CHAPTER 3

EDGE ANCHORING

3.1 Introduction to Edge Anchoring

This chapter motivates constraints that target the *edges* of constituents for copying in reduplication. Two edge anchoring constraints are argued to be needed: one that targets main stressed foot edges and requires them to correspond with the edges of the reduplicant (EDGE-ANCHOR $_{\text{Head-foot}}$), another that targets morpheme edges, also requiring the correspondents to stand at RED's edges (EDGE-ANCHOR $_{\text{Base}}$).

(1) EDGE-ANCHOR $_{\text{Head-foot}}$: Each segment at each edge of the main stressed foot of the base must have a correspondent at the same edge in the reduplicant.[1]

(2) EDGE-ANCHOR $_{\text{Base}}$: Each segment at each edge of the base must have a correspondent at the same edge in the reduplicant.

The primary evidence in favor of these constraints are cases where (a) the right edge of the main stressed foot is copied, in addition to the left edge, and (b) both edges of the base are copied and edge oriented in RED. These are illustrated in (3a,b) respectively:

(3) Evidence of EDGE-ANCHOR

a. Yidiɲ (Dixon 1977, McCarthy 1997)

mulari	<u>mula</u>-[mula]$_{\text{Foot}}$ ri	'initiated man'
t^{j}ukarpa	<u>t^{j}ukar</u>-[t^{j}ukar]$_{\text{Foot}}$ pa-n	'unsettled mind'

[1] Although similar to a simpler constraint that would require relativization of MAX-BR to the onset and coda of a foot, we see in discussion of Makassarese (§3.4.3) that the onset and coda must not only be present, but must also appear at the edges of the base.

b. Tagalog (Carrier 1979, Carrier-Duncan 1984, McCarthy & Prince 1994)

walis	(mag)-<u>walis</u>-[walis] $_{Base}$	'sweep/sweep a little'
linis	(mag)-<u>liːnis</u>-[liːnis] $_{Base}$	'clean/clean a little'

(compare: baluktot → <u>baluː</u>-baluk[tot], 'bent/variously bent')

However, these constraints do not seem to be independently re-rankable relative to each other, when cross-linguistic predictions are taken into account. Most importantly, it does not appear that the edges of an indiscriminately large base can be targeted, e.g. hypothetical *<u>mek</u>$_{10}$-metgodupik$_{10}$*. The edges of the base are targeted only if it is coextensive with the head foot. Thus, I propose an inclusion hierarchy (Prince 1997) that captures the observed implications, as well as the additional edge effects outlined below.

Several languages are characterized according to the way in which their sensitivity to edges determines the reduplication pattern they exhibit. The proposed inclusion hierarchy is meant to track various degrees of partial reduplication that are incrementally closer to total reduplication. The hierarchy works as follows. In addition to constraints (1) and (2) above, the hierarchy involves and begins with the constraint LEFT-ANCHOR, discussed in Chapter 2:

(4) LEFT-ANCHOR (Base, Reduplicant): The left edge of the reduplicant corresponds to the left edge of the base.

Numerous patterns cross-linguistically satisfy only this constraint among the three mentioned. The inclusion hierarchy leaves LEFT ANCHOR as an independent constraint, the most "general" (i.e. least stringent). If any of the anchoring constraints can be satisfied, it will be LEFT-ANCHOR.

The next constraint is the following, which is the set including both LEFT-ANCHOR and EDGE-ANCHOR$_{\text{Head-foot}}$.

(5) {LEFT-ANCHOR, EDGE-ANCHOR$_{\text{Head-foot}}$}

This constraint is more stringent than either individual constraint alone; in order to be satisfied, a candidate must anchor to not only the left edge of the base, but to the edges of the main-stressed foot as well. [2] Any violation of either of these components will lead to violation of the constraint (i.e. violation is categorical). This constraint will be used to account for the Yidiɲ data seen above in (3a).

The next constraint to be added to the hierarchy is one that anchors to the edges of the *base*. Thus, (2) is added to the set in (5):

(6) { LEFT-ANCHOR, EDGE-ANCHOR$_{\text{Head-foot}}$, EDGE-ANCHOR$_{\text{Base}}$}

These three component constraints working together as a single constraint in the inclusion hierarchy have the effect of preserving a morpheme-final segment (Tagalog, §3.4.2), or inhibit RED-final epenthesis, even in the face of a constraint requiring consonants prosodic word-finally (Makassarese, §3.4.3). In addition, the constraint in (6) will be shown to force "contraction" of the base, where foot-medial segments from the base have no correspondents in the reduplicant. The constraint is also used to account for cases where reduplication becomes impossible when the base exceeds one foot in size; in these examples, periphrasis is required to convey what is otherwise expressed with

[2] McCarthy & Prince (1995) note that although a base *syllable* cannot be copied straightforwardly, with no sensitivity to whether the syllable is light, heavy, coda-final, etc., a foot can. This distinction is achieved in a rather heavy-handed way in the current system: a main-stressed foot edge faithfulness constraint is proposed, whereas none is proposed to target the edges of a stressed syllable. However, none of the theories I am aware of achieve this result in a less stipulative manner.

reduplication. Impressionistically, the constraints in this hierarchy represent intermediate gradations between left-anchoring and total reduplication.

As we will see, adopting this inclusion hierarchy will account for several right edge effects, without ever singling out the right edge alone as a target. The theory promoted here directly captures the dependence of right edge copying on left edge copying. In any of the contexts discussed in this chapter, copying of the right edge of a domain implies that copying of the left edge of the same domain must also occur. This is an effect not achieved by past accounts of the same cases, as will be pointed out. Adopting the above inclusion hierarchy allows us to generate the predicted typology, while ruling out numerous patterns that are otherwise predicted by the symmetric theory of anchoring.

The relevant data are presented below, grouped into the classes predicted by the existence of such a constraint. We see in (7) cases of contracting reduplication, where edge anchoring compels violation of base-reduplicant CONTIGUITY.

(7) RED-contracting reduplication

a. Semai (Diffloth 1976a,b, Sloan 1988, Hendricks 1998)

kʉːʔ	kʔ$_3$-[kʉːʔ$_3$]	‘to vomit’
payaɲ	pɲ$_5$-[payaɲ$_5$]	‘appearance of being disheveled’

b. Ulu Muar Malay (Hendon, 1966, Kroeger 1989)

sieʔ	siʔ$_4$-[sɪéʔ$_4$]	‘is torn repeatedly’
dayaŋ	dan$_5$-[dayáŋ$_5$]	‘friend’

Size considerations force reduplication to be partial; however, edge anchoring ensures that the consonants at each edge of the base will have correspondents in RED. We will examine these cases in closer detail in §3.2.

