hence [-anterior] vowels and light diphthongs. If palatalization is considered as a rule of feature spreading then [e] like the other vowels must be specified for the spreading feature.

The various hiatus resolution strategies in Nupe discussed in the preceding sections also provide a means of assessing the possibility of [e] as an underspecified vowel. If for instance glide formation is regarded as a rule that turns vowels to corresponding glides before featurally distinct vowels, then vowels should differ with respect to their triggering glide formation. But this is not the case as all vowels in $V_2$ position trigger glide formation of a preceding nonlow vowel. Thus when [e] is the second vowel, the preceding featurally distinct vowel turns into a corresponding glide. In addition [e] also turns into a corresponding palatal glide in the same context, indication that there may be nothing special about it.

In the case of assimilation where the vowel [a], lacking a corresponding glide, assimilates the features of the following vowel in hiatal configurations, the features of [e] are also assimilated. Were [e] to lack underlyingly specified features the reverse should be the case, that is [e] assimilating the features of [a].

As for the elision of [e] in hiatal configurations it has been argued that this is due to the fact that it is a nominal prefix. In similar contexts that it is not regarded as a prefix, it is retained. Considering rule triggering and targeting, there is no reason to regard Nupe [e] as an underspecified vowel. But does the fact that it begins nouns in the language mark it as underspecified?

In arguing for [e] as the underspecified vowel in Gengbe, Abaglo and Archangeli (1989) use its occurrence in nouns as evidence. In Gengbe two types of nouns are

attested: vowel- and consonant-initial nouns. This is the same pattern that is observed in Nupe. Of the vowel-initial nouns in Gengbe, some begin with [è] while others begin with [à]. If the initial vowels are eliminated, nouns will be either monosyllabic or polysyllabic. The monosyllabic forms must be preceded by a vowel in isolation while polysyllabic forms need not be, and if they are, the vowel is [à] and never [è]. The surface absence of monosyllabic nouns and the presence of *e*-initial disyllabic nouns are attributed to the fact that nouns must be disyllabic on the surface (cf. McCarthy and Prince 1986 *et seq.* on prosodic minimality). For this reason an underlying monosyllabic noun must have a syllable added. This syllable is added initially in Gengbe and is assigned the features of [è]. That it is not assigned the features of any other vowel is indication that [e] lacks any features in the underlying representation. In hiatal configurations elision targets [e] whether it is $V_1$ or $V_2$. In view of this behavior of [e] Abaglo and Archangeli conclude that it is underspecified in Gengbe. The observed characteristics of nouns in Gengbe bear a striking resemblance to those of Nupe nouns.

Nupe, like Gengbe, distinguishes vowel- and consonant-initial nouns. The vowel in such nouns is always [e]. There are few native vocabulary items that actually begin with [a]. The list of *a*-initial words in (72) is repeated in (123).

(123) *'a'-initial words*

| | | | |
|---|---|---|---|
| aní | 'already' | àdíko | 'kind of bag' |
| árata | 'fifty' | àkpárà | 'European rifle' |
| ádwáni | 'seventy' | àdàmagi | 'flint lock-gun' |

Of the words in (123) the first that seems to have a CV stem is not a noun, while the others which may be nouns or adjectives do not have a CV stem. There are no comparable nouns of the form *a*-CV.

It is plausible, as argued for by Abaglo and Archangeli for Gengbe, that vowel-initial nouns in Nupe are underlyingly CV, and that the minimality requirement that nouns be disyllabic adds an initial syllable. The features of [e] fill this syllable. This can only be the case if the vowel is underspecified. Crucial to this argument is that there be no monomorphemic disyllabic nouns beginning with [e]. This seems to be borne out to a certain extent in Nupe. In the examples in (116) the forms for 'dog' [eʃigi] and 'goat' [enangi] are actually polymorphemic. In each case there is a CV noun stem followed by the diminutive suffix 'gi'. The attachment of the suffix to the noun stem results in a disyllabic form, and thus makes the surface presence of the prefix unnecessary. The form for 'dog' can actually be [eʃi] or [ʃigi], either satisfying the prosodic requirement, since each is disyllabic. Though this lends support to the CV noun stem claim, it predicts that in the forms for 'person' [ezà] and 'thing' [eŋã] *e*-elision should not be possible since the resulting forms cease to be disyllabic in violation of prosodic minimality. This notwithstanding, the presence of the nominal prefix makes it possible for nouns to be disyllabic but the fact that the prefix is [e] does not necessarily indicate that it is underspecified. The fact that in other contexts [e] behaves like every other vowel that is considered fully specified suggests that its occurrence as the initial vowel in nouns does not mean that it lacks any specification in its underlying representation.

The analysis of [e] as underspecified and therefore the appropriate candidate to fill empty vocalic slots has one implication that is not explored in Abaglo and

Archangeli's analysis of Gengbe [e] but which is used by Pulleyblank to justify the underspecification analysis of Yoruba [i]. In loanwords from English with complex onsets or codas the unsyllabifiable consonant is provided a rime, and this is filled by [i], which may be contextually [u]. The analysis of Gengbe [e] then means that in similar situations [e] should be the epenthetic vowel in the language. Since there is no indication to this effect in Abaglo and Archangeli's analysis of Gengbe, the Nupe [e] can be used to test this prediction. The prediction that [e] should be the epenthetic vowel is not borne out in Nupe. It was pointed out in an earlier discussion (chapter 2, section 6.2) that syllables with codas in loanwords from Hausa may be simplified by epenthesizing [i]. In the discussion to follow it will further be revealed that [i], with some contextual variation, and not [e] is the epenthetic vowel in Nupe.

The foregoing discussion was aimed at determining whether *e*-elision can be attributed to the vowel lacking any featural specification in its underlying representation. Its behavior has however been shown not to be compatible with its lacking underlying features. Its susceptibility to elision in the appropriate context is therefore a factor of its being a nominal prefix. Other vowels in the same context are retained because they do not function as affixes, and when the initial *e* in an *e*-CV form cannot be plausibly analyzed as a nominal prefix, it is not elided. Though the theoretical framework used in this dissertation is Optimality Theory, a theory that promotes richness of the base, and may appear not to entertain underspecified inputs, it is not out of place to see if underspecification theory gives an insight into the patterns of the behavior of segments in general, and of [e] in particular in Nupe. This is more so that underspecification has been

demonstrated not to be incompatible with OT (Inkelas 1994, and Itô, Mester, and Padgett 1993, 1995).

The instances of hiatus resolution so far examined involved hiatal contexts arising from syntactic concatenation. But as noted earlier hiatus is not restricted to syntactic boundaries. Morpheme-internal hiatus is attested. This is however not always very obvious. In discussing the Nupe examples with identical vowel sequences (cf. 83) I claimed that the fact that the language does not have phonological heavy syllables leads to an analysis of the apparently long vowels as being tautosyllabified input vowel sequences. Since these vowels are identical there is no other evidence for this claim than that the language does not contrast short and long vowels. Instances of word-internal hiatus can however be evidenced by forms for which underlying heterosyllabic vowel sequences can be posited and which surface with some form of hiatus resolution. Casali (1997) points out the need to investigate morpheme-internal hiatus and identifies a context in which this can arise. The context is one in which an intervening consonant is lost. Such a context arises in the modification of Classical Arabic loanwords in Nupe. I examine the hiatus resolution strategy used in such a context in the next section.

## 7. Word-Internal Hiatus Resolution

Word-internal hiatus is created in the modification of loanwords from Classical Arabic. This arises from deleting a consonant that marks the boundary of two syllables. The deleted consonant is one that is not in the inventory of Nupe and is otherwise not replaced by a Nupe approximate. The deletion of this intervening consonant, usually the glottal stop (ʔ) and pharyngeal fricative (ʕ), results in a heterosyllabic vowel sequence. The Nupe output of such forms consists of a glide homorganic with a high vowel in the hiatal

configuration. Assuming consonant-deletion as a descriptive intermediate stage in the adaptation of such forms, the Nupe outputs are arrived at as indicated in (124).

(124) *Word-internal hiatus resolution in loanwords from Classical Arabic*

| Classical Arabic | | (Consonant deletion) | | Nupe | Gloss |
|---|---|---|---|---|---|
| ʃariiʕa | → | ʃarii_a | → | ʃàríja | 'law, judgement' |
| faaʔida | → | faa_ida | → | fájída | 'utility, benefit' |
| naaʔib | → | naa_ib | → | nájibi | 'deputy imam' |
| malaaʔika | → | malaa_ika | | màlájíka | 'angel' |
| ad-duʕaaʔ | → | ad-du_aa | → | àdúwa | 'supplication' |

It is obvious from (124) that the hiatus resolution strategy used in the loanwords is neither glide formation, assimilation, nor elision as in the data examined up to this point. The difference between the two sets of the data is that the data in the previous sections involve native vocabulary items while the present data involve loanwords. Recall the discussion in chapter two with respect to convergence and divergence between the native and loan strata. It was claimed that the two strata might converge with respect to some phenomenon, while they might diverge with respect to some others depending on the relative ranking of the relevant loan faithfulness constraint within the hierarchy established to account for the relevant phenomenon of the target language. The data in (124) show convergence as well as divergence between the native and loan strata. Convergence is with respect to hiatus to the effect it is not tolerated in either stratum, however it is created. There is however divergence in the hiatus resolution strategy. Convergence is assured by the high-ranking NOHIATUS constraint.

The hiatus resolution strategies used in the native stratum, especially glide formation and assimilation, do not suffice to account for the loanwords. Since these strategies involve changes in identity to the input vowels, it is plausible that faithfulness to the loan input vowels prevents any of these strategies from being used. In this regard a relevant loan faithfulness constraint that requires vowels of the loan inputs to be identical in the loan output can be formulated as in (125). Since the affected features may be [vocalic] as in glide formation or [low] as in glide formation, I collapse these into V for vowel features.

(125) IDENT-SOURCE-V

Input loan vowels are identical in the loan output.

The next aspect that needs to be explained is the appearance of the glide. As I show later in section 8, languages may resolve hiatus by epenthesis. The issue here is whether to regard the glides as epenthetic or not. The appearance of glides in filling empty consonant positions is described as glide epenthesis in the literature (cf. Beckman 1998 citing Wiltshire 1994 on Tamil, Casali 1996 citing Mtenje 1980, and McCarthy & Prince 1993a on Malay/Indonesian). On the view that the glides in such situations are epenthetic the structures in which they occur incur DEP violations. This does not however account for their homorganicity with a vowel in the relevant context.

McCarthy & Prince (1993a), discussing Malay/Indonesian hiatus resolution(cf. chapter 1, section 4.1), observe that the glide in such instances can be regarded as the ambisyllabic parsing of the high vowel as the nucleus of one syllable and onset of the next. This observation suggests that the glide is not from outside the input. In this respect the occurrence of the glide cannot be regarded as a violation of DEP. As demonstrated in

the earlier discussion of the Indonesian data and simplification of codas in loanwords from Classical Arabic (chapter 2, section 4.2), the choice is between epenthesizing an unmarked vowel or copying a vowel of the adjacent syllable. The latter choice results in multiple output correspondents of the input vowel, a violation of INTEGRITY. The choice is a consequence of the ranking DEP » INTEGRITY. By analogy the homorganic glide can be plausibly regarded as a copy of the vowel and its insertion rather than that of an unmarked consonant follows from the same ranking. The difference in identity between the vowel and its glide copy is a factor of its syllabic function as onset (only consonantal segments may occur at syllable margins (cf. Prince & Smolensky 1993). The ranking DEP » INTEGRITY is included in the hierarchy required to account for the hiatus resolution pattern in loanwords from Classical Arabic.

The challenge then is to distinguish DEP violations from INTEGRITY violations. There is no easy way to do this as both are referred to as "epenthesis" in the literature. A possible way of encoding this distinction is to employ the fact that both phenomena involve filling some empty syllabic position, whatever the motivation for positing such a slot. On this view both phenomena can be described as "insertion". A typology of insertion strategies can then be motivated with DEP violations described as "epenthesis", and INTEGRTIY violations described as "copying". As notational devices epenthetic segments are underlined while copied segments are in boldface. This what I have done in the discussion of hiatus resolution in Indonesian, the syllabic simplification of loanwords in Classical Arabic, and improving onsetless high tone syllables in Yoruba in the native stratum as well as similar structure arising from adaptation of English loanwords. I further demonstrate the utility of this typology in section 10. But for the case at hand,

hiatus in loanwords from Classical Arabic is resolved by copying in the same way that syllabic simplification is. To complete the analysis and thus establish the hierarchy needed to account for the data in (124) a constraint against the deleted consonants is required. For ease of exposition I formulate the constraint as *ʔ/*ʕ. The hierarchy in (126) accounts for the use of insertion, rather than glide formation or assimilation, as hiatus resolution strategy in Classical Arabic loanwords, and the preference for copying over epenthesis. The ranking is illustrated in the tableau in (127).

(126) *Ranking for insertion as hiatus resolution strategy in loanwords from Classical Arabic*

NOHIATUS, *ʔ/*ʕ*, *COMPLEX-NUC, IDENT-SOURCE-V, DEP » INTEGRITY

(127) *Tableau for copying as optimal analysis of hiatus resolution in loanwords from Classical Arabic*

| Input: naaʔib | NOHIATUS | *ʔ/*ʕ | *COMPLEX-NUC | IDENT-S-V | DEP | INTEG |
|---|---|---|---|---|---|---|
| a. ná.ʔì.bi | | *! | | | | * |
| b. ná.ì.bi | *! | | | | | * |
| c. náì.bi | | | *! | | | * |
| d. náj.bi | | | | *! | | * |
| e. naa.bi | | | | *! | | * |
| f. ná.hì.bi | | | | | *! | * |
| g. ☞ ná.jì.bi | | | | | | * * |

In (127) candidates with other modifications of the loan input that do not bear on the analysis are omitted. Candidate (a) with the glottal stop retained in the output incurs a fatal violation of *ʔ/*ʕ. It satisfies all other constraints. The one violation of INTEGRITY as with all other candidates is due to the copied vowel to simplify the coda. Candidate (b) avoids a violation of *ʔ/*ʕ by deleting the glottal stop. This however creates hiatus resulting in a fatal violation of NOHIATUS. Candidate (c) resolves hiatus by tautosyllabifying the vowels. This results in two vowels linked to a single syllable

nucleus in violation of *COMPLEX-NUC. Candidate (d) avoids this violation by turning the vowel into a corresponding glide. This however results in a difference in identity between the input vowel and its correspondent in the output, a fatal violation of IDENT-SOURCE-V. This is similar to what obtains in the native stratum to avoid complex nuclei. In candidate (e) one of the vowels assimilates the features of the other. This also results in a differenoe in identity between the input and output vowels. Notice that the assimilating candidate would otherwise satisfy the special constraint on complex nuclei to the effect that the vowels should not have distinct features. Candidates (d) and (e) would have been optimal were the loanwords to conform to the pattern of the native stratum. That they are not optimal is a factor of the high ranking loan faithfulness constraint. Candidate (f) satisfies the loan faithfulness constraint and the constraint against hiatus. It does so by inserting an epenthetic consonant. This however results in a fatal violation of the anti-epenthesis constraint DEP as the consonant lacks a correspondent in the input. The optimal candidate (g) like candidate (f) heterosyllabifies the vowels, resolves hiatus, and satisfies the loan faithfulness constraint. It however does so by inserting a copied vowel turned glide. By so doing it avoids a violation of the anti-epenthesis constraint DEP, but incurs an additional violation of the anti-copying constraint, INTEGRITY. Given the low ranking of this constraint, the violation does not have any fatal consequence. It otherwise satisfies all other constraints. The difference in the choice of hiatus resolution strategy in Classical Arabic loanwords is thus a factor of faithfulness to the source language.

The discussion of hiatus resolution in Nupe has focused on the three different strategies used in the language—glide formation, assimilation, and elision—for this

purpose. The intralinguistic typological variation engendered by these different strategies is accounted for by motivating special constraints which when ranked accordingly resolve the ranking paradoxes that might otherwise result from reranking the constraints militating against each strategy as advocated in other approaches to hiatus resolution. An adequate account of hiatus resolution in Nupe was achieved by integrating universal tendencies with language-particular idiosyncrasies. This approach suffices to account for the presence of multiple hiatus resolution strategies in natural languages. It is however possible to abstract away from language-particular idiosyncrasies and set up a typology of hiatus resolution strategies using the constraints that have featured in the discussion of the hiatus phenomenon in the preceding sections.

## 8. Typology of Hiatus Resolution Strategies

The typology of hiatus resolution strategies that I argue for appeals to the markedness constraint against heterosyllabic vowel sequences (NOHIATUS) and that against complex nuclei (*COMPLEX-NUC), and faithfulness correspondence constraints that monitor input-output mappings (MAX, DEP, IDENT, INTEGRITY, UNIFORMITY). In this respect grammars can be typified with respect to the relation between these constraints with each grammar offering possible hiatus resolution strategies. The choices made by particular languages depend on these universal tendencies and the peculiarities of the language.

Grammars fall into two types with respect to the hiatus phenomenon. The two types are hiatus-permitting grammars and hiatus-prohibiting grammars. This broad typology is a consequence of the relation between the constraint against hiatus and that against complex nuclei. The typology with the ranking of each grammar type is given in (128).

(128) *Typology of hiatus grammars*

a. *Ranking for hiatus-permitting grammars*

*COMPLEX-NUC » NOHIATUS

b. *Ranking for hiatus-prohibiting grammars*

NOHIATUS » *COMPLEX-NUC

Hiatus-permitting grammars are those that have been identified in Casali's works, though incorrectly, as using heterosyllabification as hiatus resolution strategy. This is on the assumption that hiatus resolution is onset-driven, and the violated constraint is ONSET. But in the articulatory approach developed here, languages that do not resolve hiatus in any way are regarded as permitting hiatus. The languages cited by Casali as using heterosyllabification, and can be regarded as tolerating hiatus are English and Modern Greek (cf. Kaisse 1977). The English dialects that fall into this class will exclude linking-*r* dialects (cf. McCarthy 1993). All other languages that use one hiatus resolution strategy or another fall into the class of hiatus-prohibiting grammars in which the ranking (128b) necessarily holds. This ranking interacts with appropriate correspondence constraints to determine the choice of particular strategies.

