_2 sequences which occur in Tohono O’odham which are not Type F: \{ia, in, i, u, oi, ai, au\}.

11. Some combinations of class membership are unlearnable under almost any plausible assumptions about the role that formal simplicity plays in learning. There are no verbs which are both shortening and lengthening, for example. But it would be incorrect to state this as part of the grammar. No plausible learning mechanism will assign a root to both of these classes simultaneously. 10 out of the 16 possibilities are learnable and 8 of these are attested. As far as I know, there are no verbs which are lengthening and exceptionally truncating, although there are exceptionally truncating verbs with a long initial vowel (i.e. \textit{da:k} \rightarrow \textit{da:-d-k}); and the only verbs which are both exceptionally truncating and degeminating are also lengthening (i.e. \textit{sikol} \rightarrow \textit{si?i-s-kol}).

12. Alongside the preference for falling diphthongs is a secondary preference for diphthongs with smaller sonority differences, so \textit{au} is preferred to \textit{an}, for example. If the preference for falling diphthongs is combined with the preference for low sonority difference diphthongs, with the first criterion given priority, the following markedness scale on potential nuclear diphthongs is produced.

\begin{center}
\begin{tabular}{lcc}
Diphthong Preference Hierarchy (DPH): & possible & actual \\
\{ai, au\} & 157 & 156 & 99\% \\
\{ar, al\} & 80 & 71 & 89\% \\
\{an, am\} & 48 & 36 & 75\% \\
\{ia, ua\} & 28 & 17 & 61\% \\
\{ra, la\} & 29 & 5 & 17\% \\
\{na, ma\} & 6 & 0 & 0\% \\
\end{tabular}
\end{center}

13. The “modification”, it should go without saying, is not under the conscious control of the language speaker, but under the automatic control of the language learning apparatus which works in the complex environment which results in language change over time.

14. There is an oversimplification here. The vowel quality that results is always \textit{a}. Various accounts are possible.
Appendix B
1. Lowenstamm (1996) also rejects the idea that metathesis is involved and develops an analysis along those lines.

Appendix C
1. The criticism is directed at the intrusion of Correspondence Theory into the analysis, not Optimality Theory per se. The early OT theory of Prince and Smolensky (1993) views the output as a modification of the input. In that theory, the input is actually explicitly embedded in the output. That theory, however, proved to be inadequate.

2. Although segmental phonology does extend successfully to R-representation, it does have one peculiar quirk, not mentioned by Raimy. Although it is easy to determine the successor to a particular phoneme, or more generally the “right environment” of the phoneme, it is much more difficult to determine the “left environment.” The predecessor relation is not coded directly in the representation. Determining the predecessor requires a search starting at the # mark. This asymmetry in the structure is questionable. One might introduce a more complex structure, a double linked list, which codes both the successor and predecessor relations directly, but Raimy (p.c.) rejects this.
References


Inkelas, Sharon and Cheryl Zoll. 2004. Reduplication as morphological doubling. Manuscript, UC Berkeley and MIT.


Lowenstamm, Jean. 1996. CV as the only syllable type. In J. Durand and B. Laks, eds., *Current Trends in Phonology: Models and Methods*, University of Salford Publications.


# Glossary of Abbreviations and Rules

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The subject index is preliminary and largely confined to the first six chapters of the monograph. It needs a final editing, but is included because it may be useful even in its present state.

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