The following two familiar cases illustrate the prediction that EDGE-ANCHOR can lead to copying of all and only the main stressed foot. In Tagalog (3b), repeated below in (8), the requirement interacts with independent LEFT-ANCHOR, which above all else requires left anchoring of the base and the reduplicant.

(8) Base-delineating reduplication

Tagalog (McCarthy & Prince 1994, Carrier-Duncan 1984, Carrier 1979)

walis	(mag)-walis-[walis]	'sweep/sweep a little'
linis	(mag)-liːnis-[liːnis]	'clean/clean a little'

(compare: baluktot → baluː-baluk[tot], 'bent/variously bent')

We will return to these cases in section 3.3 to examine them in detail, relating them to a similar but more complicated pattern in Makassarese.

In the final class, EDGE-ANCHOR restricts copying to cases where the base is coextensive with the head foot.

(9) Exhaustive base-delineating reduplication

a. Yoruba (dialectal) (Pulleyblank 2000)

wolé	wolé-[wolé]	'look at the house/sanitary inspector'
lámi	lámi-[lámi]	'lick water/type of water insect'

(but: fɛ́nilɔ́mɔ → a-[fɛ́ni][lɔ́mɔ], * fɛ́nilɔ́mɔ- fɛ́nilɔ́mɔ, 'marry someone's child/someone who takes peoples' daughters and marries them')

b. Kinande (Mutaka & Hyman 1990, McCarthy & Prince 1995)[3]

ku-gulu	ku-[gulu]-gulu	'sheep/real sheep'
mú-twe	[mú-twe]-mú-twe	'real head'
m-bulí	[m-bulí]-m-buli	'sheep/real sheep'

(but: -gotseri 'sleepiness' *has no reduplicated form*: *-gotse-gotseri, *-gotseri-seri. '*real sleepiness'; must be expressed periphrastically)[4]

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[3] In these examples, the prefixal augment (*e*- or *o*-) has been omitted, as it does not participate in reduplication.

When RED cannot satisfy the relevant EDGE-ANCHOR constraint, these languages show that sometimes periphrasis wins over imperfect reduplication. Each class will be discussed in more detail in the following sections.[5]

3.2 Base contracting reduplication

3.2.1 Semai reduplication

The "expressive minor reduplication" pattern of Semai (Diffloth 1976a,b, Sloan 1988, Hendricks 1998) is a case showing the contracting effect of edge anchoring. We see copying of initial and final segments of the root.

Anchoring here is aggressive in that the intermediate material is not copied:

(10) Semai minor reduplication

a. Monosyllabic bases

kʉːʔ	kʔ$_3$-[kʉːʔ$_3$]	'to vomit'
dŋɔh	dh$_4$-[dŋɔh$_4$]	'appearance of nodding constantly'
cfaːl	cl$_4$-[cfaːl$_4$]	'appearance of flickering red object'

b. Disyllabic bases

payaɲ	pɲ$_5$-[payaɲ$_5$]	'appearance of being disheveled'
cayɛm	cm$_5$-[cayɛm$_5$]	'contracted fingers of human animal, not moving'
cruhaːw	cw$_6$-[cruhaːw$_6$]	'sound of waterfall, monsoon rain'

The transcriptions are taken directly from Diffloth 1976b. However, Diffloth 1976a explains that the minor syllables have a vowel on the surface. He calls these vowels

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[4] Philip Mutaka (p.c.) kindly provides the relevant data: *nyilwé nyíkwire ehigotseri ehyekwenene lero*, (lit.) 'I had the sleepiness of real this time', i.e. 'This time, it was the sleepiness of real that I had'. Another alternative is: *otwo tulwe itwotugotseri*, (lit.) 'that it was sleepiness', 'that was real sleepiness'.

[5] One thing to bear in mind regarding the data that will be appealed to in support of the proposed constraints is that in each case where the right edge of the base is preserved through EDGE-ANCHOR, that edge segment is a consonant, the final consonant of the prosodic word. As it stands, the constraint does not require consonant-hood of this segment, although quite possibly it should.

'minor', indicating that they are short and unstressed. All of the information that he provides suggests that this vowel is predictable from the surface environment: *a* before a back consonant: *dah- [dŋɔh]; kaʔ-[kʉːʔ]*, and *u* where a *w* has been vocalized: *cu-[cruhaːw]*. Unfortunately, information regarding the rest of the environments is not given. The generalization seems to be that the minor vowel corresponds to the place of the final consonant. If true, then this is the same correspondence that emerges in Nancowry (see chapter 4); however, rather than copying a vowel from the base, an epenthetic vowel agrees in place with the final C of the base, in satisfaction of AGREE(place) (Lombardi 1997, Alderete *et al*. 1999) in this context.

In Semai, some minimizing constraint must cause the reduplicant to be as small as possible. Hendricks proposes that it is highly-ranked ALIGN-ROOT-LEFT, which requires that the root align with the left edge of the prosodic word. This constraint would be violated by intervening material, namely the contents of the reduplicant, and would dominate MAX_{BR} (which demands total reduplication) and CONTIGUITY_{BR}, the constraint against "skipping" segments, relative to the order of their correspondents in the base. Thus, full reduplication is prevented. With left- and right-anchoring constraints in turn dominating ALIGN-ROOT-L, the reduplicant would then contain the first and last segments of the base:

(11) L-ANCHOR, R-ANCHOR » ALIGN-ROOT-L » MAX_{BR}, CONTIGUITY

Given that the AGREE constraint suggested above will also serve to minimize markedness in terms of place specification, the minimizing constraint is more likely Place Markedness, emerging via TETU. In evaluating Place Markedness below, one star is shown for each place-linked segment in the reduplicant; segments of the base of course also violate Place Markedness, but these violations are forced by highly-ranked MAX-IO. Thus, for simplicity, these stars are omitted from the tableau. The same method is used in discussion of Ulu Muar Malay in the next section. In the example at hand, E-ANCHOR then requires correspondence to both edge segments.