The question however arises as to whether heterosyllabification is a possible hiatus resolution strategy. It can be entertained as a strategy only if a language prohibits hiatus and thus uses some resolution strategy. If however in a certain context the strategy is blocked from applying, hiatus, and the attendant heterosyllabification, is tolerated. This is what happens in the case of prosodic words in hiatus in Nupe. The need for prosodic words to align with the edge of a syllable forces heterosyllabification. The constraint thus dominates the one against hiatus. The same is true of Ancient Greek (Kaisse 1977) that

resolves hiatus by elision. Stress however blocks elision from taking place when it will result in a stress clash (cf. Casali 1997). In this case the constraint against stress clash will have to dominate those in the hierarchy that determine elision as the optimal analysis of hiatus resolution in the language, as well as the one against hiatus. In Lenakel as analyzed by Rosenthall (1994) following Lynch's (1977) description of the language, the primary hiatus resolution is glide formation. This is however blocked by prosodic and stress factors, resulting in heterosyllabification.

The typological ranking for hiatus-prohibiting grammars (128b) interacts with the correspondence constraints that monitor input-output mappings to determine a grammar of hiatus resolution strategies. The grammars fall into two types with respect to whether tautosyllabification is permitted or not. The relevant types are heterosyllabifying grammars and tautosyllabifying grammars. Heterosyllabifying grammars either choose insertion as a resolution strategy or elision. The choice is dependent on the relative ranking of the input-output maximization constraint and the insertion-prohibiting constraints. The rankings are given in (129).

(129) *Rankings for heterosyllabifying grammars*

a. *Ranking for insertion*

NOHIATUS » *COMPLEX-NUC, IDENT, MAX » DEP, INTEGRITY

b. *Ranking for elision*

NOHIATUS » *COMPLEX-NUC, IDENT, DEP, INTEGRITY » MAX

Insertion and elision are considered as heterosyllabifying strategies as each input vowel is in a separate syllable. The difference between the two is that both vowels are present in the output in the case of insertion. In elision, one of the input vowels is not

present in the output. Other hiatus resolution strategies are not used in heterosyllabifying grammars, as they will result in complex nuclei. Thus the high ranking *COMPLEX-NUC suffices to block other strategies from applying

The rankings in (129) do not by themselves suggest that a heterosyllabifying language with multiple hiatus resolution strategies necessarily makes use of both strategies. On the other hand a tautosyllabifying grammar may use a heterosyllabifying strategy. This is the case in Nupe, a tautosyllabifying grammar that makes use of elision, and insertion in loanword adaptation, as hiatus resolution strategies. Languages with the ranking (129a) differ between those that resolve hiatus by epenthesis or copying depending on the ranking between the insertion-prohibiting constraints. The former will have the ranking INTEGRITY » DEP, while the latter will have the ranking DEP » INTEGRITY. Axininca Campa (Payne 1981, McCarthy & Prince 1993) is an example of the former, and Malay/Indonesian (McCarthy & Prince 1993a) is an example of the latter. Languages with the ranking (129b) use elision as hiatus resolution strategy. Casali 1996, 1997 abound with examples of languages that use elision as hiatus resolution strategy. The issue is determining which vowel is elided, a factor of universal tendencies and language-particular idiosyncrasies as evident from Casali's analyses of various languages.

The tableaux in (130) illustrate both insertion strategies and elision. In all cases the vowels are heterosyllabified. Though elision leads to one of the input vowels lacking a correspondent in the output, it is considered as a heterosyllabifying strategy. Elision, like insertion avoids tautosyllabification.

(128) *Tableaux for heterosyllabifying grammars*

a. *Insertion (epenthesis)*

| Input: Ci + a | NOHIATUS | *COMPLEX-NUC | IDENT | MAX | INTEGRITY | DEP |
|---|---|---|---|---|---|---|
| a. Ci.a. | *! | | | | | |
| b. Cia. | | *! | | | | |
| c. Cja. | | | *! | | | |
| d. Cii. | | *! | * | | | |
| e. Cee. | | *! | * | | | |
| f. Ci. | | | | *! | | |
| g. Ci.ja. | | | | | *! | |
| h. ☞ Ci.ta. | | | | | | * |

b. *Insertion (copying)*

| Input: Ci + a | NOHIATUS | *COMPLEX-NUC | IDENT | MAX | DEP | INTEGRITY |
|---|---|---|---|---|---|---|
| a. Ci.a. | *! | | | | | |
| b. Cia. | | *! | | | | |
| c. Cja. | | | *! | | | |
| d. Cii. | | *! | * | | | |
| e. Cee. | | | | | | |
| f. Ci. | | | | *! | | |
| g. ☞ Ci.ja. | | | | | | * |
| h. Ci.ta. | | | | | *! | |

c. *Elision*

| Input: Ci + a | NOHIATUS | *COMPLEX-NUC | IDENT | INTEGRITY | DEP | MAX |
|---|---|---|---|---|---|---|
| a. Ci.a. | *! | | | | | |
| b. Cia. | | *! | | | | |
| c. Cja. | | | *! | | | |
| d. Cii. | | *! | * | | | |
| e. Cee. | | *! | * | | | |
| f. ☞ Ci. | | | | | | * |
| g. Ci.ja. | | | | *! | | |
| h. Ci.ta. | | | | | *! | |

Tautosyllabifying grammars differ from heterosyllabifying grammars by having *COMPLEX-NUC ranked low in the hierarchy with respect to the rankings in (129) in a way to preclude the strategies available to the heterosyllabifying grammars. The various choices available to these grammars include glide formation, diphthong formation,

assimilation, and coalescence. The complex nuclei allowed by diphthong formation, assimilation, and coalescence differ. While the vowels in diphthong formation are distinct, those in assimilation and coalescence are identical. The constraint against complex nuclei thus needs to be relativized to a sequence of nonidentical vowels as in *COMPLEX-NUC[$V_iV_j$]. Nonetheless all three strategies still violate the general constraint against complex nuclei. It is the ranking of the special constraint that makes it possible to distinguish one strategy from the other. The correspondence constraints violated by each strategy are IDENT-IO(vocalic) for glide formation, ANCHOR-FEATURE-IO for assimilation, and UNIFORMITY for coalescence. The ranking of these constraints with respect to one another determines the choice of either in tautosyllabifying grammars. In addition, since assimilation and coalescence involve identity differences between inputs and corresponding outputs, I assume that the constraints against each strategy subsumes IDENT violations, and IDENT need not feature in the hierarchy. The general ranking for tautosyllabifying grammars is as in (131a). The correspondence constraints that make subtle distinctions between each strategy are incorporated into the hierarchy accordingly resulting in the rankings in (131b-e) for each strategy. I explain each strategy in turn.

(131) *Rankings for tautosyllabifying grammars*

a. *General ranking for tautosyllabifying grammars*

NOHIATUS » DEP, INTEGRITY, MAX » *COMPLEX-NUC

b. *Ranking for glide formation*

NOHIATUS » DEP, INTEGRITY, MAX, ANCHOR-FEATURE-IO, UNIFORMITY » *COMPLEX-NUC[$V_iV_j$] » IDENT-IO(vocalic)

c. *Ranking for diphthong formation*

NoHiatus » Dep, Integrity, Max, Anchor-Feature-IO, Uniformity, Ident-IO(vocalic) » *Complex-Nuc[$V_iV_j$]

d. *Ranking for assimilation*

NoHiatus » Dep, Integrity, Max, Uniformity, Ident-IO(vocalic), *Complex-Nuc[$V_iV_j$] » Anchor-Feature-IO

e. *Ranking for coalescence*

NoHiatus » Dep, Integrity, Max, Anchor-Feature-IO, Ident-IO(vocalic) *Complex-Nuc[$V_iV_j$] » Uniformity

The general ranking (131a) captures tautosyllabification as the optimal hiatus resolution strategy. Tautosyllabification results in complex nuclei. The high-ranking Dep, Integrity, and Max preclude insertion and elision from being optimal strategies for tautosyllabifying grammars. Tautosyllabification has the different effects of glide formation, diphthong formation, assimilation, and coalescence.

Glide formation is a consequence of tautosyllabification. The effect of tautosyllabification is a sequence of nonidentical vowels to a syllable nucleus. In order to make the nucleus less complex the first vowel in the sequence turns into a glide. This results in featural differences between the input vowel and its corresponding glide output, a violation of Ident-IO(vocalic). Glide formation is thus forced by the ranking *Complex-Nuc[$V_iV_j$] » Ident-IO(vocalic) as in (131b). As noted for heterosyllabifying grammars, the presence of one strategy in a language with multiple hiatus resolution strategies does not necessarily mean the presence of the other tautosyllabifying strategies. Languages with glide formation are constrained by the vowels that can glide in particular

languages. In such cases any other strategy may be used when such vowels occur in hiatus. As in Nupe, the vowel that lacks a corresponding vowel assimilates the features of the vowel with which it is in contact. Another language that uses glide formation as hiatus resolution strategy is Okpe (Hoffman 1973, Omamor 1988, and Pulleyblank 1986c (cf. Casali 1996)). High vowels occurring as $V_1$ in hiatus turn to corresponding glides. But when other vowels occur in the same context $V_2$ elision occurs. The same is true of Emai, but with $V_1$ elision of nonhigh vowels in hiatus (Folarin-Schleicher 1992, Schaefer 1987, cf. Casali 1996)). This is also the case in Etsako (Elimelech 1976 (cf. Rosenthall 1994, 1996). In Kimatuumbi (Odden 1992, 1995, Rosenthall 1994, 1996) on the other hand glide formation takes place when $V_1$ can glide. But when $V_1$ is non-gliding heterosyllabification ensues. The ranking of the constraints against assimilation and coalescence above *COMPLEX-NUC[$V_iV_j$] in the glide formation hierarchy suffices to rule out assimilation and coalescence.

Diphthong formation, unlike glide formation, allows the tautosyllabified vowels to form a complex nucleus. Since the vowels are not identical the resulting structure violates *COMPLEX-NUC[$V_iV_j$]. In order to maintain featural identity between the input vowels and their output correspondents the ranking IDENT-IO(vocalic) » *COMPLEX-NUC[$V_iV_j$] has to hold for diphthong formation to be optimal. An example of a language that uses diphthong formation as hiatus resolution strategy is Ngiti (Lojenga 1994 (cf. Casali 1996, 1997)).

Assimilation, like diphthong formation, results in complex nuclei. But assimilation results in the features of one input vowel being realized on another vowel in the output. This results in a violation of ANCHOR-FEATURE-IO. This constraint is thus

ranked lowest in the hierarchy in (131d). The relevant issue for languages with assimilation as hiatus resolution strategy is whether assimilation is progressive or regressive. Universal tendencies or language-particular idiosyncrasies may determine this. Yoruba is one language that uses assimilation to resolve hiatus. Assimilation is for the most part regressive, but progressive if $V_2$ is [i] (Awoyale 1985, Awobuluyi 1978, Ola-Orie & Pulleyblank 2000, Pulleyblank 1988, 1998). The other hiatus resolution strategy in Yoruba is elision, a heterosyllabifying strategy (cf. Laniran 1992 for an alternative view). The choice between assimilation and elision is a factor of syntactic and prosodic considerations (Awoyale 1985, to appear, Ola-Orie & Pulleyblank 2000).

Casali (1996, 1997) cites Anufɔ (Adjekum, Holman & Holman 1993) as a language that uses coalescence as hiatus resolution strategy. In the relevant context the vowels in hiatus surface in the output with a vowel that is different from either of the input vowels. It however shares the features of the input vowels, and thus violates UNIFORMITY. There is a sense in which the vowels are identical to the input vowels given that some features are present in the coalesced vowels. As with ANCHOR-FEATURE-IO in assimilation, UNIFORMITY may subsume IDENT violations. I however attribute the choice between assimilation and coalescence to the ranking between these two constraints as indicated in the rankings. In the Anufɔ data presented by Casali, the output consists of two identical vowels, indication that there is input-output maximization as with other tautosyllabifying strategies where MAX is ranked high in the hierarchy.

The tautosyllabifying rankings are illustrated in the tableaux in (132). Only the constraint interactions that determine the choice between the various tautosyllabifying strategies are shown.

(132) *Tableaux for tautosyllabifying grammars*

a. *Glide formation*

| Input: Ci + a | NoHiatus | Anchor-Feature-IO | Uniformity | *Complex-Nuc[$V_iV_j$] | Ident-IO(voc) |
|---|---|---|---|---|---|
| a. Ci.a. | *! | | | | |
| b. Cia. | | | | *! | |
| c. ☞ Cja. | | | | | * |
| d. Cii. | | | | | |
| e. Cee. | | | | | |

b. *Diphthong formation*

| Input: Ci + a | NoHiatus | Anchor-Feature-IO | Uniformity | Ident-IO(voc) | *Complex-Nuc[$V_iV_j$] |
|---|---|---|---|---|---|
| a. Ci.a. | *! | | | | |
| b. ☞ Cia. | | | | | * |
| c. Cja. | | | | *! | |
| d. Cii. | | *! | | | |
| e. Cee. | | | *! | | |

c. *Assimilation*

| Input: Ci + a | NoHiatus | Uniformity | Ident-IO(voc) | *Complex-Nuc[$V_iV_j$] | Anchor-Feature-IO |
|---|---|---|---|---|---|
| a. Ci.a. | *! | | | | |
| b. Cia. | | | | *! | |
| c. Cja. | | | *! | | |
| d. ☞ Cii. | | | | | * |
| e. Cee. | | *! | | | |

d. *Coalescence*

| Input: Ci + a | NoHiatus | Anchor-Feature-IO | Ident-IO(voc) | *Complex-Nuc[$V_iV_j$] | Uniformity |
|---|---|---|---|---|---|
| a. Ci.a. | *! | | | | |
| b. Cia. | | | | *! | |
| c. Cja. | | | *! | | |
| d. Cii. | | *! | | | |
| e. ☞ Cee. | | | | | * |

The foregoing typology of hiatus resolution strategies permits partitioning grammars into universal sets with several choices available within each set. Implicit in the typology is the fact that languages may use more than one strategy as determined by language-internal factors. This will prevent ranking paradoxes engendered by merely

reranking the constraint violated by each strategy lowest in the hierarchy to predict cross-linguistic preferences. Hiatus resolution is thus better accounted for by integrating universal tendencies with language-particular idiosyncrasies.[6]

The analysis of multiple hiatus resolution strategies in Nupe and the typology of hiatus resolution strategies proposed raise a number of issues with respect to the hiatus phenomenon in the OT literature. I examine these issues next vis-à-vis the analysis presented in the preceding sections.

## 9. Issues in Hiatus Resolution

The issues that are pertinent to the hiatus phenomenon that emerge from the preceding discussion and in the hiatus resolution literature includes what drives hiatus resolution, hiatus resolution strategies and militating constraints, and choice of strategy within and across languages. These issues are addressed in the following sections.

### *9.1 Motivation for hiatus resolution*

I noted in section 3 that there are two different motivations for hiatus resolution in the literature. The first attributes hiatus resolution to syllable well-formedness (Casali 1996, 1997, Rosenthall 1994, 1996), while the second attributes it to articulatory difficulty (Ola-Orie & Pulleyblank 2000 and Pulleyblank 1998). The syllable well-formedness motivation for hiatus resolution attributes hiatus resolution to the ill-formedness of syllables without onset. In the hiatus context the second syllable lacks an onset. This results in a violation of the syllable well-formedness constraint (133) that requires syllables to have onsets.

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[6] I should point out that aspects of the preceding analysis appear in Kawu (2001). The analysis presented here improves on that analysis in a number of ways. The present analysis thus supercedes that in the mentioned work.

(133) ONSET

Syllables must have onsets.

Since $V_2$ in the sequence $CV_1.V_2$ lacks an onset it is ill-formed, thus prompting a resolution to improve the ill-formed syllable.

The prediction of the onset-driven account of hiatus resolution is that supplying the second vowel in the $CV_1.V_2$ sequence with an onset as in $CV_1.\underline{C}V_2$ suffices to resolve hiatus. But this prediction is not completely borne out given the various hiatus resolution strategies attested in languages. However, of the hiatus resolution strategies identified by Casali—heterosyllabification, elision, glide formation, diphthong formation, coalescence, and epenthesis—all but heterosyllabification result in the minimization of ONSET violations. In addition only epenthesis supplies the ill-formed syllable with an onset. Besides this drawback of the onset-driven motivation of hiatus resolution, Ola-Orie & Pulleyblank (2000) and Pulleyblank (1998) raise other objections to this analysis with particular reference to hiatus resolution in Yoruba.

The alternative to syllable well-formedness approach to hiatus resolution suggested by Pulleyblank (1998) is the articulatory approach. Resetting the articulators between a sequence of nonidentical vowels is difficult. The constraint that forces hiatus resolution is thus NOHIATUS; it prohibits heterosyllabic vowel sequences. Ola-Orie & Pulleyblank (2000) however restrict hiatus to a sequence of nonidentical vowels despite acknowledging a broader definition of hiatus to the effect that any sequence of vowels in different syllables constitutes hiatus. Restricting NOHIATUS to a sequence of featurally distinct vowels inadvertently allows for heterosyllabic sequences of identical vowels. Hiatus should not be restricted in this way as any sequence of vowels, be the vowels

similar or different, not separated by a consonant in different syllables constitutes hiatus. Thus for any input with a sequence of vowels, an output with the vowels heterosyllabified constitutes hiatus and an output with the vowels tautosyllabified does not constitute hiatus. It is this broader definition of hiatus that has been adopted in the discussion of hiatus resolution strategies in Nupe. The restriction of hiatus to featurally distinct vowels also suggests that assimilation suffices to resolve hiatus. But as with the onset-driven account the variability in strategy, intra- and inter-linguistically, suggests that the narrower definition of hiatus is inadequate.