(12) { LEFT-ANCHOR, EDGE-ANCHOR$_{\text{Head-foot}}$, EDGE-ANCHOR$_{\text{Base}}$} » Place Markedness » MAX$_{BR}$

/RED,cʔɛːt/	E-ANCHOR	Place Markedness	MAX$_{BR}$
a. ☞ct- [cʔɛːt]		**	**
b. cʔɛːt- [cʔɛːt]		***!*	
c. c- [cʔɛːt]	*!	*	***

Thus, a candidate that anchors to both edges, adding only a minimal minor vowel would best satisfy this ranking (a), even though this candidate violates CONTIGUITY$_{BR}$. Given the satisfaction of the constraint requiring edge anchoring, the ranking of L-ANCHOR is no longer crucial. The reduplicant in (b) fatally violates Place Markedness; in (c), it fails to copy the segment from the right side of the base. Another candidate, *cʔɛːt-ct*, would tie with the winner on the above constraints. However, given that the language generally only allows a minor syllable to precede a right-aligned foot, the active prosodic constraints would prefer candidate (a).

3.2.2 Ulu Muar Malay

Ulu Muar Malay exhibits a similar edge-anchoring pattern. Reduplication can occur in one of six types in Ulu Muar Malay, in spite of the fact that there is no meaning difference contrasting the different shapes (Hendon 1966:58). The form that RED takes is, however, dependent to a certain extent on the shape of the stem. In addition, stylistic factors are also reported to affect the shape of the reduplicant, with shorter forms occurring in faster speech. One of these patterns is of particular interest to the present discussion. This RED copies the edgemost consonants of the base (and usually the first vowel) ;[6] all other base segments are excluded from RED.

To illustrate the six types of reduplication, Hendon uses a hypothetical stem; this is because no real stem is attested in all six forms, although several stems occur with more than one variant. I repeat his example here, which uses the hypothetical stem /patɪŋ/ (Type III (13c) is the focus of discussion):

(13) Reduplication alternants

a. Type I: patɪŋ-patɪŋ (total reduplication)
   Stems of any shape can occur in this shape.

b. Type II: patɪm-patɪŋ (total reduplication with assimilation at morpheme juncture)
   Markedness of the stem-final consonant is reduced in this pattern. Stem-final nasals are replaced by the nasal homorganic with the following stop when the stem begins with a stop, as in the example above. Stem-final stops are replaced by [ʔ]. In all other cases, such as when the stem does not begin with a stop, the stem-final consonant is deleted.

c. Type III: pam-patɪŋ
   This type of reduplication is found only with stems which
   i. end in a stop, [h], or [ʔ] and begin with a consonant
   ii. end in a nasal and begin with a stop or [s]

d. Type IV: pa-patɪŋ
   Found only with stems that begin with a single consonant. (This is the only pattern cited with an example of a vowel-final stem, *suko*.)

[6] The vowel of the reduplicant may be optionally deleted before NC clusters; I am abstracting away from this fact here.

e. Type V: ppatɪŋ
   This type is found with stems that begin with a consonant or a cluster of consonants.

f. Type VI: tɪŋ-patɪŋ
   This type is dubbed "uncommon".

Additional data of the crucial edge anchoring "Type III" is given here.

(14) Ulu Muar Malay reduplication

a. sieʔ	sɪʔ-siéʔ	'is torn repeatedly'
b. dayaŋ	dan-dayáŋ	'friend'
c. budaʔ	bʊʔ-budáʔ	'children'
d. laɲit	laʔ- laɲít	'palate'

RED-final consonants appear only as *ʔ, h,* or a nasal. Oral stops are neutralized to *ʔ*. The Coda Condition yields place assimilation of nasal codas. The vowels *i* and *u* appear as their lax counterparts *ɪ* and *ʊ*, respectively. Malay has final stress. So maintenance of the initial vowel must be due to a constraint requiring faithfulness to V_1.[7] The final coda's only virtue is its position at the right edge of the foot (and base). No data directly shows that the base edge (rather than the foot) is crucial. However, its importance here can be inferred from the complete lack of reduplication data with bases larger than a foot; the language does have a limited number of stems larger than two syllables.

In (15), the emergent reduplicant is CVC, as forced by edge anchoring plus faithful copying of V_1 of the base. Place Markedness violations are again noted for the reduplicant only. The reduplicants in (d & e) fail to copy both edges of the base, fatally.

[7] Such a constraint has independent justification from some dialects of French e.g. Parisian, and also in Quebec French in certain environments (Charette 1991:203). Although schwa deletion is allowed word-internally in both Parisian and Quebec French (e.g. *mat~~e~~las* 'mattress'), schwa is not deleted in initial position in a disyllabic word in Parisian French (*cheval,* vs. Quebec French *ch~~e~~val* 'horse'). In both dialects, deletion is not allowed in polysyllabic words (*cependant* 'however').

In (b), the reduplicant is too large, as it causes gross violation of Place Markedness. Finally, (c) copies the unstressed vowel of the base, as opposed to the first vowel as in the winning candidate (a).

(15) E-ANCHOR, FAITH V$_1$» Place Markedness

/RED + budaʔ/	{ LEFT-ANCHOR, EDGE-ANCHOR$_{\text{Head-foot}}$, EDGE-ANCHOR$_{\text{Base}}$}	FAITH V$_1$	Place Markedness
a. ☞ buʔ$_5$- [budáʔ$_5$]			***
b. budaʔ$_5$- [budáʔ$_5$]			****!*
c. baʔ$_5$- [budáʔ$_5$]		u!	***
d. bud$_3$- [bud$_3$áʔ]	*!		***
e. bu$_2$-[bu$_2$dáʔ]	*!		**

In sum, anchoring of the edges plus faithfulness to V$_1$ of the base are required of the reduplicant; however, copying of any additional material is foregone in order to minimally violate the relevant minimizing constraint, which is suggested to be Place Markedness.

3.3 Base-contracting truncation: Dutch hypocoristics

In Dutch hypocoristics (Hanks & Hodges, 1990, Struijke, p.c.) we see truncation to the edges of a foot-long base name:

(16) Foot-long base names

a. [Gérrit]	Gert
b. [Jákob]	Jaap
c. [Wíllem]	Wim
d. [Jósef]	Joop

Note that in spite of such a pattern, targeting the edges of the name in larger names is not possible, e.g. *Leonardus, *Les.*

(17) Anchoring to foot/base edges

[Gérrit]	{L-ANCHOR, E-ANCHOR$_{HdFt}$, E-ANCHOR$_{Base}$}	CONTIG	L-ANCHOR
a. ☞ Gert		*	
b. Ger	*!		
c. Rit	*!		*

When the base is coextensive with the head foot, then it is possible to anchor to both edges of the base. However, when the two are not coextensive, as with *Leonardus*, then CONTIGUITY is shown to be active.

(18) No edge-anchoring

Leo[nárdus$_9$]	{L-ANCHOR, E-ANCHOR$_{HdFt}$, E-ANCHOR$_{Base}$}	CONTIG	L-ANCHOR
a. Les$_9$	*	*!	
b. ☞Leo	*		
c. Dus$_9$	*		*!

At no time is it necessary to appeal explicitly to the right edge. Rather, the right edge becomes important when it is both rightmost in the base name and in the head foot of the base. Even then, the right edge is only singled out as part of a pair that necessarily includes the left edge of the base as well.

3.4 Additional main stressed foot edge cases

3.4.1 Yidiɲ reduplication

Accounting for the reduplication pattern found in Yidiɲ is entirely straightforward in the current proposal. As can be seen from the data below, the reduplicant is anchored to both edges of the main stressed foot in the base.

(19) Yidiɲ (Dixon 1977, McCarthy 1997)

mulari	mula-[mula]$_{Foot}$ ri	'initiated man'
t^jukarpa	t^jukar-[t^jukar] $_{Foot}$ pa-n	'unsettled mind'

This account can be compared to that of McCarthy (1997). In the context of the exploration of the connection between prosodic circumscription and faithfulness, McCarthy notes that the foot-final segment can be targeted using a prosodic anchoring constraint that requires base-reduplicant correspondence to preserve a segment's status as foot final (INPUT-ANCHOR-POSITION$_{BR}$(Foot, Foot, Final)). The problem with invoking such a constraint is that it requires explicit preservation of final material with no implication regarding other more prominent positions in the base. The proposed EDGE-ANCHOR constraint safely preserves the needed implication that the left edge of the main stressed foot is targeted, along with the right edge.

3.4.2 Tagalog reduplication

In Tagalog (Carrier 1979, Carrier-Duncan 1984, McCarthy & Prince 1994), reduplication of the final consonant of the base is performed in all and only cases where this final C is at the end of a disyllabic stem. When the stem is longer, then the reduplicant has no final coda:

(20) Tagalog disyllabic reduplication: compelled violation of E-ANCHOR

a. Coda in reduplicant

walis	(mag)-walis-[walis]	'sweep a little'
linis	(mag)-liːnis-[liːnis]	'clean a little'

b. No coda in reduplicant

baluktot	baluː-baluktot	'variously bent'
ʔintindin	ʔintiː-ʔintindiŋ	'several small understandings'

Reduplicants are always disyllabic. So the only case in which the reduplicant allows a faithful final coda is when it is the stem-final C that is copied; otherwise, the reduplicant is V-final.

In the case of a disyllabic root, both edges would clearly be copied (e.g. *(mag)-walis-walis*), showing that E-ANCHOR » NO CODA. With the ranking NO CODA » MAX_{BR}, we see that in longer roots, since satisfaction of E-ANCHOR is no longer possible*: baluː-baluktot*, NO CODA decides in favor of a V-final reduplicant (a):

(21) Emergence of NO CODA

/RED, baluktot/	L-ANCHOR	E-ANCHOR	NO CODA	MAX_{BR}
a. ☞balu-baluk[tót]		*	**	ktot
b. baluk-baluk[tót]		*	***!	tot

This example illustrates that EDGE-ANCHOR $_{\text{Head-foot}}$ is needed to explain why copying of the coda only occurs for disyllabic bases. It is also clear that the responsible constraint cannot be a version of STRUCTURE ROLE, which requires that corresponding segments have identical syllabic roles (McCarthy & Prince 1993a, 1994). Even if the constraint were expanded to go beyond merely requiring corresponding segments to have the same structure role to requiring that corresponding syllables have identical internal structure, the correct candidate would not be selected. Such a constraint would predict **baluk-baluktot* instead, unlike E-ANCHOR. This right edge effect by which the right edge of the stem is coped (and the head foot, with which it is co-extensive), is not due to a right edge constraint. By attributing this behavior to EDGE-ANCHOR $_{\text{Head-foot}}$, the implication is clear that right edge copying in a disyllabic stem entails left edge copying; the edges are targeted together as a unit. Also, by constructing the hierarchy where base edge copying implies foot edge copying, we do not predict that IO-CONTIGUITY will be violated in order to satisfy E-ANCHOR in this case: **balut$_{8}$-baluktot$_{8}$*; there is no way to satisfy both with a base so large.

The EDGE-ANCHOR approach is useful, in that it helps derive the implication that right edge copying must be accompanied by another force of the grammar, (in these cases, copying of both edges of the head foot). The constraint is necessarily categorical, assigning one violation for any form that fails to copy *both* edges of this foot. The claim in Nelson (1998), that EDGE-ANCHOR was violated once for each edge that went unanchored, is ultimately rejected, since this formulation allows for the emergence of targeted unstressed right edge copying in situations where violation of left edge copying was compelled. No such cases seem to exist.

Thus, in summary, both edges of the head foot are copied when possible; as we see in Tagalog, this is not always feasible. Left edge copying is preferred over both right edge copying and copying of a non-edge. E-ANCHOR assigns one violation whether one or both edges go unanchored. Due to the relativization of E-ANCHOR to the head foot, the comparison below is only valid for cases where the base is coextensive with the head foot:

(22) Non-edge and right edge copying equally marked

edge copied	L-ANCHOR	E-ANCHOR
a. both edges	✓	✓
b. left edge only	✓	*
c. right edge only	*	*
d. neither edge	*	*

This formulation has the following result: if violation of L-ANCHOR (and thus E-ANCHOR) is compelled (c,d), then some other constraint altogether must determine what is to be copied.

In the next section, I will explore reduplication in Makassarese. The system proposed here allows us to capture how closely this pattern resembles reduplication of the type just explored in Tagalog.

3.4.3 Makassarese

The importance of the reduplication pattern of Makassarese for base-reduplicant relations was pointed out in McCarthy & Prince (1994), citing previous work by Aronoff et al. (1987). The interest of this language for our purposes is the complex set of conditions that govern whether the right edge of the base will be faithfully copied or not; I argue that E-ANCHOR plays a crucial role in this decision.