Attributing hiatus resolution to the ill-formedness of heterosyllabic vowel sequences predicts that tautosyllabification suffices to resolve such sequences. This prediction is borne out to a large extent in that of the typology of hiatus resolution strategies identified in the preceding section all but insertion (epenthesis or copying) and elision do not involve tautosyllabifying the vowel sequences. Tautosyllabification has the effects of glide formation, diphthong formation, assimilation and coalescence. The effect of tautosyllabification in different languages is a function of language-particular idiosyncrasies.

Casali (1996) recognizes the fact that hiatus resolution may not be solely due to ONSET, but also due to NOHIATUS (*V.V). He however does not explore how this may feature in the hiatus phenomenon, since it is not obvious that such a constraint should be entertained in the theory alongside ONSET. McCarthy and Prince (1993ab) however argue against recognizing NOHIATUS as a constraint of universal grammar on the grounds that it amounts to parametrizing ONSET to the effect that onsetless syllables are barred except word-initially (*[$_{\sigma}$V except word-initially). This is informed by the need to explain the

Initial-V phenomenon in Axininca Campa that tolerates initial onsetless syllables, but epenthesizes a consonant in V-V sequences at stem-suffix junctures. Rather than have a constraint against V-V sequences, they derive the initial-V phenomenon from the interaction between ALIGN-LEFT (every stem begins at the left edge of a prosodic word) and ONSET. Since the initial V, but not the suffixal V, corresponds to the left edge of the stem, epenthesis will lead to edge misalignment. This is not the case with the second V that is not at the edge of a prosodic word. Though the facts of Axininca Campa fall out from the analysis, the assumptions of McCarthy and Prince appear to have some problems.

The analysis of the facts of Axininca Campa assumes that hiatus resolution is onset-driven, an assumption that has been shown to be inadequate. The fact that several languages tolerate vowel-initial words but do not all resolve hiatus via epenthesis suggests that the two are independent. In addition V-V sequences do arise at the juncture of prosodic words as seen in the Nupe examples, and the approach of McCarthy and Prince would predict that each be aligned with the stem edge, thus ruling out epenthesis in such combinations. Since this does not seem to be the case, the explanation for epenthesis lies elsewhere. In the analysis developed here Axininca Campa can be regarded as a heterosyllabifying grammar, hence the choice of epenthesis as hiatus resolution strategy.

Furthermore, McCarthy and Prince's argument can be extended to include all constituents of the prosodic hierarchy. Each such element should be properly aligned with corresponding edges in their domains. In the case of the second V in a V-V sequence epenthesis leads to dealigning the syllable from its edge in the same way that it

would a prosodic word. There is no obvious way of restricting the interaction of ONSET and ALIGN-LEFT (ranking is of course always a viable means) to bar prosodic word-initial epenthesis while allowing it for other constituents of the prosodic hierarchy.

Furthermore the instances of hiatus that are subject to the alignment explanation are those arising from morphological and syntactic concatenation. In the preceding discussion it was established that hiatus does arise word-internally. It is not obvious how alignment will treat such sequences since neither vowel is at the edge of a prosodic constituent in the input. In order for all instances of hiatus to receive a uniform treatment, there must be an alternative to the alignment approach. The approach adopted in the preceding analyses appeals to a syllable structure constraint that bars associating more than one vowel to a syllable nucleus. Whatever the affiliation of the input vowels, the constraint forces syllabification in the output with each vowel associated to a different syllable nucleus. This results in hiatus, and hiatus is resolved accordingly. In view of the foregoing, NOHIATUS is required as a constraint of universal grammar and its interaction with other constraints accounts for intra- and cross-linguistic patterns of hiatus resolution as demonstrated in the preceding analyses.

*9.2 Hiatus resolution strategies and militating constraints*

Casali (1996, 1997) identifies six hiatus resolution strategies and the constraints that each strategy violates. The violated constraints fall into two classes: markedness constraints and faithfulness correspondence constraints. Rosenthall's (1994, 1997) proposal is essentially in the same spirit, though the markedness constraints differ in some cases. The resolution strategies and the violated constraints are as in (134).

(134) *Hiatus resolution strategies and violated constraints*

| Strategy | Violated constraint |
|---|---|
| Heterosyllabification | ONSET |
| Glide formation | *CG (cf. Rosenthall's SECARTIC) |
| Diphthong formation | NODIPH |
| Elision | MAX |
| Epenthesis | DEP |
| Coaleseence | UNIFORMITY, IDENT |

Of the above strategies I have suggested that heterosyllabification cannot be regarded as a hiatus resolution strategy but rather is a factor of hiatus-permitting grammars. In this regard it may only arise in hiatus-prohibiting grammars if hiatus resolution is blocked in certain contexts. Elision, epenthesis, and coalescence receive the same account in my analysis. But my analysis differs with respect to the constraints that glide formation and diphthong formation violate. While Casali, and Rosenthall consider these strategies as violating markedness constraints, I consider glide formation as violating a faithfulness constraint, specifically IDENT-IO(vocalic]. Glide formation is also considered as a consequence of diphthong formation (a result of tautosyllabification) which violates the constraint *COMPLEX-NUC[$V_iV_j$], rather than NODIPH. I have also distinguished epenthesis from copying, both being insertion strategies. While both supply the second syllable with an onset, epenthesis violates DEP, while copying (glide insertion) violates INTEGRITY.

Conspicuously absent from the list of strategies is assimilation, and a corresponding violated constraint. This omission is not accidental but arises from the

analyses of hiatus resolution in the works of Casali, and Rosenthall, and much earlier work in vowel contact situations. Even in Ola-Orie and Pulleyblank's analysis of assimilation as a strategy for resolving hiatus in Yoruba, there is no indication what constraint is violated. The only indication is that assimilating vowels satisfy NOHIATUS, while nonassimilating vowels violate it. This is consistent with their adoption of the narrow definition of hiatus. In the approach to hiatus resolution argued for above assimilation violates ANCHOR-FEATURE-IO. It bars the realization of the features of the vowels in hiatus on each other. But in early work in vowel contact situations assimilation has been regarded as elision and compensatory lengthening (cf. Cole 1976 and Clements 1986 on Luganda, and Cahill 1994 on Siswati). The analysis of assimilation as elision and compensatory lengthening in these languages allows for uniformity of analysis to the effect that glide formation is accompanied by compensatory lengthening. Since it is assumed that glide formation results in a nonmoraic parsing of the underlying vowel the surviving vowel spreads to fill the empty mora, hence compensatory lengthening. By analogy elision leads to nonparsing of a vowel leaving the mora intact, and the surviving vowel spreads to fill the mora. In a theory that regulates input-output mappings, compensatory lengthening can be attributed to the need for each input mora to have an output correspondent. Glide formation results in an empty mora that is filled by the surviving vowel resulting in identity changes. There is however input-output segmental maximization. This can be extended to the case of assimilation without assuming elision accompanied by compensatory lengthening to the effect that the nongliding vowel assimilates the features of the following vowel to resolve hiatus ensuring both moraic and

segmental input-output maximization. This is the case in Nupe in which glide formation and assimilation do not incur MAX violations, but do incur IDENT violations.

*9.3 Choice of hiatus resolution strategy within and across languages*

Existing optimality-theoretic accounts of hiatus resolution (Casali 1996, 1997, Ola-Orie & Pulleyblank 1998, Pulleyblank 1998, and Rosenthall 1994, 1997) attribute the choice of hiatus resolution strategy within and across languages to the constraint that is ranked lowest in particular languages. All other constraints are ranked above this constraint. Thus, for instance, of the strategies and constraints in (134) a language that uses glide formation will have *CG ranked lowest in the hierarchy with the other constraints high-ranking. To the extent that languages use a unique strategy to resolve hiatus, the approach is consistent with optimality-theoretic constraint interaction. But, as Casali (1997) admits, this approach is oversimplified as it does not allow for the possibility of two or more different hiatus outcomes in the same language. This possibility is what occurs more commonly in languages. The approach advocated in existing analyses potentially introduces ranking paradoxes. For example a language using epenthesis and elision will have the ranking MAX » DEP to account for epenthesis, and the reverse ranking DEP » MAX for elision. It is this potential for ranking paradoxes that informed the alternative approach adopted for the analysis of multiple hiatus resolution strategies in Nupe that integrated universal tendencies as implied by existing approaches, and language-particular idiosyncrasies.

The other assumption made in existing approaches to hiatus resolution is with respect to the role of markedness constraints in determining the choice of hiatus resolution strategy within a language. In this regard a language that does not use glide

formation as a strategy will have *CG ranked very high in the hierarchy. In the same vein a language that does not use diphthong formation will have NODIPH ranked very high. Rosenthall (1994, 1997) motivates a number of markedness constraints on permissible onsets and nuclei in languages such as *Secondary Articulation, No Complex Onset, and No Long Vowel. Though these high-ranking constraints may determine the inventory of syllable structure and vocalic inventory of a given language, they may have a limited role in determining the outcome of hiatus in such a language. For instance hiatus resolution of a sequence of identical vowels, and assimilation of a low vowel before a qualitatively distinct vowel in Nupe result in surface long vowels, and yet there are no phonological long vowels in the language. On the other hand glide formation results in rising diphthongs, segments that are possible nuclei in the language. This ambivalence raises questions about the role of markedness constraints against permissible syllable structures and nuclei in particular languages in determining the choice of hiatus resolution strategy.

An additional drawback of attributing the choice of strategy in a particular language to permissible syllable structure or nuclei is that a particular structure may be permitted in a language and yet the language uses a strategy that avoids such a structure. This is the case in Axininca Campa (McCarthy & Prince 1993a, Payne 1981) where hiatus is resolved by epenthesis despite the presence of diphthongs in the language.

More importantly permissible syllable structure and nuclei as determinants of choice of hiatus resolution strategy has implications for constraint interaction in OT. The principle of constraint interaction in OT determines the optimal analysis of any given input. Otherwise unattested structures may emerge in languages in response to universal tendencies or to improve structural markedness. Thus for instance English differs from

French in not having underlying nasalized vowels. The constraint against nasal vowels will be highly ranked in the grammar of English, but will not be so highly ranked in the grammar of French. But this does not necessarily prohibit nasalized vowels emerging in the grammar of English, as indeed they do when oral vowels are followed by nasal consonants.

In view of the limited role for markedness constraints against particular structures determining the outcome of hiatus in particular languages, an alternative approach is called for. This approach is one that appeals to faithfulness correspondence constraints that monitor input-output mappings. In this regard each particular outcome violates some correspondence constraint as indicated in the typological rankings in (129, 131). The only markedness constraints that feature in the typology are NOHIATUS and *COMPLEX-NUC. The ranking of these two constraints relative to each other as in (128) defines grammars with respect to whether they permit or prohibit hiatus. For hiatus-prohibiting grammars the hiatus-prohibiting ranking (128b) interacts with faithfulness correspondence constraints to define particular hiatus resolution strategies. The presence of multiple hiatus resolution strategies in a given language is then accounted for by factoring in language-particular idiosyncrasies. This might warrant motivating additional constraints, and ranking them accordingly to avoid the ranking paradoxes that might otherwise result from reranking the constraints violated by each hiatus resolution strategy. This is what I have done for the analysis of glide formation, assimilation, and elision as hiatus resolution strategies in Nupe.

### *9.4 Interim summary II*

In the preceding sections I presented an analysis of hiatus resolution in Nupe. I attributed hiatus resolution to the markedness of heterosyllabic vowel sequences, and formulated a constraint (NOHIATUS) to that effect. I demonstrated that glide formation is the primary hiatus resolution strategy in Nupe with high and mid vowels turning to corresponding glides accordingly. Glide formation is complemented by assimilation when the vowel lacking a corresponding glide ([a]) occurs in the relevant context in hiatus. Elision was argued to be a special hiatus resolution strategy affecting the nominal prefix *e* in nouns of the form *e*-CV. The intralinguistic typological variation engendered by the presence of multiple hiatus resolution strategies in Nupe was accounted for by motivating appropriate special constraints. Deploying these constraints accordingly in the hierarchy motivated for the primary hiatus resolution strategy preempted the ranking paradoxes that would otherwise have resulted from reranking the constraints in the established hierarchy to account for the other strategies. This ensured an adequate account of hiatus resolution in Nupe.

A typology of hiatus resolution strategies that appealed to the markedness constraints against hiatus (NOHIATUS), and complex nuclei (*COMPLEX-NUC) interacting with faithfulness correspondence constraints that monitor input-output mappings was set up. Grammars fall into two broad types with respect to the hiatus phenomenon, those that permit hiatus and those that prohibit hiatus. For grammars that prohibit hiatus, there are two grammar types defined by whether tautosyllabification is tolerated or prohibited. For grammars that prohibit tautosyllabification insertion (epenthesis or copying) or elision are the hiatus resolution strategies. As for grammars

that permit tautosyllabification the choices available are glide formation, assimilation, diphthong formation, and coalescence. Input-output identity considerations determine the choice of strategy. Languages with multiple hiatus resolution strategies may cross-choose as a heterosyllabifying grammar may use a tautosyllabifying strategy in addition to a heterosyllabifying strategy, and vice versa. Nothing in the typology requires that the multiple choices be from the same grammar type. The intralinguistic typological variation engendered by the presence of multiple hiatus resolution strategies in natural languages is best accounted for by integrating language-particular idiosyncrasies with universal tendencies. In the specific case of Nupe, this was achieved by motivating special constraints and deploying them accordingly. This approach is extended to another instance of intralinguistic typological variation in Nupe engendered by the syllabic simplification of loanwords.

## 10. Syllabic Simplification Again

The structural constraints that interact to determine attested syllable types in Nupe have been argued to be responsible for the modifications that loanwords with the unattested syllable structures undergo (cf. chapter 2, section 4). In the specific case of loanwords from Classical Arabic (chapter 2, section 4.2) codas are simplified by inserting a vowel that is a copy of the immediately preceding vowel. I claimed that copying an input vowel is preferred to epenthesizing an unmarked vowel. This choice was attributed to the ranking DEP » INTEGRITY.

In the discussion of word-internal hiatus resolution in the adaptation of loanwords from Classical Arabic (section 7) it was suggested that the interaction between DEP and INTEGRITY should define a typology of insertion strategies. This is to the effect that in

insertion-demanding situations epenthesis or copying should occur, depending on the relative ranking of the two constraints. On this view once the ranking DEP » INTEGRITY holds in a grammar then the alternative ranking that prefers epenthesis (INTEGRITY » DEP) should not occur in the same grammar. The occurrence of copying and epenthesis in comparable contexts in the same grammar engenders intralinguistic typological variation, which in turn leads to a potential ranking paradox. Both insertion strategies are used in the syllabic simplification of loanwords in Nupe. The variation that ensues is accounted for by motivating constraints that capture the variation context and deploying them accordingly into the copying hierarchy. This avoids the potential paradox engendered by the existence of both strategies in the grammar of Nupe. I consider the use of copying in some forms, use of copying and epenthesis in the same form, exclusive use of epenthesis in some forms, and unsystematic exceptions to copying. Finally I examine syllabic simplification of loanwords from languages other than Classical Arabic.

*10.1 Copying*

Loanwords from Classical Arabic with simple codas (simple in the loan input, or a result of deletion of one member of a complex coda in the loan output) are simplified by copying the vowel of the syllable of which the coda is a part in the loan input. The coda is subsequently parsed as an onset of the resulting syllable in the loan output. The three vowels of Arabic [i, u, a] are copied accordingly as in the examples in (135). As noted earlier I transcribe the Arabic emphatic consonants as upper case letters. Whatever the length of the vowel of the loan input the output vowel is short. Since syllabic simplification leads to differences between the loan input and the output in the source

language, and thus violations of the loan faithfulness constraint FAITH-SOURCE(Coda), the constraint will not feature in the rankings except where necessary.

(135) *Copying in the simplification of simple codas in loanwords from Classical Arabic*

| Classical Arabic | | Nupe | Gloss |
|---|---|---|---|
| kaafir | → | káfiri | 'unbeliever' |
| fitna | → | fitína | 'tumult' |
| mu?min | → | múmìni | 'believer' |
| ad-diin | → | àdíni | 'religion' |
| baaliɣ | → | bálìgi | 'of age, puberty' |
| kaafuur | → | kafurù | 'camphor' |
| luuT | → | lutù | 'homosexual' (<Lot) |
| Zuhr | → | zúrù | 'midday prayer' |
| xuTba | → | hútúba | 'Friday sermon' |
| sutra | → | sùtúra | 'well-dressed' (<jacket, tunic) |
| qadar | → | kádára | 'destiny' |
| ʤahannam | → | ʤáhànámà | 'hell' |
| abad | → | àbàdá | 'forever' |
| madħ | → | mádá | 'panegyric, glorification of Allah' |
| ʃakk | → | ʃáka | 'doubt, uncertainty' |

Copying of the immediately preceding vowel to supply the coda consonant with a nucleus in the examples in (135) is accounted for by the ranking in (136), illustrated in a tableau in (137).