First, I will list some preliminary details about the language. There are no long vowels or diphthongs; each vowel is then a member of its own syllable. The only permissible word-final codas are ŋ and ʔ; medially, codas must be either nasal (with coda nasals homorganic to the following consonant), ʔ, or the first half of a geminate sonorant. Coda ʔ is realized as gemination of a following voiceless stop. Stress is on the penultimate syllable, however epenthetic vowels are ignored. The minimal word is a foot, with the minimal foot being a disyllabic trochee.

Before discussion of reduplication in this language, the conditions governing word-final epenthesis must be made clear. The points made here are all drawn from McCarthy & Prince (1994); the analysis given here departs from theirs only in matters that concern right edge correspondence and reduplication.

The stringent coda condition outlined above leads to a dilemma in the case of a disallowed stem-final consonant. Epenthesis occurs in order to parse these segments (epenthesized segments are underlined):

(23) Epenthesis in Makassarese (McCarthy & Prince 1994's (40))

/rantas/	rántasaʔ	'dirty'
/teʔter/	téʔtereʔ	'quick'
/jamal/	jámalaʔ	'naughty'

At first glance, epenthesis does not appear to be minimal; rántasaʔ ≻ rántasa, even though both obey the coda condition. Thus, McCarthy and Prince propose that an additional constraint, FINAL-C, must dominate DEP:

(24) {CODA COND, FINAL-C} » DEP

/rantas/	CODA COND	FINAL-C	DEP
a. ☞rántasaʔ			**
b. rántasa		*!	*
c. rántas	*!		

This ranking then will work well for generating the correct output for C-final inputs, however there is another twist as far as V-final inputs are concerned.

With V-final inputs, the parse is faithful, in spite of the FINAL-C violation incurred by the faithful candidate. Thus, one additional constraint is needed to prohibit epenthesis stem-finally. I suggest that EDGE-ANCHOR can accomplish this. In the case of input-output correspondence, no main stressed foot is present in the input for anchoring. This leaves only input-output anchoring where the input (root) anchors to the output (prosodic word).

(25)

/lompo/	CODA-COND	EDGE-ANCHOR-IO	FINAL-C	DEP
a. ☞lom.po|			*	
b. lom.po|ʔ		*!		*

(26) Reduplication in Makassarese (Aronoff et al. 1987, McCarthy & Prince 1994, McCarthy 1999)

a. Reduplication of disyllabic, unsuffixed roots

/batu/	batu-[bátu]	'small stone(s)'	
/golla/	golla-[gólla]	'sweets'	
/tau/	tau-[táu]	'doll'	
/tauŋ/	tauŋ-[táuŋ]	'yearly'	[taun-tauŋ]
/ballaʔ/	ballaʔ-[bállaʔ]	'little house'	
/bulaŋ/	bulaŋ-[búlaŋ]	'monthly'	[bulam-bulaŋ]

b. Disyllabic reduplication of longer roots

/manara/	manaʔ-ma[nára]	'sort of tower'
/balao/	balaʔ-ba[láo]	'toy rat'
/baine/	baiʔ-ba[íne]	'man women'

c. ʔ-final disyllabic reduplication of disyllabic roots with final epenthesis

/ak+beser/	ak-beseʔ-[bése]reʔ	‘quarrel in jest’

d. ʔ-final reduplication of C-final root with stress-determining *-i* (‘transitive’)

/gassiŋ+i/	gassiʔ-ga[ssíŋi]	‘make strong’
cf. /lompo+i/	lompo-lom[pói]	‘make somewhat big’
cf. /gassiŋ#i/	gassiŋ-[gássiŋ]i	‘he is strong’ (stress-neutral *–i* ‘3rd sub’)

The analysis of reduplication with bases larger than two syllables has the same structure as that for bases that exceed a foot in Tagalog: satisfaction of EDGE-ANCHOR is not possible, thus left anchoring occurs, and the effect of anticipated markedness constraint (here, FINAL-C) is allowed to emerge.

(27) Emergence of FINAL-C

/RED, manara/	L-ANCHOR	{ LEFT-ANCHOR, EDGE-ANCHOR$_{Head\text{-}foot}$, EDGE-ANCHOR$_{Base}$}	FINAL-C
a. ☞manaʔ-ma[nára]			
b. mana-ma[nára]			*!

It is only when the satisfaction of EDGE-ANCHOR is an option, as with disyllabic bases, that faithful correspondence of head foot edges to base edges precludes FINAL-C satisfaction.

(28)

/batu, RED/	{ LEFT-ANCHOR, EDGE-ANCHOR$_{Head\text{-}foot}$, EDGE-ANCHOR$_{Base}$}	FINAL-C
a. ☞batu-[batu]		**
b. batuʔ-[batu]	*!	*

The additional candidate *batuʔ-[batuʔ]* is ruled out by EDGE-ANCHOR-IO.

Finally, something must be said of disyllabic roots that are suffixed with an internal, stress-attracting suffix, as in *lompo-lom[pói]* in (26). Why not **lompoʔ-*

lom[pói]? This pattern complicates matters slightly. I tentatively suggest that this outcome can be avoided if we appeal to output-output constraints. If output-output constraints require maximization of all segments from the unsuffixed reduplicated form to the suffixed one, both C-final and V-final forms receive an explanation.

(29) a. DEP-OO$_{\text{Reduplicated}}$: Every segment in the suffixed reduplicated form has a correspondent in any reduplicated form that is not suffixed.

b. STROLE: A segment in RED and its correspondent in the base must have identical syllabic roles (McCarthy & Prince 1993a, 1994).

c. IDENT(nasal): Corresponding segments must agree in nasality.

This is illustrated below, where for *gassiŋ*, the assumption is that *ŋ* is in correspondence with the glottal stop (rather than inserted, as in McCarthy & Prince 1994). MAX-IO will compel violations of DEP-OO caused by parsing of the suffix; these violations have been left out of the tableau below.

(30) C-final suffixed root

/RED,gassiŋ-i/ [gassiŋ$_6$-gassiŋ$_6$]$_{\text{Reduplicated}}$	DEP-OO$_{\text{Reduplicated}}$	FINAL-C	STROLE	IDENT(nasal)
a. ☞gassiʔ$_6$-gassiŋ$_6$i				*
b. gassi-gassiŋi		*!		
c. gassiʔ-gassíŋ$_6$i	*!			
d. gassiŋ$_6$-gassí.ŋ$_6$i			*!	

(31) V-final, suffixed root

/RED,lompo-i/ [lompo$_6$-lompo$_6$]$_{\text{Reduplicated}}$	DEP-OO$_{\text{Reduplicated}}$	FINAL-C	STROLE	IDENT(nasal)
a. ☞lompo$_6$- lompo$_6$i		*		
b. lompoʔ-lompoi	*!			

The addition of the output-output faithfulness constraint will enhance paradigm uniformity. A system like that of Makassarese is predicted that *does* allow for emergence of FINAL-C when stress is drawn away from the foot that earlier encompassed the root. In Makassarese however, once the main stressed foot and the root have served coextensively as the base for reduplication, addition of an epenthetic consonant to the reduplicant is not possible, no matter how the surface environment is altered upon further derivation.

3.5 Edge anchoring alternating with no anchoring

In several examples reported in the literature, the availability of reduplication is conditioned by the size of the base. If the base is disyllabic, then reduplication may occur. If the base is larger, however, the meaning imparted by reduplication in the disyllabic forms is conveyed by a fixed segment affix or other periphrastic means. Examples follow:

(32) Kinande noun reduplication (Mutaka & Hyman 1990)[8]

ku-gulu	ku-[gulu]-<u>gulu</u>	‘sheep/real sheep’
mú-twe	[mú-twe]-<u>mú-twe</u>	'real head'
m-bulí	[m-bulí]-<u>m-buli</u>	'sheep/real sheep'
gotseri	No Reduplication	'sleepiness/real sleepiness'
	*got[seri]-<u>seri</u>.	(see fn. 4 for periphrastic expression)
nyurúgúnzù	No Reduplication	'butterflies/real butterflies'
	*nyurú[gúnzù]-<u>gúnzù</u>	

[8] I am setting aside the issue of monosyllabic stems. In this case, the output is trisyllabic, e.g. *swa* → *swa-swaswa.* My suspicion is that the base augments via copying to fulfill the disyllabic requirement, reduplicates, and then deletes a syllable by haplology.

(33) Yoruba agentive reduplication (Pulleyblank 2000)

wolé	wolé-[wolé]	'look at the house/sanitary inspector'
lámi	lámi-[lámi]	'lick water/type of water insect'
yínrùn	yínrùn-[yínrùn]	'twist neck/meningitis'
náwó	náwó-[náwó]	'spend money/extravagant person'
fɛ́nilɔ́mɔ	a-fɛ́nilɔ́mɔ	'marry someone's child/someone who takes people's daughters and marries them'
ʃèbàjɛ́	a-ʃèbàjɛ́	'do evil/evil-doer'
yániláʃɔ	a-yánilá∫ɔ	'lend someone cloth; cloth-lender'

In order to explain the restriction in Yoruba, Mutaka and Hyman propose that a "Morpheme Integrity Constraint" requires copying of the entire morpheme:

> Mapping of a melody to a reduplicative template takes place by *morpheme*. If the whole of a morpheme cannot be successfully mapped into the bisyllabic reduplicative template, then none of the morpheme may be mapped. (Mutaka and Hyman 1990, p. 83)

This result can be captured here without the stipulation of an independent restriction on the grammar. I assume that the now familiar ANCHOR constraints each dominate a 'Realize Morpheme' constraint (Samek-Lodovici 1992), 'REALIZE ('real X')'. This constraint, when undominated, will allow for the realization of the meaning intended for an input reduplicative morpheme to be expressed rather through periphrasis in cases where a dominating constraint would thus be better-satisfied (here, EDGE-ANCHOR). Assuming base maximization, as discussed in chapter 2, then the base on which L-ANCHOR is assessed in the following example is {-gotseri}.[9] An additional constraint

[9] In Kinande, Yoruba, and Tagalog, two distinct anchoring constraints agree on winners in the case of a disyllabic base, and then diverge. In Coeur d'Alene truncation (Doak 1990, McCarthy p.c.), which is apparently similar to contraction in English, deletes every segment after the stressed vowel. Stress is lexical; the resulting form can be of varying length:

Full form	Truncated form	
$tk^w ar^w$aréqɛʔst	$tk^w ar^w$arɛ́	'orange (fruit)'
st'm'áltmʃ	st'm'á	'buffalo'

against periphrasis must be assumed; here, I crudely employ *PERIPHRASIS for this purpose.

(34)

/-gotseri, RED$_{\text{'real X'}}$/	{ LEFT-ANCHOR, EDGE-ANCHOR$_{\text{Head-foot}}$, EDGE-ANCHOR$_{\text{Base}}$}	RLZ ('real X')	* PERIPHRASIS
a. -gotseri		*!	
b. ☞ *nyilwé nyíkwire ehigotseri ehyekwenene lero*[10]			*
c. -<u>gotseri</u>-got[seri]	*!		
d. -<u>gotse</u>-got[seri]	*!		
e. -got[seri]-<u>seri</u>	*!		
f. -got-<u>seri</u>-[seri]	*!		

Similarly, in the case of Yoruba, the ranking only allows reduplication to occur when both edge and left anchoring will be satisfied.[11]

(35) Affixation in lieu of reduplication

/fɛ́nilɔ́mɔ, RED$_{\text{agentive}}$/	E-ANCHOR	RLZ(agentive)	*PERIPHRASIS
a. ☞a-fɛ́ni[lɔ́mɔ]			*
a. fɛ́ni[lɔ́mɔ]		*!	
b. <u>fɛ́nilɔ́mɔ</u>-fɛ́ni[lɔ́mɔ]	*!		
c. <u>fɛ́ni</u>-fɛ́ni[lɔ́mɔ]	*!		
d. fɛ́ni[lɔ́mɔ]-<u>lɔ́mɔ</u>	*!		
e. fɛ́ni-<u>lɔ́mɔ</u>-lɔ́mɔ	*!		

hnq'wəq'wosm'ítʃnʃn hnq'wəq'wosm'í 'dog'

This is another case of two separate base-truncatum anchoring constraints (here, MAX-ɾ́-BT, L-ANCHOR-BT), actively determine the output.

[10] Philip Mutaka (p.c.) clearly states that not all speakers will converge on this means of expressing the notion 'real sleepiness'. The important point however is that the notion of 'real sleepiness' is not ineffable in the language.