(136) *Ranking for copying as insertion strategy for syllabic simplification of simple codas in loanwords from Classical Arabic*

NOCODA, DEP » INTEGRITY

(137) *Tableau for copying as insertion strategy for syllabic simplification of simple codas in loanwords from Classical Arabic*

| Input: sutra | NOCODA | DEP | INTEGRITY |
|---|---|---|---|
| a. sùtra | *! | | |
| b. sùtíra | | *! | |
| c. ☞ sùtúra | | | * |

In (137) candidate (a) with the coda consonant incurs a fatal violation of NOCODA. Candidate (b) simplifies the coda by inserting an unmarked vowel. The NOCODA violation is avoided. But since the inserted vowel lacks an input correspondent, it incurs a fatal violation of DEP. The optimal candidate also simplifies the coda by inserting a vowel copied from the immediately preceding syllable. Since the copied vowel has an input correspondent, DEP is satisfied. The input vowel however has two output correspondents, a violation of the anti-copying constraint, INTEGRITY. But given the low ranking of the constraint, the violation is not fatal.

The foregoing establishes copying as the optimal strategy for the syllabic simplification of loanwords from Classical Arabic. But in some forms with complex codas copying and epenthesis are used.

*10.2 Copying and epenthesis*

In Classical Arabic loanwords with complex codas, copying and epenthesis effect syllabic simplification. The two coda consonants are parsed in Nupe without deletion. This creates two insertion sites. The first site is filled with a copy of the adjacent vowel while the second is filled with an unmarked vowel. The epenthetic vowel is [i], and it is contextually [u]. The [u] variant occurs after labial consonants. The generalization here is

that the epenthetic vowel agrees in labiality with the consonant for which it functions as nucleus. As I shall show shortly it may also agree in labiality with a following consonant instead of a preceding one. The prediction for the distribution of [i] and [u] is not always borne out. Thus it is possible to have [i] where [u] is expected, and [u] where [i] is predicted. This may be a factor of the features of the vowels of the word that hosts the epenthetic vowel to the effect that if they are nonlabial [i] may surface instead of [u], and if they are labial [u] may surface instead of [i]. This is the case in Yoruba syllabic simplification of English loans. Awobuluyi (1967) and Awobuluyi and Bamgbose (1967) attribute the asymmetry to Back Harmony conflicting with Labial Consonant Harmony. In some instances the former takes precedence while in some others the latter takes precedence. The generalization can however be expressed as a condition on epenthetic vowels to agree in place features with some constituent segment of the host word.[7]

The Classical Arabic examples with complex codas that are simplified by copying and epenthesis are given in (138).

(138) *Copying and epenthesis in the simplification of complex codas in loanwords from Classical Arabic*

| Classical Arabic | | Nupe | Gloss |
|---|---|---|---|
| ʔiðn | → | ízìni | 'permission' |

[7] This generalization can be formulated as an agreement constraint as in (i). The constraint as formulated allows for the epenthetic vowel to agree in place with either the preceding or following consonant or other vowels in the word.

(i) AGREE(Place)
An epenthetic vowel agrees in place with an adjacent consonant or vowel.

The effects of (i) are obvious from the examples that will be considered in subsequent discussion. It will however not be deployed in the hierarchies to be motivated in the variation between copying and epenthesis.

| | | | |
|---|---|---|---|
| ʕilm | → | ílìmi̱ | 'knowledge' |
| mulk | → | múlúki̱ | 'power, authority' |
| Subḥ | → | súbúhi̱ | 'morning prayer' |
| qabr | → | kábàri̱ | 'grave, tomb' |
| al-amr | → | àlámàri̱ | 'affair, matter' |
| aSl | → | asali̱ | 'origin, ancestry, lineage' |

The examples in (138) with copying and epenthesis in the same form pose a problem beyond intralinguistic typological variation as there is no tinkering with the hierarchy in (136) that can derive the correct pattern. Reversing the ranking predicts epenthesis, and unranking predicts optionality between copying and epenthesis. Either way the generalization that accounts for the choice of copying is jeopardized. The fact that copying occurs at the first insertion site requires maintaining the ranking that favors copying. What needs to be explained is the failure of copying at the second site. I attribute this to the fact that multiple output correspondents are constrained by an adjacency condition to the effect they should be minimally distant from each other. A constraint to this effect is formulated accordingly in (139).[8]

(139) MINIMAL DISTANCE (MINDIST)

If $x$ in $S_1$ has $y$ and $z$ as correspondents in $S_2$, then $y$ and $z$ must be adjacent, where $y$ is the original copy of $x$.

[8] A version of this constraint, without the relation between $x$ and $y$, was first used in Kawu (2000c) to account for the copied consonant in gerundial affixation to complex polysyllabic verbs in Yoruba to the effect that it is the onset of the initial syllable that is copied to anchor the resulting high tone onsetless syllable.

A plausible alternative to account for the forms in (138) is to restrict the violations of INTEGRITY by limiting the number of multiple output correspondents that a given input should have. But it is not obvious how this should be encoded in a constraint, especially INTEGRITY. That the issue here is that of distance rather than number is evidenced by forms with word-internal hiatus as well as simple codas. The input vowel has two output correspondents, one surfacing as a glide serves as onset for $V_2$ in hiatus, and the other as nucleus to simplify the coda as in the examples in (140).

(140) *Multiple output copies in loanword adaptation*

| Classical Arabic | | Nupe | Gloss |
|---|---|---|---|
| naaʔib | → | nájibi | 'deputy imam' |
| ʕaib | → | ájíbi | ' fault, foible' |

The forms in (138) indicate the possibility of multiple output copies. As the examples show both copies of the input vowel are adjacent to it (j-i, i-i) in the output. Since adjacency is respected in these forms it must be case that in the forms in (136), copying is blocked at the second insertion site to avoid a violation of MINDIST. MINDIST can be deployed into the hierarchy without tampering with the copying subhierarchy as in (141). The ranking is illustrated in a tableau in (142) to account for the use of copying and epenthesis in the forms with complex codas.

(141) *Ranking for copying and epenthesis in the simplification of complex codas*

NOCODA, MINDIST » DEP » INTEGRITY

(142) *Tableau for copying and epenthesis in the simplification of complex codas*

| Input: qabr | NoCoda | MinDist | Dep | Integrity |
|---|---|---|---|---|
| a. kábr | *! | | | |
| b. kábiri | | | * *! | |
| c. kábàra | | * ! | | * * |
| d. ☞ kábàri | | | * | * |

The input faithful candidate (a) in (142) with the complex coda unsimplified incurs a fatal violation of NoCoda. Candidate (b) avoids this violation by epenthesizing an unmarked vowel at both insertion sites. It incurs two violations of the anti-epenthetic constraint the second of which is fatal. Since the vowels are not related to any input vowel (b) gratuitously satisfies MinDist. Candidate (c) also avoids violations of NoCoda by simplifying the coda with copies of the input vowel. While the first copy is adjacent to the input corresponding vowel the second is not, a fatal violation of MinDist. It has no Dep violations but incurs two violations of the anti-copying constraint, nonfatal violations given the low ranking of the constraint. The optimal candidate (d) with copying and epenthesis avoids a violation of MinDist as the multiple output correspondents are adjacent. This is achieved at the expense of a Dep violation as epenthesis is used at the second insertion site. This candidate incurs one violation of each of the anti-insertion constraints. But since MinDist makes the decision, the ranking between them is no longer crucial in determining the optimal analysis. The MinDist constraint effectively makes the reranking of the constraints that may otherwise be required to account for both insertion strategies in the same form or within the grammar itself unnecessary. However there are forms with a simple coda in which epenthesis is the preferred insertion strategy, a situation that still requires reranking in which MinDist may not be a factor.

### *10.3 Epenthesis*

Classical Arabic words that are borrowed into Nupe with the definite article *al-*, with *l* assimilating to the following coronal stop or fricative consonant, behave differently with respect to syllabic simplification. When the definite article precedes a consonant-initial root the consonant of the definite article is syllabified as a coda. The resulting coda is simplified in Nupe with an epenthetic vowel [i] before a nonlabial initial consonant of the stem, and [u] before a labial initial consonant of the stem to which the article is attached as in the examples in (143).[9]

(143) *Epenthesis in syllabic simplification of loanwords from Classical Arabic with the definite article 'al-'*

| Classical Arabic | | Nupe | Gloss |
|---|---|---|---|
| al-dʒanna | → | àlìdʒáńna | 'paradise' |
| al-ɣair | → | àlìhéri | 'good, benevolence' |
| al-qamḥ | → | álíkáma | 'wheat' |
| al-qawl | → | àlìkáwàli | 'promise' (<word) |
| al-baraka | → | àlùbáríka | 'blessing' |
| al-baaruud | → | àlùbàrú | 'gunpowder' |
| al-baSal | → | (a)lùbása | 'onion' |

[9] Hyman (1970b) claims that the *al* forms are borrowed from Hausa, but that they have Arabic equivalents. The reason he gives is that Hausa borrowed them directly from Arabic. Nupe then in turn borrowed them from Hausa. However not all forms occurring in Nupe occur in Hausa, indication that there is direct borrowing from Arabic. Besides, relating the Nupe forms directly to Arabic makes for analytical clarity.

In the forms in (143) the expected copying to simplify the coda does not occur. Epenthesis takes place instead. The exclusive use of epenthesis in these forms suggests a reranking of the insertion-prohibiting constraints, which if permitted, will lead to a ranking paradox. The difference between these examples and those in which copying occurs (cf. 135, 138) is that the vowel that should copy in (143) is that of the definite article, which by nature may be regarded as affixal, while the vowel that copies in the latter is part of the root. The failure of copying may then be attributed to the general tendency of roots to permit more marked structure than affixes. This is similar to the situation in Indonesian discussed in chapter one, and to which I return again shortly.

In the discussion of the Indonesian data it was argued that the failure of copying to resolve hiatus in forms involving affixes is a factor of splitting INTEGRITY into INTEGRITY-AFFIX and INTEGRITY-ROOT. In order to account for the Indonesian data, the ranking INTEGRITY-AFFIX » INTEGRITY-ROOT was motivated. It was however noted that this contradicts the Root-Affix Faithfulness Metaconstraint (McCarthy & Prince 1995). INTEGRITY by its definition seems to be special as a faithfulness constraint. Since it bars certain correspondence relations it can be interpreted from a markedness perspective to the effect that it is more marked to have multiple output correspondents of an input than a single output correspondent. On this view it can be said that roots may permit multiple output correspondents, while affixes may not. This is the essence of the RAFM, allowing marked structures in roots while prohibiting them in affixes. Given this interpretation the relativized constraints INTEGRITY-AFFIX and INTEGRITY-ROOT, with the ranking INTEGRITY-AFFIX » INTEGRITY-ROOT are needed to account for the data. INTEGRITY-AFFIX, as a special constraint as earlier indicated, is integrated into the hierarchy to

account for epenthesis in the examples in (143). In view of the claim in chapter two to the effect that the borrowing language has access to the structure of the source language, it is appropriate to assume that the Nupe speaker treats *al-* as the affix that it is in the source language.

The other issue raised by the Indonesian data is why the root vowel is not copied instead. In the Nupe adaptation of the Classical Arabic loanwords, the same issue arises. Of the examples cited only one has a root vowel that is different from the affixal vowel, that is, *àlìhéri*. I attribute the directionality of copying to linearity considerations. Linearity consists in preserving the precedence structure of corresponding elements. At issue is the order between the original vowel and its copy. The copy is not ordered before the original. There is a sense in which ordering the copy before the original in the output is inconsistent with the precedence structure of the input. For this reason, LINEARITY is ranked high in the hierarchy. This prevents the root vowel from copying to provide a nucleus for the coda consonant of the definite article.

The hierarchy that accounts for the forms in (143) is as in (144) with an illustrative tableau in (145).

(144) *Ranking for epenthesis in syllabic simplification of loanwords from Classical Arabic with he definite article 'al-'*

NOCODA, LINEARITY » INTEGRITY-AFFIX » DEP » INTEGRITY-ROOT

(145) *Tableau for epenthesis in syllabic simplification of loanwords from Classical Arabic with the definite article 'al-'*

| Input: al-ɣair | NoCoda | Linearity | Integrity-Affix | Dep | Integrity-Root |
|---|---|---|---|---|---|
| a. àlhérɪ̀ | *! | | | | |
| b. àlàhérì | | | *! | | |
| c. àlèhérì | | *! | | | * |
| d. ☞ àlɪ̀hérì | | | | * | |

In (145) violations are with respect to simplification of the final consonant of the definite article. The input faithful candidate (a) incurs a fatal violation of NoCoda while satisfying all other constraints. Candidate (b) has the vowel of the definite article copied to serve as nucleus for the coda consonant. This incurs a fatal violation of Integrity-Affix. Candidate (c) avoids this violation by copying the vowel of the stem. But the copy precedes the original, a fatal violation of Linearity. The optimal candidate (d) with an epenthetic vowel satisfies all constraints but Dep. In effect the optimality of epenthesis is a result of the ranking Integrity-Affix » Dep. This makes Integrity-Root irrelevant for the computation of optimality in this case. Once again the potential paradox engendered by the choice of epenthesis is nipped in the bud by deploying the special constraint Integrity-Affix into the hierarchy.

A plausible alternative to the analysis of the data in (143) is one that considers the fact that copying may be blocked by /l/ or that *a*-initial words do not allow copying. Neither of this is the case. The word for 'power' *múlúkɪ* from *mulk* shows that /l/ can be copied over. As for *a*-initial words, the word for 'culture' *asalɪ* from *aSl* indicates that /a/ does copy when initial.

The splitting of Integrity to account for the asymmetric behavior of roots and affixes with respect to multiple output correspondents was used to account for insertion as a hiatus resolution strategy in Malay/Indonesian (Cohn 1989, Cohn & McCarthy 1994,

McCarthy & Prince 1993a) in chapter one. I consider the data in more detail. As indicated in section 8, Indonesian is an example of a heterosyllabifying grammar. It uses insertion as resolution strategy to the effect that the onset of $V_2$ is a glide that is homorganic to $V_1$. As demonstrated in the analysis of word-internal hiatus resolution in loanwords from Classical Arabic (section 7), the homorganic glide is a copy of the preceding vowel. In effect the vowel has two correspondents in the output, a vowel and a glide. This is seen in the examples in (146).

(146) *Hiatus resolution by insertion (copying) in Indonesian*

| | | | |
|---|---|---|---|
| diam | → | di.jam | 'quiet' |
| buah | → | bu.wah | 'fruit' |
| udʒi-an | → | u.dʒi.jan | 'test' |
| bantu-an | → | ban.tu.wan | 'aid, relief' |
| hari-an | → | ha.ri.jan | 'daily' |

Since the options available to a heterosyllabifying grammar are elision or insertion, Indonesian prefers insertion (cf. 129a). For insertion the choice is between epenthesis and copying. Since the examples in (146) show evidence of copying, it is the case that the ranking DEP » INTEGRITY holds in Indonesian. The implication is that epenthesis is not an option for resolving hiatus in the language. But in some hiatal configurations involving a prefix and a stem, hiatus is resolved by epenthesizing the glottal stop as in the examples in (147).[10]

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[10] McCarthy and Prince (1993) point out the hiatus is resolved by *ʔ*-epenthesis when the first vowel is non-high or when the vowels in hiatus are identical. The former may be attributed to the non-high vowels lacking corresponding glides in Indonesian, while the latter may be attributed to OCP effects especially if the vowels in hiatus are those that can glide. McCarthy & Prince on their part attribute the asymmetry between the forms in (146) and (147) to alignment considerations. Cohn & McCarthy use the same

(147) *Hiatus resolution by insertion (epenthesis) in Indonesian*

| | | | | |
|---|---|---|---|---|
| di-ankat | → | di.ʔan.kat | (*di.jan.kat) | 'be lifted' |
| di-ukir | → | di.ʔu.kir | (*di.ju.kir) | 'be carved' |
| di-ambil | → | di.ʔam.bil | (*di.jam.bil) | 'be taken' |
| api-api | → | a.pi.ʔa.pi | (*a.pi.ja.pi) | 'fires' |

An account of the failure of copying in the forms in (147) would require the impossible option of reranking the anti-insertion constraints. The forms in (146) differ from those in (147) in that $V_1$ that should copy is part of the stem in the former while it is part of the affix in the latter. The stem vowel can have multiple output correspondents, but the affix vowel cannot, hence, INTEGRITY-AFFIX » INTEGRITY-ROOT. The ranking required for the variation between copying and epenthesis in hiatus resolution in Indonesian, abstracting away from other possible strategies, is as in (148). The ranking is more comprehensive than the one given in (9) in chapter one.

(148) *Ranking for copying and epenthesis in hiatus resolution in Indonesian*

NOHIATUS, LINEARITY » INTEGRITY-AFFIX » DEP » INTEGRITY-ROOT

The ranking (146) allows for variation between glide insertion, the glide being a copy of an input root vowel, and glottal stop insertion, the glottal stop lacking an input correspondent. It is obvious from the examples in (147) that linearity considerations prevent a stem vowel from copying when the affix vowel does not copy, hence the high-ranking LINEARITY. The ranking (148) is illustrated in a tableau in (149).

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approach with some modifications. The account of the facts that I present shortly does not appeal to alignment.

(149) *Tableau for copying and epenthesis in hiatus resolution in Indonesian*

| Input: diam | NOHIATUS | LINEARITY | INTEGRITY-AFFIX | DEP | INTEGRITY-ROOT |
|---|---|---|---|---|---|
| a. di.am | *! | | | | |
| b. di.ʔam | | | | *! | |
| c. ☞ di.jam | | | | | * |
| Input: di-ukir | | | | | |
| a. di.u.kir | *! | | | | |
| b. di.ju.kir | | | *! | | |
| c. di.wu.kir | | *! | | | * |
| d. ☞ di.ʔu.kir | | | * | | |

In the top part of the tableau in (149) the input is a root, while the bottom part has prefix-root input. In the root input, the output with the input vowels heterosyllabified (a) incurs a fatal violation of NOHIATUS. Candidate (b) resolves hiatus by inserting the glottal stop. Since the glottal stop lacks an input correspondent, (b) incurs a fatal violation of DEP. The candidate satisfies both INTEGRITY constraints, as there is no input with multiple output correspondents. The optimal candidate (c) resolves hiatus by having a copy of the input vowel serve as onset for the second vowel. Since the vowel is a root vowel INTEGRITY-AFFIX is satisfied, and a DEP violation is avoided. The candidate however violates INTEGRITY-ROOT, a nonfatal violation given the low ranking of the constraint. LINEARITY is satisfied in each case, as there is no copy preceding the original. For the input root thus, copying is optimal and epenthesis is suboptimal.

In the prefix-root input, the candidate with the vowels heterosyllabified (a) incurs a fatal violation of NOHIATUS. This is resolved by copying as in candidate (b). But unlike in the root-input tableau the copied vowel is part of the prefix resulting in its having multiple correspondents in the output, a fatal violation of INTEGRITY-AFFIX. Candidate (c) avoids this violation by copying the root vowel. But the copy precedes the stem and thus incurs a fatal violation of LINEARITY. The optimal candidate (d) avoids this violation

by epenthesizing the glottal stop, a violation of DEP. This violation however is not fatal as in the root-input case since INTEGRITY-AFFIX dominates DEP. Here, as in the case of simplification of Arabic loanwords with the definite article in Nupe, INTEGRITY-ROOT plays no role in the decision. Hence epenthesis is optimal when the vowel that should have multiple output correspondents is part of the prefix rather than the root, and copying is suboptimal. The optimality of copying and epenthesis in hiatus resolution by insertion in Indonesian is accounted for by splitting and ranking the split INTEGRITY constraints accordingly. The ranking paradox that would have otherwise ensued is avoided.

The foregoing analyses of copying, copying and epenthesis, and epenthesis in the syllabic simplification of loanwords from Classical Arabic in relevant contexts have appealed to a number of plausible generalizations, and motivating and ranking special constraints accordingly to explain the intralinguistic typological variation that these engender. But there are loanwords from Classical Arabic whose syllables are simplified exclusively by epenthesis, where copying is expected, with no obvious generalization. For this reason I regard the forms as unsystematic exceptions, and do not attempt an analysis. Examples are given in (150).

(150) *Epenthesis in syllabic simplification of Classical Arabic loanwords*

| Classical Arabic | | Nupe | | Gloss |
|---|---|---|---|---|
| adʒal | → | ádʒàli | (*adʒàla) | 'death' (<appointed term) |
| al-adab | → | ládàbi | (*ládàba) | 'good manners' |
| iimaan | → | imanì | (*imanà) | 'faith, belief' |
| raʕd | → | rádi | (*ráda) | 'thunder' |
| muraad | → | mùrádi | (*mùráda) | 'desire' |

ħaraam → hàrámù (*hàrámà) 'unlawful, forbidden'

The preceding discussion establishes copying as the optimal choice for simplifying marked syllable structures in loanwords from Classical Arabic. The choice of epenthesis in certain contexts has been accounted for by appealing to a number of contextual factors, and where such factors cannot be appropriately motivated the forms with epenthesis where copying is expected are treated as unsystematic exceptions. But in loanwords from languages other than Classical Arabic epenthesis is the syllabic simplification strategy. This brings another dimension to intralinguistic typological variation.

*10.4 Epenthesis as syllabic simplification strategy in loanwords from languages other than Classical Arabic*

In the previous chapter I pointed out that codas in loanwords from Hausa might be left as in the loan input without syllabic simplification (chapter 2, section 6.2). There it was mentioned that inserting an unmarked, and thus epenthetic, vowel effects syllabic simplification. I repeat the data in (64) in (151) with the simplified alternatives, setting aside for the moment issues of optionality.

(151) *Epenthesis in syllabic simplification of loanwords from Hausa*

| Hausa | | Nupe | Gloss |
|---|---|---|---|
| hár | → | hárị́ | 'until' |
| fárkó: | → | farịko | 'first' |
| gàskíjá: | → | gàsịkija | 'truth' |
| fúskà: | → | fúsíka | 'face' |
| káskó | → | kasịko | 'shallow pot' |

| | | | |
|---|---|---|---|
| háské: | → | hási̲ke | 'light' |
| kúskúrè: | → | kúsi̲kúrè | 'mistake' |

Loanwords from Hausa are not the only ones with epenthesis as syllabic simplification strategy. The same is true of loanwords with marked syllable structures—complex onsets, simple and complex codas—from English. Such complex structures are simplified by epenthesizing [i], which may be contextually [u] as in the examples in (152).

(152) *Epenthesis in syllabic simplification of loanwords from English*

| English | | Nupe | |
|---|---|---|---|
| brɛd | → | bú̲rjádi̲ | 'bread' |
| gləʊb | → | gílòóbù̲ | 'globe' |
| flaʊə | → | fú̲láwà | 'flower, flour' |
| bænk | → | báǹki̲ | 'bank' |
| kɔt | → | kòótù̲ | 'court' |
| sɜf | → | swàáfù̲ | 'detergent' (<surf) |
| æləm | → | álwàmù̲ | 'alum' |

The challenge posed by the exclusive use of epenthesis for simplifying marked syllables from Hausa and English is how to maintain the optimality of copying in Classical Arabic loanwords with similar structures. There might be more at issue than just the ranking between the anti-insertion constraints. It seems plausible that the choice of strategy is dependent on the source language. The model of lexical stratification developed in chapter two, section 6, especially the mechanism of constraint relativization

points towards a plausible means of encoding inter-language differences with respect to the choice of copying or epenthesis in a way that does not jeopardize the ranking established in prior discussion. Holding the ranking DEP » INTEGRITY constant, the inter-language difference can be encoded by indexing the appropriate loan faithfulness constraint to the source language. Taking INTEGRITY-SOURCE as the appropriate loan faithfulness constraint it can be indexed to Classical Arabic, English and Hausa. Since English and Hausa are treated in the same way they can be collapsed. The indexed constraints are ranked accordingly to get copying for Arabic loanwords and epenthesis for languages other than Arabic. In this respect the contextual factors that are at work in Classical Arabic are not taken into consideration in setting up the hierarchy. The hierarchy that determines the optimality of copying or epenthesis, depending on the source language, is given in (153).

(153) *Hierarchy for language-dependent syllabic simplification strategy in Nupe*

NOCODA, *COMPLEX, INTEGRITY-SOURCE$_{ENGLISH/HAUSA}$ » DEP » INTEGRITY-SOURCE$_{CLASSICAL\ ARABIC}$, INTEGRITY

In the hierarchy in (153) the syllable structure constraints are undominated. The choice of syllabic simplification strategy is determined by the relative ranking of the INTEGRITY-SOURCE constraints with respect to the anti-insertion constraints. Epenthesis as the optimal choice for syllabic simplification of loanwords from English and Hausa is assured by the ranking INTEGRITY-SOURCE$_{ENGLISH/HAUSA}$ » DEP. On the other hand copying as the optimal choice for the simplification of loanwords from Classical Arabic is assured by the ranking DEP » INTEGRITY-SOURCE$_{CLASSICAL\ ARABIC}$. That copying may

be required in the grammar of Nupe independent of the syllabic simplification of loanwords is guaranteed by the ranking DEP » INTEGRITY.

*10.5 Final summary*

The presence of multiple hiatus resolution strategies in Nupe potentially introduces ranking paradoxes on the view that each hiatus resolution strategy requires a different ranking of the constraints militating against each strategy. The inadequacy of this approach necessitated an alternative approach that integrates universal tendencies with language-particular idiosyncrasies. On this approach the presence of multiple hiatus resolution strategies in natural languages, and the intralinguistic typological variation that this engenders, is adequately accounted for. In the specific case of Nupe, a number of special constraints encoding the peculiarities of Nupe were motivated and deployed accordingly in the hierarchy that was used to account for glide formation as the primary hiatus resolution strategy in the language. The other attested strategies— assimilation and elision—were adequately accounted for without resorting to any rerankings.

Abstracting away from language particular idiosyncrasies a typology of hiatus resolution strategies was set up based on the markedness constraints against heterosyllabic vowel sequences and complex nuclei, and correspondence constraints that monitor input-output mappings. The typology essentially excludes syllable well-formedness constraints and constraints on permissible nuclei in languages as determinants of the choice of strategy that languages make. The typology partitions languages into different grammars with different hiatus resolution strategies available for each grammar type. That a language falls into one grammar class does not imply that only the strategies available in that grammar class are used. In the same vein if a

language exhibits multiple hiatus resolution strategies all the strategies need not be from the same grammar type.

The intralinguistic typological variation that multiple hiatus resolution strategies engender also manifests in the syllabic simplification of loanwords. The choice is between copying and epenthesis with each requiring a different ranking of the same constraints. The variation results from using both strategies in the grammar of Nupe. The choice of strategy was demonstrated to be in part contextually determined, and in part dependent on the source language. As in the discussion of multiple hiatus resolution strategies appropriate constraints were motivated and ranked accordingly in order to preempt the ranking paradoxes that might have otherwise ensued.

# CHAPTER FOUR

# AFFIXATION

## 1. Introduction

This chapter, as different from the preceding chapters, is devoted to a study of Nupe morphology. My goal here is manifold. The first objective is to provide an insight into the phonological and morphological characteristics of major lexical categories of the language (§2). These characteristics are compared with the claims of OT about such categories. In §3, the derivational morphology of Nupe is examined with a view to determining the characteristics and behavior of affixes in the language. Two affix types are distinguished with respect to whether they are segmentally contentful or not. Examples of segmentally contentful affixes are given. The role of correspondence and alignment constraints in their realization is demonstrated. The realization of affixes that are segmentally empty necessitates a model of copying based on the interaction between the insertion-prohibiting constraints discussed in the preceding chapters (§4). Instances of the realization of a number of segmentally empty affixes based on the model are discussed. The implications of this model for the reduplication phenomenon are explored. Gerundial affixation (§5) illustrates an instance of variation in which there is more than one possible optimal output in affixation to certain verb stems resulting in optionality. This, as with other instances of variation examined up to this point, is resolved by deploying a special constraint. Crucial to the account of optionality is that the special constraint is crucially unranked with respect to some constraint in the hierarchy that derives the instances of unique optimal outputs of gerundial affixation. Implications of the suggested approach to optionality for the theory vis-à-vis other proposals in the OT

literature are identified. Other instances of variation occasioned by affixation are discussed in §6.

## 2. Major Lexical Categories

The major lexical categories in Nupe exhibit characteristics that tend to distinguish them from one another. The relevant categories include nouns, adjectives, adverbs, and verbs. These lexical categories can be classified as free morphemes as they have independent existence and do not rely on other morphemes for their realization. I discuss each category in turn.

### *2.1 Nouns*

Nouns in Nupe are minimally disyllabic. The syllable in Nupe can be a syllabic nasal (N), a vowel (V) or a consonant and vowel (CV). Nouns can therefore be of the form N-CV, V-CV or CV-CV, but never N-V. Nouns longer than two syllables can have a recurring sequence of (N)CV (cf. Smith 1967, 1969). Examples of the different noun forms are given in (154).

(154) *Noun types in Nupe*

a. N-CV

| | |
|---|---|
| ǹdá | 'father' |
| ǹná | 'mother' |
| ǹkó | 'King's council' |
| m̀bà | 'feast of mourning' |

b. V-CV

| | |
|---|---|
| èdé | 'cloth' |
| egó | 'grass' |
| egwa | 'hand' |
| egjà | 'blood' |
| èwò | 'shirt' |

c. CV-CV

| | |
|---|---|
| nakã̀ | 'body, meat' |
| nuwã | 'water' |
| bàbò | 'gourd' |
| kata | 'room' |
| kárà | 'fence' |

d. (C)V-(N)-CV-CV

| | |
|---|---|
| eʃìgi | 'dog' |
| emagi | 'mosquito' |
| dàǹgi | 'cat' |
| gbàǹgbá | 'duck' |
| tsèǹkafa | 'rice' |

*2.2 Adjectives*

Nupe adjectives like nouns are minimally disyllabic. Real adjectives are few in the language as several adjectival expressions are realized predicatively. Consequently such predicative adjectives have verbal forms. However the few real adjectives fall into two

classes. The first class comprises attributive adjectives. The second comprises quantitative adjectives. The two are similar in some respects and different in others. I describe the characteristics of each class in turn.

*2.2.1 Attributive adjectives*

Attributive adjectives express the attribute of the noun with which they occur. These adjectives without exception are always consonant-initial. So they are of the form CV-(N)-CV, but never V-CV. In this respect they differ from nouns. Attributive adjectives may describe quality, color, state, size, or shape. Examples are given in (155).

(155) *Attributive adjectives in Nupe*

a. Adjectives of quality and state

| | |
|---|---|
| wáŋ́gi | 'good' |
| dèdè | 'bad' |
| báká | 'sour' |
| jáká | 'peppery' |
| máná | 'sweet' |
| woro | 'new' |
| gbakó | 'old' |

b. Adjectives of size and shape

| | |
|---|---|
| wãtʃíkó | 'big' |
| tétéŋ́gi | 'small' |
| swarwa | 'long (vertical)' |
| kwarwa | 'long (horizontal)' |
| kuru | 'round' |

c. Adjectives of color

| | |
|---|---|
| bòókǔ | 'white' |
| ʒikò | 'black' |
| dzúrú | 'red' |
| dòfa | 'blue' |

*2.2.2 Quantitative Adjectives*

Quantitative adjectives in Nupe differ from the attributive adjectives with respect to whether they can begin with vowels or not. Numerals fall into this class, and they can be V-initial or C-initial. They are also minimally disyllabic. Examples of both types of numerals are given in (156).

(156) *Nupe numerals*

a. V-initial numerals

| | |
|---|---|
| eʃi | 'twenty' |
| árata | 'fifty' |
| ádwáni | 'seventy' |

b. C-initial numerals

| | |
|---|---|
| niní | 'one' |
| gúbà | 'two' |
| gútwàbà | 'seven' |
| gbə̃wó | 'thirty' |
| rudí | thirty-five' |
| kpákó | 'two hundred' |

Some elaboration on the Nupe numeral system is in order. There are few basic numbers in the language. Most numbers are derived by addition, subtraction or multiplication of the few basic numbers. The numbers two through ten have as their first syllable *gú*. This is followed by one or two syllables. The *gú* in these forms is analyzed as a marker of cardinality (Kandybowicz 2000, Kawu 1997). The subsequent syllable(s) is regarded as the root expressing the number meaning. More on the morphology of numerals in sections 3 and 4.

*2.3 Adverbs*

Adverbs are similar to nouns and adjectives in being minimally disyllabic. The difference between adverbs and adjectives and nouns in Nupe is that adverbs are never vowel-initial. A distinguishing characteristic of adverbs is that the final syllable is without exception always *jí*. Examples of adverbs are given in (157).

(157) *Nupe adverbs*

| | |
|---|---|
| sãjí | 'quietly' |
| karají | 'carefully' |
| sárájí | 'aplenty' |
| kájí | 'separately' |

It is plausible to consider *jí* as an adverbial marker. But in the above examples the parts before *jí* are not independent morphemes. In this respect it can be regarded as a frozen morpheme. Its status as an adverbial affix is however borne out by its attaching to adjectives to express adverbial meanings. Examples are given in (158). Literally, the resulting forms are translated as 'in . . . manner'.

(158) *Derived adverbs*

| Adjective | | Adverb | |
|---|---|---|---|
| woro | 'new' | worojí | 'in new manner' |
| dzúrú | 'red' | dzúrújí | 'in red manner' |
| kuru | 'round' | kurují | 'in round manner' |

Summarizing, nouns, adjectives, and adverbs in Nupe consist of two or more syllables. Of these categories only nouns admit of the full range of possible syllable type combinations. In addition, except for numerals, adjectives and adverbs are never vowel-initial. Verbs however present a slightly different picture.

*2.4 Verbs*

The verb as a major lexical category differs from nouns, adjectives, and adverbs by being minimally monosyllabic. According to Smith (1969) the Nupe verb is typified by lack of initial syllabic consonant, and lack of noninitial pre-consonantal nasal consonant as is commonly found in nouns. Other than that, the verb in Nupe is always consonant initial (never vowel-initial), and monosyllabic. Complex verbs are formed from simple monosyllabic verbs, or verbs and nouns. They are minimally disyllabic and maximally quadri-syllabic. I discuss each verb type in turn.

*2.4.1 Simple verbs*

Simple verbs in Nupe are monosyllabic. As with other words in the language, the tone occurring on verbs is distinctive. It is thus possible to have verbs of the same segmental content, but which are differentiated by the occurrence of either high, mid or low tone. Examples of simple verbs are given in (159).

(159) *Nupe simple verbs*

| | | | | | |
|---|---|---|---|---|---|
| tá | 'tell' | tjá | 'be mild' | tã́ | 'hurt' |
| ta | 'chew' | fja | 'drift' | tũ | 'send' |
| tà | 'deceive' | twá | 'trim' | dʒĩ | 'do' |
| gba | 'read' | tswa | 'forge' | pã | 'turn' |
| te | 'break' | tswã́ | 'winnow' | tú | build' |

*2.4.2 Complex verbs*

Complex verbs in Nupe differ from simple verbs in being polysyllabic. According to Smith (1969) polysyllabic verbs may be classified according to the grammatical status and function of their constituent elements. On their grammatical status, the constituents can be free or bound depending on whether they have independent existence or not. As for function, the constituents can be either verbal or nominal. Most polysyllabic verbs may thus consist of a verbal and a nominal element, or two verbal elements, both elements in each case being free forms. Some others may consist of a bound form and a nominal element, a bound form and a verbal element, or a verbal and a bound form. The bound form in each case is so-called, as it does not have independent existence. It is however possible to classify bound forms either as verbal, or nominal depending on whether they occur before (verbal) or after (nominal) the free form. Madugu (1981) however makes the case for regarding one of the bound elements as prepositional. But given the fact that prepositional meanings are expressed in verbal forms in the language, classifying the relevant forms as verbal suffices. There are also verbs with three elements.