[11] A similar result can be found in Ancient Greek perfect reduplication (Steriade 1982, Suzuki 1984). In this case, it is onset sonority rather than base size that dictates the threshold of what constitutes an acceptable base. When the onset of the base is neither a single C not a voiceless stop + sonorant cluster, *e*-epenthesis rather than initial consonant reduplication results: *sper, e-sparmai 'to sow'* (cf. *pneu, pe-pneuka 'to breathe'; krag, ke-kraga 'to cry'*, etc.).

Here again, an alternative to reduplication is found when EDGE-ANCHOR cannot be satisfied.

3.6 Exploring the formulation of EDGE-ANCHOR

This section discusses the formulation of the proposed constraint. The foot-based version will be justified in comparison to a morpheme-based one used in Nelson (1998b), and also a modification of that version. In entertaining the earlier and intermediate formulations of EDGE-ANCHOR, I intend to address the problems inherent in these alternatives, and to thus explain why the version I have utilized in the above discussion is preferred. In presenting the constraints, I examine the different targets that are predicted, as well as the different effects that the constraints can have.

As mentioned upon the introduction of the constraint at the beginning of the chapter, EDGE-ANCHOR is formulated in a categorical fashion. That is, if a candidate fails to copy from both sides of the foot or base, then the candidate receives a violation mark for the appropriate EDGE-ANCHOR constraint. Under this approach, it is of no relevance to the constraint if the candidate copies material from one or neither edge; once edge-anchoring has failed to be fully satisfied, the constraint is violated. Crucial to the decision of what the constraint should ultimately distinguish is the validity of the prominence classes predicted to be distinct. For example, a symmetric system with no edge-anchoring constraint, but rather independent left- and right-anchoring constraints predicts three classes.

(36) Non-edge copying is most marked

edge copied:	L-ANCHOR	R-ANCHOR
a. both edges	✓	✓
b. left edge only	✓	*
c. right edge only	*	✓
d. neither edge	*	*

The following three distinction classes are predicted in that theory:

(37) *most prominent* ──► *least prominent*
both edges > {left edge, right edge} > non-edge

The indeterminacy in the middle of the scale is due to the free re-ranking assumed to be available to constraints in an OT grammar. Even if we revise this to further claim that the ranking is fixed between L-ANCHOR and R-ANCHOR such that L-ANCHOR » R-ANCHOR, there is still the problem of over-classification:

(38) both edges > left edge> right edge > non-edge

The problem resides at the least-prominent end of the scale. These constraints predict both a distinction between right edge and non-edge, and furthermore that the right edge is privileged over internal material. Given the lack of support typologically for such a partitioning of the two alleged categories, I maintain that it is better to allow the two to be conflated, as in the proposed theory, until evidence dictates the need for separate categories.

Moreover, any theory with independent LEFT- and RIGHT-ANCHOR constraints makes a variety of predictions that are unattested. Below, I summarize these predictions. First, a symmetric anchoring theory predicts that copying of edges can be compelled when the base is of any length. If both anchoring constraints dominate CONTIGUITY-BR, (as is argued to be the case in Semai in Hendricks 1998, e.g.), then a base of any length could potentially be thus contracted, as in hypothetical *metgodupik*$_{10}$ → *mek*$_{10}$-*metgodupik*$_{10}$. Assuming a monosyllabic reduplicant, then the following tableau illustrates the problematic prediction.

(39)

/RED, metgodupik/	ANCHOR-LEFT (Base, RED)	ANCHOR-RIGHT (Base, RED)	CONTIGUITY-BR
a. ☞mek$_{10}$-metgodupik$_{10}$			*
b. met-metgodupik		*!	
c. metgodupik-pik	*!		

This pattern of dramatic edge-selection is unattested as far as I know, and I presume and predict it to be ruled out universally. This proposal aims to eradicate the pattern by relativizing EDGE-ANCHOR minimally to main stressed foot edges only.

Another prediction is that unstressed right edge copying could still be compelled. All that is needed is a constraint **C** that would force violation of L-ANCHOR. Then right-anchoring would be free to exert its effects under the ranking: **C** » L- ANCHOR » R-ANCHOR. We can create such a pattern by considering hypocoristic formation in hypothetical French′. In order to remove any possible alternative that appeals to stress, let us assume this language has initial stress.

(40) Hypocoristics in French′

C-initial names		*V-initial names*	
Cároline	Caro	Élizabeth	Zabet
Dóminique	Domi	Álexandra	Sandra
Béatrice	Bea	Ámelie	Melie

In this case, if ONSET is the constraint dominating LEFT-ANCHOR, which in turn dominates RIGHT-ANCHOR, then we predict that an unstressed right edge anchoring system can be compelled. Again, given no cases typologically to support the singling out of an unstressed right edge, I take the failure of the proposed theory to generate a system like the one described above to be an asset.[12]

In earlier work (Nelson 1998), I formulated E-ANCHOR as follows, sensitive to degrees of satisfaction of the constraint:

(41) *Multiple-violation, morpheme-based version*

EDGE-ANCHOR$_{BR}$: Each segment at an edge of the base corresponds to the segment standing at the same edge in the reduplicant. One violation is given to each edge of the base to which the reduplicant fails to anchor.

However, this formulation leads to the prediction of the same problem with respect to distinction classes, as shown below.

(42) Non-edge copying most marked

edge copied:	L-ANCHOR	E-ANCHOR
a. both edges	✓	✓
b. left edge only	✓	*
c. right edge only	*	*
d. neither edge	*	**

Four distinction classes are predicted in that theory:

(43) both edges > left edge > right edge > non-edge

[12] In the future, I plan to investigate this prediction experimentally; the experiment would test the hypothesis that a language that truncates to unstressed right edges is more difficult to learn than a system that truncates to unstressed left edges. If correct, this result would obviously provide further evidence for the proposed asymmetry in the grammar.

The result is then that in the default case, unstressed right edge copying implies left edge copying. Otherwise, right edge copying must be due to stress.[13]

This formulation has advantages over the previous situation: in contrast with a system in which the symmetric constraints are freely rankable, there is no danger of predicting the unattested ranking with an unstressed right edge syllable being expressly targeted for copying in the default pattern. Furthermore, there is no need to posit a fixed ranking in order to derive the preference for left over right edge copying.