These are usually verbal+nominal+verbal. Examples of the various complex verbs are given in (160).

(160) *Nupe complex verbs*

a. Verb-Verb

| | | | |
|---|---|---|---|
| jákpe | ← | já | kpe |
| 'stoop' | | 'bend' | 'cover' |
| bòja | ← | bò | ja |
| 'rescue' | | 'save' | 'lose' |
| taja | ← | ta | ja |
| 'slip' | | 'shift' | 'lose' |
| gògã | ← | gò | gã |
| 'pass, overtake' | | 'receive' | 'surpass' |
| pàdã | ← | pà | dã |
| 'dent' | | 'press' | 'be in' |

b. Verb-Noun

| | | | |
|---|---|---|---|
| gãgwa | ← | gã | egwa |
| 'escape' | | 'surpass' | 'hand' |
| gòmi | ← | gò | emi |
| 'confess' | | 'accept' | 'mouth' |
| patukpa | ← | pa | tukpa |
| 'remind' | | 'remember' | 'ear' |

| | | | | |
|---|---|---|---|---|
| | ʃijé | ← | ʃi | ejé |
| | 'bribe' | | 'buy' | 'eye' |
| | tígí | ← | tí | egí |
| | 'weep' | | 'drip' | 'tear' |

c. Bound Verb-Verb/Noun

| | | | | |
|---|---|---|---|---|
| | fipà | ← | fi | pà |
| | 'pin down' | | ? | 'press down on' |
| | fujèkò | ← | fu | jèkò |
| | 'be cold' | | ? | 'cold' |
| | ʃìkò | ← | ʃì | èkò |
| | 'knock' | | ? | 'fist' |
| | bitʃi | ← | bi | etʃi |
| | 'run' | | ? | 'run' |
| | lotũ | ← | lo | etũ |
| | 'work' | | ? | 'work' |
| | lele | ← | le | ele |
| | 'sleep' | | ? | 'sleep' |
| | kpàwúlélé | ← | kpà | wúlélé |
| | 'ululate' | | ? | 'ululation' |

d. Verb-Bound Verb/Noun

| | | | | |
|---|---|---|---|---|
| | kefi | ← | ke | fi |
| | 'come upon' | | 'hit' | ? |

| | | | | |
|---|---|---|---|---|
| wulu | ← | wu | elu | |
| 'beat' | | 'beat' | ? | |
| badà | ← | ba | edà | |
| 'stalk' | | 'cut' | ? | |

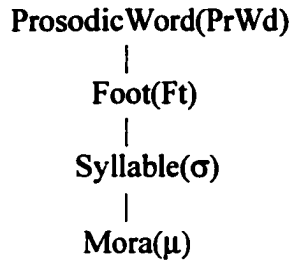
e. Verb-Noun-Verb

| | | | | |
|---|---|---|---|---|
| támidã | ← | tá | emi | dã |
| 'greet' | | 'stretch' | 'mouth' | 'be in' |
| lámitú | ← | lá | emi | tú |
| 'follow' | | 'take' | 'mouth' | 'ride' |

The distinguishing characteristics of the major lexical categories of Nupe can be replicated across the languages of the world, such that lexical items have phonological peculiarities that mark their membership of a given lexical category. The characteristics are not necessarily the same for these languages. Nonetheless the notable features of verbs and nouns in Nupe are characteristic of several Benue-Congo languages of West Africa. Thus in languages such as Yoruba, Gengbe, Ewe, to mention but a few, simple verbs are monosyllabic, always consonant-initial, and never vowel initial, while nouns may be consonant-initial or vowel-initial, and except for Ewe (cf. Abaglo and Archangeli 1989), minimally disyllabic.

The prosodic theory of minimality (McCarthy & Prince 1986 *et seq.*) explores the idea that templatic restrictions be defined in terms of prosodic units. The prosodic hierarchy that evolved following work by Selkirk (1980ab) is as in (161).

(161) Prosodic Hierarchy




The hierarchy in (161) builds higher units out of lower ones, and thus imposes constraints on the higher units. In this regard the metrical foot is defined with respect to moras and syllables, and is constrained by these lower units. Consequently a foot is required to be binary, syllabically or moraically. A constraint to this effect is formulated as in (162).

(162) FOOT BINARITY (cf. McCarthy & Prince 1993b)

Feet must be binary under syllabic or moraic analysis.

According to McCarthy and Prince (1993b) the hierarchy (161) and the constraint (162) combine to define the Minimal Word (Broselow 1982, McCarthy & Prince 1986 *et seq.*, Prince 1980). The Prosodic Hierarchy requires a Prosodic Word to contain at least a Foot, while FOOT BINARITY requires a Foot to be bimoraic or disyllabic. Hence a Prosodic Word must contain at least two moras or syllables. Word minimality restrictions thus follow from the requirement that a morphological unit, stem or lexical word, should correspond to a Prosodic Word. On this view major lexical categories such as nouns, adjectives, adverbs and verbs should meet this condition. As it turns out the condition is met by Nupe nouns, adjectives, and adverbs, but not by verbs that are basically monosyllabic. Prince and Smolensky (1993) argue against a constraint on the minimal word. Instead the effects of minimality are derived from (162) and a phonology-morphology interface constraint. Such a constraint is one that requires a morphological

category to correspond to a phonological category. The relevant constraint is as in (163).

(163) LX ≈ PR (Prince & Smolensky 1993)

Every Lexical Word must correspond to a Prosodic Word.

Nouns, adjectives, and adverbs in Nupe adhere to LX ≈ PR, but verbs do not. That subminimal verbs are not augmented to bimoraicity or disyllabicity as has been observed to be the case in some languages with subminimal input stems or lexical words (cf. McCarthy & Prince 1993b, Prince & Smolensky 1993 for Axininca Campa, Lardil, Diyari, and Yidiŋ) is a consequence of constraint interaction. The constraint interaction necessary to have the subminimal outputs emerge as optimal is one in which constraints against any form of augmentation are ranked above LX ≈ PR as in (164). The ranking is illustrated in the tableau in (165). Though the ranking DEP » INTEGRITY is not crucial for the computation of optimality in this case, it has been independently established in earlier chapters.

(164) *Ranking for the optimality of subminimal verbs in Nupe*

MAX, DEP » INTEGRITY » LX ≈ PR

(165) *Tableau for the optimality of subminimal verbs in Nupe*

| Input: bé$_{VERB}$ | MAX | DEP | INTEGRITY | LX ≈ PR |
|---|---|---|---|---|
| a. ⟨bé⟩ | *! | | | |
| b. béi | | *! | | |
| c. béhi | | * *! | | |
| d. bée | | | *! | |
| e. bébe | | | * *! | |
| f. ☞ bé | | | | * |

In (165) the input verb is monosyllabic, and hence subminimal. Candidate (a) is an underparsing of the input, as it is subminimal. This vacuously satisfies LX ≈ PR but fatally violates MAX. Candidates (b) and (c) augment the input to bimoraicity and disyllabicity respectively via epenthesis, satisfying LX ≈ PR, but fatally violating DEP.

The same is true of candidates (c) and (d) with an extra mora and syllable added by copying. This results in fatal violations of INTEGRITY with LX ≈ PR satisfied. The optimal candidate (d) faithfully realizes the subminimal verb as monosyllabic. It satisfies all other constraints but violates LX ≈ PR. Given the low ranking of the constraint this violation has no fatal consequence. Verbs are thus the only major lexical items in Nupe that do not conform to the minimality condition.

The fact that all categories may be C-initial may follow from the general requirement on syllable well-formedness to the effect that a syllable must have an onset. But given the abundance of vowel-initial words in the language the ONSET constraint ranks very low in the grammar of Nupe. That these vowel-initial words are not supplied with an onset can be attributed to the same constraint interaction that prevents augmentation of subminimal verbs (cf. 164) with ONSET replacing LX ≈ PR in the hierarchy as in MAX, DEP » INTEGRITY » ONSET. Alternatively, it can be said that nominals are prone to ONSET violations than other lexical categories. Nonetheless the constraint interaction assures that input vowel-initial nominals and single vowel inputs as in syntactically bound forms are not supplied with an onset.

The foregoing gives an insight into the characteristics of major lexical categories in Nupe. While nouns, adjectives, and adverbs conform to the claims of OT about lexical words to the effect that they must correspond to prosodic words, verbs do not. While all categories may satisfy ONSET, nouns and adjectives do violate it. Inputs from these lexical categories are not modified to satisfy the constraints. This is due to the low ranking of the constraints relative to faithfulness correspondence constraints. I discuss affixes and their characteristics next.

## 3. Affixes

Affixes like the major lexical categories examined in the preceding section have semantic content. They however differ from the lexical categories in lacking independent existence. They are bound forms and their occurrence depends on the occurrence of the free forms. Two functional classes of affixes are distinguished: inflectional and derivational. Nupe is not an inflectional language, and so rarely makes use of inflectional affixes. On the other hand it makes use of a lot of derivational affixes. The major lexical categories serve as stems for the realization of the affixes. Some affixes are segmentally contentful while others are not. Both affixes have other phonological properties that determine their eventual realization. The difference is that segmentally empty affixes depend on the host stem for their realization with respect to their phonological content. Other inherent properties of the affixes determine their ultimate output. Some examples of segmentally contentful affixes are discussed next.

### *3.1 Plural affix*

The plural affix is the only Nupe affix that can be plausibly regarded as an inflectional affix. It is realized as *ʒì*. In addition to its segmental and tonal content the plural affix can be characterized by its prosodic shape (CV), choice of host stem, and locus of affixation. For the choice of host stem, the plural affix can only meaningfully occur with count nouns and adjectives that may function as nouns. As for locus of affixation, it occurs to the right of the host stem; it is a suffix. It may however not occur closest to the noun that it pluralizes. The following examples show the characteristics of the plural affix. In the examples *nana* 'this' is a determiner while the discontinuous *na . . . na* 'that' is a complementizer.

(166) *Plural affixation*

a. Noun pluralization

| Noun | | Plural | |
|---|---|---|---|
| ǹdá | 'father' | ǹdá-ʒì | 'fathers' |
| ewa | 'snake' | ewa-ʒì | 'snakes' |
| dòkò | 'horse' | dòkò-ʒì | 'horses' |
| dòkò nana | 'this horse' | dòkò nana-ʒì | 'these horses' |
| dòkò bòókũ̀ | 'white horse' | dòkò bòókũ̀-ʒì | 'white horses |
| dòkò na sà na | 'the pretty horse' | dòkò na-ʒì sà na | 'the pretty horses' |

b. Adjective pluralization

| Adjective | | Plural | |
|---|---|---|---|
| wáńgi | 'good' | wáńgi-ʒì | 'good ones' |
| woro | 'new' | woro-ʒì | 'new ones' |
| dzúrú | 'red' | dzúrú-ʒì | 'red ones' |
| tétéńgi | 'small' | tétéńgi-ʒì | 'small ones' |
| kuru | 'round' | kuru-ʒì | 'round ones' |
| jèkò | 'cold' | jèkò-ʒì | 'cold ones' |

c. Impossible pluralization

| | | |
|---|---|---|
| ǹdá | 'father' | *ʒì-ǹdá |
| esã̀ | salt | *esã̀-ʒì |

| | | |
|---|---|---|
| gúbà | 'two' | *gúbà-ʒì |
| sãjí | 'quietly' | *sãjí-ʒì |
| ta | 'chew' | *ta-ʒì |
| jákpe | 'stoop' | *jákpe-ʒì |

The examples in (166c) show that the plural morpheme cannot meaningfully occur as a prefix, may not occur with non-count nouns, cannot occur with quantitative adjectives, adverbs, and verbs.

*3.2 Nominal affix*

The Nupe nominal affix is realized as *è*. It is prosodically a V, its host stem is a verb, and it occurs to the left of its host stem, and thus a prefix. It is one of the few prefixes in the language. Examples of its occurrence are given in (167). These examples are constrained by the fact that not all verbs can be meaningfully nominalized, and the nominal prefix occurs with a limited number of verbs.

(167) *Nominal affixation*

| Verb | | Noun | |
|---|---|---|---|
| bo | 'be tired' | è-bo | 'tiredness, fatigue' |
| fă | 'rest' | è-fă | 'holiday' |
| ge | 'be good, be pretty' | è-ge | 'prettiness, beauty' |
| gbè | 'hunt' | è-gbè | 'hunting' |
| má | 'be sweet' | è-má | 'sweetness, pleasure' |
| rwa | 'pour' | è-rwa | 'funnel' |
| sà | 'be pretty' | è-sà | 'beauty' |
| só | 'hide' | è-só | 'hideaway' |

| | | | |
|---|---|---|---|
| tã́ | 'hurt' | è-tã́ | 'pain' |
| ʒè | 'answer' | è-ʒè | 'response' |

The verbs that can be nominalized by *è* for the most part are simple verbs. There are no complex verbs of any type that *è* can be meaningfully prefixed to. But there are other processes for deriving nominals from verbs. This is the subject of §4 below.

*3.3 Place of origin affix*

The place of origin affix *ʧî* is used to describe persons from a named place. Its host stem is thus always a place name. It is a suffix as it occurs to the right of the host stem. Examples are given in (168).

(168) *Place of origin affixation*

| Place | Person | |
|---|---|---|
| Láfìàgi | Láfìàgi-ʧi | 'one from Lafiagi' |
| Pátígi | Pátígi-ʧi | 'one from Patigi' |
| Bîdă | Bîdă-ʧi | 'one from Bida' |
| Likpàta | Likpàta-ʧi | 'one from Likpata' |
| New Brunswick | New Brunswick-ʧi | 'one from New Brunswick' |
| Highland Park | Highland Park- ʧi | 'one from Highland Park' |
| Franklin Park | Franklin Park-ʧi | 'one from Franklin Park' |

*3.4 Agentive affix*

The agentive affix is homophonous with the place of origin affix. It is also *ʧî*. Its host stem is usually nominals. There are two kinds of nominals that the agentive affix can

occur with. Though the nominals may have different sources, they have the same structure, and it is this kind of structure that the agentive affix can meaningfully attach to. The first nominal type has as source a verb phrase consisting of a transitive verb followed by a noun. The agentive does not attach to the verb phrase as it is. Instead the verb and the noun are inverted resulting in a nominal. It is to this nominal that the agentive is suffixed. This process of agentive affixation is illustrated in (169).

(169) *Agentive affixation to nominals derived by verb-complement inversion*

| Verb Phrase | Nominal | Agentive |
|---|---|---|
| pá eja | ejapá | ejapá-tʃi |
| 'paddle a canoe' | 'canoe-paddling' | 'canoe paddler' |
| pá mátò | mátòpá | mátòpá-tʃi |
| 'drive a car' | 'car-driving' | 'driver' |
| wã jikã | jikãwã | jikãwã-tʃi |
| 'catch fish' | 'fish-catching' | 'fisherman' |
| wò kútí | kútíwò | kútíwò-tʃi |
| 'worship idol' | 'idol-worshipping' | 'idol worshipper' |
| pa ebà | ebàpa | ebàpa-tʃi |
| 'look after a place' | 'place-watching' | 'watchman, guard' |

The other instance of agentive affixation is to nominals derived by noun-verb inversion of complex verbs of the form verb-noun. Complex verbs of the type form nominals by inverting the verbal and nominal elements (cf. Madugu 1981, Smith 1969). Though the complex verbs consist of a verb followed by a noun, they usually express a

verb meaning unlike the forms in (168) where the noun is a complement of the verb. Examples of agentive affixation of nominals derived from complex verb inversion are given in (170). The nominal elements in the complex verb may have the nominal prefix *e* that has been deleted in forming the complex verb. The prefix surfaces in the inverted nominal. The tone of the prefix is either low or mid depending on its tone in the noun that forms the complex verb.

(170) *Agentive affixation to nominals derived by inversion*

| Complex Verb | Nominal | Agentive |
|---|---|---|
| bagwa | egwaba | egwaba-tʃi |
| 'be stingy' | 'stinginess' | 'miser' |
| bili | elibi | elibi-tʃi |
| 'be wicked' | 'wickedness' | 'wicked person' |
| bitʃi | etʃibi | etʃibi-tʃi |
| 'run' | 'running' | 'runner' |
| tʃèwò | èwòtʃè | èwòtʃè-tʃi |
| 'trade' | 'trading' | 'trader' |
| gũ̀kũ | ekũgũ̀ | ekũgũ̀-tʃi |
| 'fight' (war) | 'fighting' | 'warrior' |
| kóni | enikó | enikó-tʃi |
| 'sing' | 'singing' | 'musician' |
| lotũ | etũlo | etũlo-tʃi |
| 'work' | 'working' | 'worker' |

| | | |
|---|---|---|
| nùnu | enunù | enunù-tʃi |
| 'farm' | 'farming' | 'farmer' |
| ʃìdzò | èdzòʃì | èdzòʃì-tʃi |
| 'precede' | 'preceding' | 'leader' |
| dájàtʃi | jàtʃídá | jàtʃídá-tʃi |
| 'fornicate' | 'fornication' | 'fornicator, adulterer' |

*3.5 Ordinal affix*

The Nupe numerals 2-10 have *gú* as the first syllable. This is followed by one or two other syllables. Kawu (1997) regards *gú* as the cardinal prefix and the following syllable(s) as the numeral root. Kandybowicz (2000) proposes a semantics of Nupe numerals to the effect that *gú* functions to establish cardinality while the numeral root functions to instantiate cardinality. The numeral root as instantiation of cardinality is predicated on the fact that in ordinals the numeral root is retained and the ordinal affix is attached to it. Ordinals do not occur with the *gú* prefix. The ordinal affix is again homophonous with both the place of origin and agentive affixes. It is realized as *tʃi*, and it also attaches to the right of the host stem. The cardinals and corresponding ordinals are given in (171).

(171) *Nupe cardinals and ordinals*

| Cardinal | | Ordinal | |
|---|---|---|---|
| niní | 'one' | *niní-tʃi | |
| gú-bà | 'two' | bà-tʃi | 'second' |
| gú-tá | 'three' | tá-tʃi | 'third' |

| | | | |
|---|---|---|---|
| gú-ni | 'four' | ni-tʃi | 'fourth' |
| gú-tsũ | 'five' | tsũ-tʃi | 'fifth' |
| gú-tswã̀jì | 'six' | tswã̀jì-tʃi | 'sixth' |
| gú-twàbà | 'seven' | twàbà-tʃi | 'seventh' |
| gú-totá | 'eight' | totá-tʃi | 'eighth' |
| gú-twã́ni | 'nine' | twã́ni-tʃi | 'ninth' |
| gú-wo | 'ten' | *wo-tʃi | |

It is obvious from (171) that neither the cardinal or ordinal affix occurs with the number 'one'. The form for the ordinal 'first' is either *farko* or *mafari*, both of which are loanwords from Hausa. Another characteristic of the cardinal affix is that it occurs more only with 'two to ten'. No other numbers in the language begin with *gú* except those that combine any of these other numbers. On the other hand the ordinal affix commonly occurs with 'two to nine'. It rarely occurs with numbers greater than 'nine'. Instead the ordinality of numbers greater than nine can be expressed with the general formula in (172). Some instantiations of the formula are given. In the examples below hiatus is resolved in accordance with the patterns in the preceding chapter.

(172) *Ordinality of n ≥ 10*

| | | | | |
|---|---|---|---|---|
| na | be | a | *x* | na (where *x* = n): |
| Comp | add | them | n | Comp |
| 'that makes them n' | | | | |
| na be a gúwo na | | | | 'tenth' |
| na be a·ɛ̀ʃi na | | | | 'twentieth' |

na be a kpákó na 'two hundredth'

### *3.6 Diminutive and augmentative affixes*

The diminutive and augmentative affixes in Nupe are *gi* and *kó* respectively. Both affixes may attach to nouns to instantiate a smaller or larger version of the noun. They are suffixal. Not every free form may have both a diminutive and augmentative version. In these cases the free form may be regarded as generic and inherently diminutive. Examples of the various possibilities are given in (173).

(173) *Diminutive and augmentative affixation*

| Noun | | Diminutive | | Augmentative | |
|---|---|---|---|---|---|
| ǹdá | 'father' | ǹdá-gi | 'uncle' | ǹdá-kó | 'grandfather' |
| ǹná | 'mother' | ǹná-gi | 'aunt' | ǹná-kó | 'grandmother' |
| ena | 'flesh' | (e)nan-gi | 'goat' | (e)nan-kó | 'cow' |
| ewa | 'snake' | | | (e)wan-kó | 'python' |
| biʃebá | 'cockrel' | | | biʃebá-kó | 'cock' |
| èbi | 'knife' | | | èbi-kó | 'sword' |

The discussion of the various affixes of Nupe in this section reveals a number of characteristics associated with the affixes with respect to their segmental composition, tone, prosodic shape, locus of affixation, and stems that they may occur with. The discussion of affixation in the OT literature is mainly concerned with the locus of affixation (McCarthy and Prince 1993a). McCarthy and Prince's theory of Generalized Alignment captures the alignment of the edges of prosodic and grammatical (morphological or syntactic) categories with one another. In the morphological domain the relevant alignment parameter is one that aligns affixes to morphological categories

(Stem or Root). In this regard affixes can be characterized as prefixes or suffixes. Infixation results from phonological considerations taking precedence over morphological considerations. Each of the affixes considered in Nupe can be characterized with respect to its being a prefix or suffix. But locus of affixation is just one characteristic of the affixes. The choice of host stem can be built into the formulation of the alignment constraint for each affix. In this respect the following alignment constraints encode the characteristics of the segmentally contentful affixes in the preceding sections. Each affix is subscripted with its semantic content.

(174) *Alignment constraints on Nupe segmentally contentful affixes*

a. Plural affix

ALIGN([ʒi]$_{\text{PLURAL}}$, L, STEM$_{\text{NOM}}$, R)

The plural affix *ʒi* is aligned with the right edge of a nominal stem.

b. Nominal affix

ALIGN([è]$_{\text{NOM}}$, R, STEM$_{\text{VERB}}$, L)

The nominal affix *è* is aligned with the left edge of a verb stem.

c. Place of origin affix

ALIGN([ʧĩ]$_{\text{PLACE OF ORIGIN}}$, L, STEM$_{\text{PLACE}}$, R)

The place of original affix *ʧĩ* is aligned with the right edge of a place stem.

d. Agentive affix

ALIGN([ʧĩ]$_{\text{AGENTIVE}}$, L, STEM$_{\text{VOC}}$, R)

The agentive affix *ʧĩ* is aligned with the right edge of a vocation stem.

e. Ordinal affix

ALIGN([*tʃĩ*]$_{\text{ORDINAL}}$, L, ROOT$_{\text{NUM}}$, R)

The ordinal affix *tʃĩ* is aligned with the right edge of a numeral root.

f. Diminutive affix

ALIGN([*gi*]$_{\text{DIMINUTIVE}}$, L, STEM$_{\text{NOUN}}$, R)

The diminutive affix *gi* is aligned with the right edge of a noun stem.

g. Augmentative affix

ALIGN([*kó*]$_{\text{AUGMENTATIVE}}$, L, STEM$_{\text{NOUN}}$, R)

The augmentative affix *kó* is aligned with the left edge of a noun stem.

The alignment constraints identify the affixes by their segmental composition, semantic content, locus of affixation (prefix or suffix), and choice of host stem. The prosodic size of each affix is a factor of its segmental composition. In order for all characteristics of an affix to be realized when it attaches to a stem, correspondence constraints regulate the input and the output. The relevant correspondence constraints are MAX and IDENT. The ranking between the relevant alignment constraint and the correspondence constraints is not crucial for the output of affixation of segmentally contentful affixes. But forms that do not comply with all the constraints are not optimal outputs. The constraint hierarchy for the realization of segmentally contentful affixes is as in (175). The alignment constraint in the hierarchy can be instantiated for each affix. I illustrate the hierarchy in (175) for two affixes in (176).

(175) *Hierarchy for the realization of segmentally contentful affixes*

ALIGN, MAX, IDENT

(176) *Illustrative tableaux for the realization of segmentally contentful affixes*

a. *Tableau for nominal affixation*

| Input: è + fá | ALIGN([*è*]$_{NOM}$, R, STEM$_{VERB}$, L) | MAX | IDENT |
|---|---|---|---|
| a. fá | | *! | |
| b. é-fá | | | *! |
| c. fá-è | *! | | |
| d. ☞ è-fá | | | |

b. *Tableau for augmentative affixation*

| Input: èbi + kó | ALIGN([*kó*]$_{AUGMENTATIVE}$, L, STEM$_{NOUN}$, R) | MAX | IDENT |
|---|---|---|---|
| a. èbi | | *! | |
| b. èbi-gó | | | *! |
| c. kó-èbi | *! | | |
| d. ☞ èbi-kó | | | |

In the tableau in (176) the (a) candidates that fail to realize the affix incur fatal violations of MAX. The (b) candidates are not identical to the input. In (175a) the output tone of the affix is not identical to the input tone, hence a fatal violation of IDENT. In (175b) there is a change of identity to a segment of the affix. Any changes to the input specification of the affix thus result in violations of IDENT. The (c) candidates satisfy MAX and IDENT, but align the affix with the wrong edge of the stem. This results in fatal violations of the alignment constraint. The (d) candidates with all input elements realized in the output, all output elements identical to the input, and the affixes aligned with the proper edge satisfy all constraints, and are thus optimal. Though the constraint hierarchy does not involve any domination relations, it illustrates the role of alignment and correspondence constraints in the realization of segmentally contentful affixes. These constraints are crucial for the realization of segmentally empty affixes.

The affixes examined thus far have, in addition to other characteristics, segmental content. They differ from other affixes that do not have segmental content. The affixes that lack segmental content may however have other characteristics comparable with

those that have segmental content. Before examining affixes that lack segmental content and the role of alignment and correspondence constraints in their realization, it is appropriate to consider a model that mediates the realization of segmentally empty affixes.

## 4. A Model for the Realization of Segmentally Empty Affixes

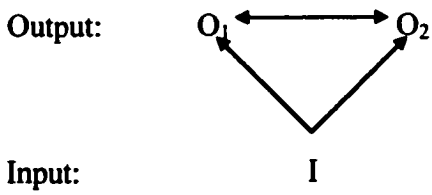
In previous work (Kawu 1998, 2000c) I distinguished two kinds of copying—reduplicative copying and nonreduplicative copying. Each kind of copying is motivated differently. It was demonstrated in Kawu 2000c that nonreduplicative copying is phonologically motivated. The instances of consonant copying to improve structural markedness in Yoruba gerundial affixation (chapter 2, section 5), vowel copying for syllabic simplification of loanwords from Classical Arabic in Nupe (chapter 2, section 4; chapter 3, section 10), glide insertion as word-internal hiatus resolution strategy in Classical Arabic loanwords in Nupe (chapter 3, section 7), and glide insertion as hiatus resolution strategy in Indonesian (chapter 3, section 10) are all phonologically motivated. They are thus cases of nonreduplicative copying. Reduplicative copying on the other hand is morphologically motivated. It occurs when a morpheme lacking segmental content is realized as a copy of the stem to which it attaches. This is the more familiar pattern of copying that has been discussed in the literature as reduplication.

The distinction between phonological (nonreduplicative) and morphological (reduplicative) copying has been made in the literature (cf. Rose 1997, Smith 1998, Ussishkin 1999, among others) and there are differences of opinion as to how they should be related, if at all. Smith (1998) suggests that they should be kept separate. Gafos (1998) on the other hand suggests that nonreduplicative copying be reduced to reduplicative

copying, a recognition of the need to unify the two kinds of copying. Kawu (1998, 2000c) shares the unification view of Gafos, albeit in a different direction—accounting for reduplicative copying with the mechanisms for nonreduplicative copying. A major point of difference from Gafos' suggestion is that unlike cases of reduplicative copying, the presence of a reduplicative morpheme in instances of nonreduplicative copying cannot be plausibly motivated. The proposal in Kawu (1998, 2000c) for unifying nonreduplicative and reduplicative copying crucially depends on the interaction between the insertion-prohibiting constraints DEP and INTEGRITY. In the cases of copying to improve structural markedness noted in the above paragraph and demonstrated at relevant sections in the preceding chapters the choice is between epenthesis and copying. Epenthesis is due to the ranking INTEGRITY » DEP, while copying is due to the ranking DEP » INTEGRITY. The same choices are available for the realization of segmentally empty affixes. They can be realized either as unmarked segments (epenthesis), or as a copy of the host stem (copying). The greater tendency in natural languages is copying, hence reduplication and its place in prosodic morphology theory.

Since INTEGRITY prohibits multiple output correspondents, and nonreduplicative and reduplicative copying involve multiple output correspondents of an input, a unified model of copying appropriately referred to as the Integrity Model of Copying (IMC) is proposed to account for both phonologically and morphologically motivated copying. The IMC is as diagrammatically represented in (177).

(177) *Integrity Model of Copying*




The IMC as sketched in (177) captures the fact that the input (I) has at least two correspondents in the output ($O_1$, $O_2$), there may be more depending on the situation at hand. But for exposition purposes two correspondents suffice. The IMC immediately raises the issue of correspondence relations between the input and the multiple outputs on one hand, and between the multiple outputs on the other. In accordance with standard Correspondence Theory (McCarthy & Prince 1995), *I* stands in an input-output relation with both $O_1$ and $O_2$. In effect any constraint that regulates the input-output relation can be assessed with respect to either output, if not both. A correspondence relation also exists between $O_1$ and $O_2$. All the correspondence relations instantiated by the IMC are captured by the formulation in (178).

(177) *Correspondence in Multiple Outputs*

For any element $x \in S_1$, and y and $z \in S_2$, if $x\Re y$ and $x\Re z$, then $y\Re z$.

If the *x-y* or *x-z* relation can be stated as IO correspondence, the multiple outputs notwithstanding, an obvious way of stating the *y-z* relation is as OO correspondence. However stating the *y-z* relation as such potentially confuses this with OO correspondence (Benua 1995, 1997). OO correspondence mediates a special type of IO relation where I is the output of some input, which in turn serves as input for another output. The original output and the latter output are mediated by Output-Output correspondence. This is not the case with the model in (177), the input simultaneously

corresponds to the multiple outputs, and the multiple outputs correspond to each other. The *y-z* relation thus needs to be stated differently in order to avoid a confusion of terminology. I characterize this relation as Multiple Output Correspondence (MO-Correspondence). IMC thus admits of IO-Correspondence and MO-Correspondence. The implications of these relations vis-à-vis the reduplication phenomenon are explored in §5 below.

The model sketched in (177) parallels McCarthy and Prince's (1995) Full Model of reduplication that recognizes Base-Reduplicant (BR), Input-Output (IO), and Input-Reduplicant(IR) correspondence. For this reason $O_1$-$O_2$, I-$O_2$, and I-$O_1$ may be regarded as corresponding respectively to these relations. There are however crucial differences between both models. I return to this issue in §5.

It is important to make another distinction before demonstrating how IMC mediates the realization of segmentally empty affixes. In instances of nonreduplicative copying examined in the preceding chapters, copying is purely phonological and no affixes are involved. Instances of reduplicative copying to be looked at shortly involve affixes. For this reason I characterize nonreduplicative copying as *nonaffixal copying*, and reduplicative copying as *affixal copying*. This characterization is necessary to capture the standard account of reduplication in which the input morpheme is described as RED, and other instances involving morphemes that source segmental material from neighboring forms but do not come under the purview of reduplication as RED cannot be plausibly motivated in such cases. In this respect all morphemes whose segmental content is dependent on other forms are affixal. Consequently, their realization is mediated by IMC, and other inherent, that is, underlying, properties that they may have.

The DEP-INTEGRITY interaction by itself is not sufficient to account for affixal copying. The relevant alignment and other correspondence constraints used to account for the realization of segmentally contentful affixes enter into the interaction in order to determine the ultimate output of segmentally empty affixes. I discuss a number of segmentally empty affixes the sections that follow.

*4.1 Numeric universal affix*

The numeric universal affix is segmentally empty, but its characteristics are discernible from its realization as a copy of the numeral to which it attaches. The resulting form has the meaning 'all *n*'. Examples of numeric universal affixation are given in (179).

(179) *Numeric universal affixation*

| Numeral | | Universal | |
|---|---|---|---|
| gúbà | 'two' | gú-**bà**-bà | 'both'/'all two' |
| gútá | 'three' | gú-**tà**-tá | 'all three' |
| gúni | 'four' | gú-**nì**-ni | 'all four' |
| gútsũ | 'five' | gú-**tsǜ**-tsũ | 'all five' |
| gúwo | 'ten' | gú-**wò**-wo | 'all ten' |

The examples in (179) exhaust the possible occurrence of the numeric universal affix. They reveal the characteristics of the affix. It is monosyllabic (CV), has a low tone, is a prefix, it circumscribes the cardinal prefix *gú* and attaches to the numeral root from which it takes its segmental content. Alternatively, it is plausible that the tone of the universal affix is fixed as HL with the H merging with the H of the cardinal prefix *gú*, the L replaces the tone of the numeral root, and the affix is realized to the right of the numeral root, making it a suffix. The tone of the numeral root is then realized on the

affix. In this regard the form for 'all three' will be *gútà-tá*. Whichever analysis is adopted, the ultimate output of the affix is a function of its inherent characteristics. For the present purposes I regard the numeric universal affix as a prefix, though it has the appearance of an infix. This is because it is aligned with the left edge of the numeral root. Observe that the numeral root in all the examples are monosyllabic, just like the affix. When the numeral root is disyllabic or the numeral is realized as two syllables or more without the cardinal affix, the affix cannot meaningfully occur with it. Instead the universal quantifier *kpáátá* 'all' is used with such numerals. Examples of numeric universal of such numerals are given in (180).

(180) *Numeric universal of polysyllabic numerals*

| Numeral | | | Universal | |
|---|---|---|---|---|
| gútwàbà | 'seven' | ***gútwà**-twàbà | kpáátá gútwàbà | 'all seven' |
| gútotá | 'eight' | ***gútò**-totá | kpáátá gútotá | 'all eight' |
| kpákó | 'two hundred' | ***kpà**-kpákó | kpáátá kpákó | 'all two hundred' |
| árata | 'fifty' | ***árà**-rata | kpáátá árata | 'all fifty' |

In (180) the numerals 'seven' and 'eight' have the same prefix-root structure as those in (179), the difference being that the numeral root is disyllabic. Since the affix targets the instantiation of the numeral and this is disyllabic, targeting half of it is ungrammatical. For 'two hundred' with no prefix-root structure, there is no prefix to circumscribe. Copying part of the instantiation of the number is again ungrammatical. 'Fifty' like 'two hundred' does not have a prefix-root structure but it is V-initial. Since the affix is CV, it might target the first such syllable, hence circumscribing the initial V. Since the number is instantiated as three syllables, the monosyllabic numeric universal affix cannot

grammatically occur with such forms. The restrictions observed for the numeric universal affix, a segmentally empty affix, are instantiated, even if differently, for other segmentally empty affixes. The same is true for the lexical categories that occur as free forms and segmentally contentful affixes.

The numeric universal affix serves to illustrate the relevant issues that define the reduplicative phenomenon. Reduplicative affixes differ from nonreduplicative affixes in not having any segmental specification. As McCarthy and Prince (1993a) observe, reduplicative affixes are unspecified and are realized as the phonological elements associated with them in the output. It is pertinent to add that these may be regulated by other factors in a way that what is valid for phonologically contentful affixes is also true for phonologically empty affixes. In this respect segmentally empty affixes can be characterized in terms of the locus of affixation, prosodic shape, and choice of host stem. As with segmentally contentful affixes some of these characteristics can be encoded in an alignment constraint. The difference between the two types is that for a segmentally empty affix, the affix is identified by its semantic content, while its inherent properties are subscripted to this identification. For the numeric universal affix the relevant alignment constraint is as in (181).