A serious problem remains however. In the edge-anchoring system in which the constraint is sensitive to degrees of violation, the unfounded prediction is still made that that the right edge is actually preferred over a non-edge with respect to copying of unstressed material. In addition, the prediction that the right edge can still be targeted *upon compelled violation* of left anchoring (regardless of stress) still remains. These residual RIGHT-ANCHOR effects arise because R-ANCHOR is still a part of the EDGE-ANCHOR constraint; partial satisfaction by right edge copying receives one fewer violation than copying no edges, which opens the door to possible optimality.

Thus, the constraint is revised to neutralize the distinction between internal and right edge material:

(44) *Categorical, morpheme-based version*

> EDGE-ANCHOR$_{BR}$: Each segment at an edge of the base corresponds to the segment standing at the same edge in the reduplicant. *One violation is given if the reduplicant fails to anchor to both edges.*

---

[13] It is entirely possible that some constraint other than stress could cause the right edge to be copied. One possible example would be in a language where final unstressed vowels are long (Zhang 2001, Barnes 2001). Potentially such a language could target final long vowels, which would be prominent by virtue of their length, not their position. It is also conceivable that tone distinctions could determine the locus of anchoring via prominence of a final H tone; however, I have not yet encountered such a case. See Chapter 1 for some speculation of what types of elements seem to be subject to right edge reference and which are not.

This system then makes a three-way distinction in terms of preferred targets for copying:

(45) both edges > left edge > {right edge, non-edge}

Both edges are copied when possible; left edge copying is preferred over both right edge copying and copying of a non-edge. E-ANCHOR assigns one violation whether one or both edges go unanchored.

(46) Non-edge and right edge copying equally marked

edge copied:	L-ANCHOR	E-ANCHOR
a. both edges	✓	✓
b. left edge only	✓	*
c. right edge only	*	*
d. neither edge	*	*

This leads to the new result that if violation of L-ANCHOR (and thus E-ANCHOR) is compelled, then some other constraint altogether must decide between right edge and internal copying.

3.7 Other edge-relativized constraints in the literature

At least two examples of constraints that target both edges can be found in the literature. Bickmore (1999:128) proposes the following constraint, which aligns an edge of an output High Tone Span (HTS) with an edge of the stem:

(47) ALIGN (H,E,S,E): Align an edge E of an output HTS with the edge E of the stem.

The constraint however does not target both edges simultaneously; it is satisfied when a HTS is aligned to either edge of the stem. Thus, the example candidates below both

```
                                                          H
                                                          |
```
satisfy the constraint in (47) for input /to-timok-er-a/, tòtímókérá 'we rest':

```
(48)   a. to-(timok-er-a)Stem                 b. to-(timok-er-a)Stem
                \  |  /                                  \ /
                   H                                      H
```

Any candidate that contains a HTS within the stem in which neither edge of that stem aligns with a stem edge will violate the constraint.

Another constraint that appeals to edges is proposed by Gordon (2002:498). His constraint, which aligns secondary stress, targets both edges of the output simultaneously (paraphrased):

(49) COINCIDE EDGE (PrWd, σ̀): The edges of a Prosodic Word must coincide with the edges of secondary stress syllables.

In order to be perfectly satisfied, candidates must have secondary stressed syllables standing at both edges of the prosodic word. Violation marks are assigned for each edge to which no secondary stress syllable is aligned.

3.8 Residual issues

To a certain extent, the foot-relativized EDGE-ANCHOR constraint writes the requirement that the reduplicant be a foot into the constraint itself. This is a liability of the proposal, since reduplicant size restrictions are typically taken to emerge by the Emergence of the Unmarked (McCarthy & Prince 1994, 1995), in order to avoid the typological possibility of back-copying a size restriction. However, the requirement is not as strong as the templatic constraint "RED=σσ", as if contraction is compelled, as seen for Semai and Ulu Muar Malay, then the constraint can still be perfectly satisfied, as long as the edges of the main stressed foot in the base are copied.

Given the claim that anchoring targets privileged positions, then "head foot edges" would be a novel category. With the minor exception of "inherent reduplication" examples though, all other reduplicated words exist along with a non-reduplicated, prosodified word. The head foot edges may represent the essential structure of the head foot, in a way that is admittedly not yet completely understood.

A final issue to consider is: what repercussions does EDGE-ANCHOR have for our understanding of locality? Strictly speaking, if locality requires that a segment that is copied over must itself be copied, then structures such as *kʔ-[kɨːʔ], dan-[dayáŋ]*, must violate this. However, there is also a sense in which they could not be more local; there is no other position in which locality, in the sense above, would be better-satisfied.

3.9 Conclusion

In conclusion, I offer a summary of the cases and effects observed in this chapter.

(50) Cases and effects

Case	*Effect*	*Ranking*
Semai, Ulu Muar Malay	Base-contraction in reduplicant	EDGE-ANCHOR >> BR-CONTIGUITY
Dutch	Base-contraction in truncated form	EDGE-ANCHOR >> BT-CONTIGUITY
Yidiɲ	Edges of main stressed foot correspond to edges of RED	BR-CONTIGUITY, EDGE-ANCHOR >> NO CODA
Tagalog	Edges of main stressed foot only copied if correspond to stem edges	LEFT-ANCHOR, EDGE-ANCHOR >> NO CODA
Makassarese	Epenthesis RED-finally only if stem is C-final	EDGE-ANCHOR-IO, EDGE-ANCHOR-BR >> FINAL C
Yoruba, Kinande	Reduplication only if base = foot; otherwise, periphrasis	EDGE-ANCHOR, MORPH-REAL >> *PERIPHRASIS

Given the implication of the copying of the right edge of the base always occurring when it was also the right edge of the main stressed foot, I have claimed that the two proposed EDGE-ANCHOR constraints are a part of an inclusion hierarchy, beginning with LEFT-ANCHOR:

(51) EDGE-ANCHOR inclusion hierarchy

LEFT-ANCHOR
{ LEFT-ANCHOR, EDGE-ANCHOR$_{\text{Head-foot}}$}
{ LEFT-ANCHOR, EDGE-ANCHOR$_{\text{Head-foot}}$, EDGE-ANCHOR$_{\text{Base}}$}

In this chapter, we saw illustrations of the various predictions made by these constraints. The proposed system captures numerous right edge effects that were previously treated with specifically right edge correspondence constraints. I argued here that, consistent with the Positional Anchoring approach, the right edge cannot, and need not, be singled out by faithfulness constraints. EDGE-ANCHOR constraints, which are evaluated categorically, account for the implication that the right edge of a main stressed foot may only be targeted in case the left edge of the foot is targeted along with it.