(181) ALIGN([NUMERIC UNIVERSAL]$_{\sigma}$, R, ROOT$_{NUM}$, L)

The low-toned syllable numeric universal affix is aligned with the left edge of the numeral root.

The constraint (181) interacts with correspondence constraints to determine the output realization of numeric universal affixation. The relevant interaction is as in (182). The ranking is illustrated in the tableau in (183).

(182) *Ranking for numeric universal affixation*

ALIGN([NUMERIC UNIVERSAL]$_{\sigma}$, R, ROOT$_{NUM}$, L), MAX, IDENT, DEP »

INTEGRITY

(183) *Tableau for numeric universal affixation*

| Input: gútá + NUMUN$_{\sigma}$ | ALIGN([NUMERIC UNIVERSAL]$_{\sigma}$, R, ROOT$_{NUM}$, L), | MAX | IDENT | DEP | INTEGRITY |
|---|---|---|---|---|---|
| a. gú-tá | | *! | | | |
| b. gú-hì-tá | | | | * *! | |
| c. **gù**-gú-tá | *! | | | | * * |
| d. gú-tá-**tà** | *! | | | | * * |
| e. **tà**-gútá | *! | | | | * * |
| f. gú-**tá**-tã | | | *! | | * * |
| g. gú-**tàtà**-tá | *! | | | | * * * * |
| h. ☞ gú-**tà**-tá | | | | | * * |

In (183) the input consists of the numeral *gútá* and the numeric universal affix. The numeric universal does not have any segmental content. It is however specified as a low-toned syllable. Candidate (a) fails to realize the affix. This results in an input element lacking a correspondent in the output. The fatal violation of MAX makes this candidate suboptimal. In a broad sense, then, MAX assures that the affix has a correspondent in the output. Since the affix lacks segmental content it may be realized as unmarked segments as in candidate (b). But the segments lack input correspondents resulting in fatal violations of DEP. The other possibility for the realization of the affix is as a copy of input segments. This is the case with candidates (c-h). Since the segments are already in the input, DEP is satisfied. However the inputs have multiple correspondents in the output resulting in violations of INTEGRITY. But given that it is low-ranking the violations are not fatal. Thus any of the candidates (c-h) can be optimal. That not all of them are optimal is a factor of the characteristics of the numeric universal affix as specified in the

input and encoded in the alignment constraint. Candidate (c) realizes the affix as a copy of the cardinal prefix *gú*. But since *gú* is not the instantiation of the numeral and the affix targets the numeral root it is suboptimal. Candidate (d) realizes the affix as a copy of the numeral root, but places it to the right of the root as a suffix. Since the affix is a prefix, the candidate fatally violates the alignment constraint. Candidate (d) avoids this violation by realizing the affix to the left of the host stem with all its other properties. But this is not aligned with the numeral root, a fatal violation of the alignment constraint. Candidate (e) avoids this violation by having the affix aligned to the root. It however realizes the affix on a high tone instead of its inherent low tone. This leads to a fatal violation of IDENT. Candidate (g) realizes the affix as disyllabic. This does not conform to the monosyllabic specification of the affix, hence the fatal violation of the alignment constraint. Compared to other candidates, candidate (g) incurs additional violations of INTEGRITY. The optimal candidate (h) realizes the affix as a copy of the numeral root, on a low tone, as a prefix to the numeral root, and as monosyllabic. This satisfies all constraints, but violates INTEGRITY since the input segments have multiple output correspondents.

The above discussion is representative of the constraint interaction that is required for the realization of segmentally empty affixes. In subsequent discussion I identify other segmentally empty affixes and the characteristics that determine their eventual output realization as evident from the data. I point out important differences between the affixes. The realization of the affixes as copies of the stem to which they attach is confirmation that the ranking DEP » INTEGRITY is operative in the grammar of Nupe as demonstrated

in the use of copying for the syllabic simplification of loanwords from Classical Arabic discussed in the preceding chapters.

*4.2 Numeric distributive affix*

Numerals exhibit a second instance of affixal copying. This involves the numeric distributive affix, which like the universal affix lacks segmental content. Its characteristics are however strikingly different from those of the universal affix. One crucial difference is that unlike the universal affix, it is unrestricted with respect to which numerals it occurs with as the examples in (184) indicate. The resulting form has the meaning 'in *n*s'.

(184) *Numeric distributive affixation*

| Numeral | | Distributive | |
|---|---|---|---|
| niní | 'one' | niní-**niní** | 'one by one' |
| gúbà | 'two' | gúbà-**gúbà** | 'in two's' |
| gútotá | 'eight' | gútotá-**totá** | 'in eight's' |
| gútwàbà | 'seven' | gútwàbà-**twàbà** | 'in seven's' |
| kpákó | '200' | kpákó-**kpákó** | 'in two hundred's' |
| eʃi | 'twenty' | eʃi-**eʃi** | 'in twenties' |
| árata | 'fifty' | árata-**rata** | 'in fifties' |
| gúwo bè gúbà e | 'twelve' | gúwo bè gúbà-**gúbà** e | 'in twelve's' |
| eʃi dĭ gúbà | 'eighteen' | eʃi dĭ gúbà-**gúbà** | 'in eighteen's' |
| kpákó tú ʃibà | '240' | kpákó tú ʃibà-**ʃibà** | 'in 240's' |
| ʃibà | 'forty' | ʃibà-**ʃibà** | 'in forties' |

The numeric distributive affix differs from the numeric universal affix in being disyllabic. It is a suffix, and it attaches to all numerals. It lacks an inherent tone. It thus sources its segmental and tonal content from the host stem. When the numeral is disyllabic, be it C- or V-initial such as 'one', 'two hundred', and 'twenty', the affix is a complete copy of the numeral. When the numeral has a prefix-root structure with the root being monosyllabic, the affix copies both the prefix and root as in 'two'. If however the root is disyllabic it copies only the root as with 'eight'. In the case of numerals with more than two syllables with no prefix-root structure such as 'fifty' the last two syllables are copied. Other numerals in (184) are derived by addition, subtraction, and multiplication respectively. Literally 'twelve' is 'ten' (*gúwo*) plus (*bè . . . e* 'with') 'two' (*gúbà*). As for 'two hundred and forty' it is 'two hundred' (*kpákó*) plus (*tú* 'exceed') 'forty' (*fíbà*), that is, 'exceed two hundred by forty'. 'Eighteen' is 'twenty' (*efí*) minus (dí 'decrease') 'two', that is 'twenty less two'. 'Forty' is derived by implicit multiplication as there is no element indicating the procedure. Literally it is 'twenty' (*(e)fí*) by 'two' (*(gú)bà*). However the numeral is instantiated, numeric distributivity is achieved by copying the last two syllables of the last numeral.

The relevant alignment constraint for the numeric distributive affix is as in (185).

(185) ALIGN([NUMERIC DISTRIBUTIVE]$_{\sigma\sigma}$, L, STEM$_{NUM}$, R)

The disyllabic numeric distributive affix is aligned with the right edge of the numeral stem.

The same constraint interaction that regulates the realization of the numeric universal affix can be used to account for the realization of the numeric distributive affix with the

relevant alignment constraint. The ranking is as in (186) with an illustrative tableau in (187).

(186) *Ranking for numeric distributive affixation*

ALIGN([NUMERIC DISTRIBUTIVE]$_{\sigma\sigma}$, L, STEM$_{NUM}$, R), MAX, IDENT, DEP » INTEGRITY

(187) *Tableau for numeric distributive affixation*

| Input: gútwàbà + NUMDIST$_{\sigma\sigma}$ | ALIGN([NUMDIST]$_{\sigma\sigma}$, L, STEM$_{NUM}$, R) | MAX | IDENT | DEP | INTEGRITY |
|---|---|---|---|---|---|
| a. gútwàbà | | *! | | | |
| b. gútwàbà-hihì | | | | *!*** | |
| c. gútwàbà-**twà** | | *! | | | * * |
| d. gú-**twàbà**-twàbà | *! | | | | * * * * |
| e. gú-twàbà-**twaba** | | | | *!* | * * * * |
| f. ☞ gútwàbà-**twàbà** | | | | | * * * * |

In tableau (187) candidate (a) fails to realize the numeric distributive affix resulting in a fatal violation of MAX. Candidate (b) realizes the affix with epenthetic segments and thus incurs fatal violations of DEP. Candidate(c) realizes the affix as a monosyllable. Since the affix is specified in the input as disyllabic, the candidate incurs a fatal violation of MAX. Candidate (d) realizes the affix as a prefix and thus incurs a fatal violation of the alignment constraint. Candidate (e) realizes the affix as a suffix, but with mid tones. Unlike the numeric universal affix that has a specified tone, the numeric distributive affix lacks a specified tone. The choice here is between epenthesizing the least marked mid tone or copying the tone of the stem. The first choice incurs fatal violations of DEP as the epenthesized tones do not have input correspondents. The optimal candidate (f) realizes the affix as a copy of the stem and thus satisfies all constraints but the low ranked INTEGRITY. Since there are no changes in the identity of the corresponding segments and tones all candidates satisfy IDENT.

Numeric universality and distributivity show the properties that segmentally empty affixes have that determine their realization when they attach to stems. Specifically, the affix may be monosyllabic or disyllabic, it may or may not have an inherent tone, it may be a prefix or a suffix, and its occurrence may be restricted or unrestricted with respect to the relevant free forms. There are however other affixes whose sizes are determined by the size of their host stem. Other than this they can be characterized with respect to other properties such as locus of affixation and choice of host stem. These affixes are the subject of the next section.

*4.3 Spatial intensity and temporal distributive affixes*

Nouns of space in Nupe can be modified to express intensity. The spatial intensity affix is realized as a copy of the host stem, segmentally and tonally. Since there is no difference between the stem and affixal copies, it is not obvious whether it is a prefix or suffix. Given the greater tendency for suffixation in the language, I regard the spatial intensity affix as a suffix. Examples of spatial intensity affixation are given in (188).

(188) *Spatial intensity affixation*

| Spatial Noun | | Intensity | |
|---|---|---|---|
| fití | 'up' | fití-**fití** | 'far up' |
| tàkò | 'down' | tàkò-**tàkò** | 'far down' |
| zǔ̀mà | 'back' | zǔ̀mà-**zǔ̀mà** | 'far behind' |
| jégbóró | 'front' | jégbóró-**jégbóró** | 'far ahead' |

The temporal distributive affix, like the spatial intensity affix, also echoes the host stem. It attaches to temporal nouns to give a distributive meaning, and it is regarded as a suffix. Examples are given in (189).

(189) *Temporal distributive affixation*

| Temporal Noun | | Distributive | |
|---|---|---|---|
| làzì | 'morning' | làzì-**làzì** | 'every morning' |
| jigídí | 'afternoon' | jigídí-**jigídí** | 'every afternoon' |
| lòózǔ | 'evening' | lòózǔ-**lòózǔ** | 'every evening' |
| jèʃí | 'night' | jèʃí-**jèʃí** | 'every night' |
| efo | 'day' | efo-**efo** | 'every day'/'daily' |
| etswa | 'month' | etswa-**etswa** | 'every month'/'monthly' |
| eja | 'year' | eja-**eja** | 'every year'/'yearly' |

The relevant alignment constraints for the spatial intensity and temporal distributive affixes are as in (190) and (191) respectively.

(190) ALIGN([SPATIAL INTENSITY], L, $\text{STEM}_{\text{SPACE}}$, R)

The spatial intensity affix is aligned with the right edge of the spatial stem.

(191) ALIGN([TEMPORAL DISTRIBUTIVE], L, $\text{STEM}_{\text{TEMP}}$, R)

The temporal distributive affix is aligned with the right edge of the temporal stem.

Since the affixes lack any size restrictions, their realization as complete copies of the stem can be attributed to MAX. The affixes thus take the prosodic size of the host stem.

The preceding discussion attributes the realization of segmentally contentful and empty affixes. The ultimate output in each case is a factor of the properties of each affix as specified in the input, and the interaction between alignment constraints and correspondence constraints. The segmentally empty affixes and their realization fall under the standard accounts of reduplication. But the IMC can be extended to account for

instances in which morphemes source segmental content from neighboring forms. Such morphemes, regarded as affixes, may have other properties that determine what is copied. Such affixes may have no segmental content at all or the segmental content is only partially specified. The next section examines such affixes in Yoruba and Tiberian Hebrew.

*4.4 Partially specified morphemes*

Yoruba clitics (Adewole 1998, Akinlabi 1985, Akinlabi and Liberman 2001, Awobuluyi 1975, Awoyale 1983, Bamgbose 1980, Manfredi 1995, Oyelaran 1992, and Pulleyblank 1986c) exhibit characteristics of partially specified morphemes. Of particular interest are the third person singular object and emphatic clitics. Akinlabi and Liberman, discussing the tonal behavior of Yoruba clitics, observe that object pronouns have high tone after low or mid tone verbs. After high tone verbs the tone of the enclitics become mid. The high tone verb and the high tone enclitic may be separated by an inserted mid tone vowel as in the case of the second person plural. These are illustrated in (192).

(192) *Yoruba object clitics* (Akinlabi 1985, Akinlabi and Liberman 2001)

a. High tone verb + object clitic

| | |
|---|---|
| ó kɔ́ **mi** | 'he/she/it taught me' |
| ó kɔ́ **ɛ** | 'he/she/it/ taught you' |
| ó kɔ́ **ɔ** | 'he/she/it/ taught him/her/it' |
| ó kɔ́ **wa** | 'he/she/it/ taught us' |
| ó kɔ́ ɔ **jí** | 'he/she/it/ taught you pl.' |
| ó kɔ́ **wɔ̃** | 'he/she/it/ taught them' |

b. Toneless (mid) verb + object clitic

ó kpa **mí** 'he/she/it/ killed me'

ó kpa **é** 'he/she/it/ killed you'

ó kpa **á** 'he/she/it/ killed him/her/it'

ó kpa **wá** 'he/she/it/ killed us'

ó kpa **wɔ́** 'he/she/it/ killed them'

ó kpa **jí** 'he/she/it killed you pl.'

c. Low tone verb + object clitic

ó kɔ̀ **mí** 'he/she/it/ divorced me'

ó kɔ̀ **é** 'he/she/it/ divorced you'

ó kɔ̀ **ɔ́** 'he/she/it/ divorced him/her/it'

ó kɔ̀ **wá** 'he/she/it/ divorced us'

ó kɔ̀ **wɔ́** 'he/she/it/ divorced them'

ó kɔ̀ **jí** 'he/she/it divorced you pl.'

A few things are obvious from the data in (192). First the object clitic in Yoruba is inherently high-toned. Second the clitics are of two types—bisegmental and monosegmental. The bisegmental clitics are CV while the monosegmental ones are V. Of the monosegmental ones the second person singular is consistently realized as $\varepsilon$, while the third person singular is identical to the vowel of the verb with which it shares a syntactic relation. Whatever the vowel of the verb the third person object clitic is always realized as its copy. The full range of such realizations is given in (193).

(193) *Realization of Yoruba third person object clitic as copy of verb vowel*

| | |
|---|---|
| ó tì **í** | 'he/she/it pushed him/her/it' |
| ó kpè **é** | 'he/she/it called him/her/it' |
| ó bè **é** | 'he/she/it begged him/her/it' |
| ó kpa **á** | 'he/she/it killed him/her/it' |
| ó lù **ú** | 'he/she/it beat him/her/it' |
| ó tò **ó** | 'he/she/it arranged it' |
| ó kɔ̀ **ɔ́** | 'he/she/it/ divorced him/her/it' |
| ó jì **í** | 'he/she/it praised him/her/it' |
| ó tẹ̀ **ẹ́** | 'he/she/it deceived him/her/it' |
| ó gù **ú̩** | 'he/she/it climbed it' |
| ó wɔ̀ **ɔ́** | 'he/she/it measured him/her/it' |

The emphatic clitic like the third person object clitic is also realized as a vowel. It is different from the third person clitic with respect to tone. The tone of the emphatic clitic is low. As with the clitics discussed by Akinlabi (1985) and Akinlabi and Liberman (2001) it is deleted when the preceding vowel is on a low tone. It is otherwise realized as a copy of the vowel of the preceding syntactic element. In Akinlabi and Liberman's description the syntactic element can be a verb, noun, adjective, or another clitic. The various possibilities are illustrated in (194). The examples are adapted from Akinlabi and Liberman (2001).

(194) *Realization of the Yoruba emphatic clitic as copy of the preceding vowel*

| Basic | | Emphatic | |
|---|---|---|---|
| ó sṳ̃ | 'he slept' | ó sṳ̃ ṳ̃ | 'he slept (emph.)' |
| ó dé | 'he arrived' | ó dé è | 'he arrived (emph.) |
| ó lé olú | 'he pursued Olu' | ó lé olú ù | 'he pursued Olu (emph.)' |
| ó lé akĩ | 'he pursued Akin' | ó lé akĩ ĩ | 'he pursued Akin (emph.)' |
| ó mɔ̀wé kpúkpɔ̀ | | ó mɔ̀wé kpúkpɔ̀ ɔ | |
| 'he knows books a lot' | | 'he knows books a lot (emph.)' | |
| ('he is intelligent') | | ('he is intelligent (emph.)') | |
| ó dʒɛ é | 'he ate it' | ó dʒɛ é è | 'he ate it (emph.)' |

The Yoruba clitics exemplify affixal copying that do not fall under standard accounts of reduplication. The clitics like the segmentally empty affixes discussed in Nupe have certain properties, prosodic shape and inherent tone, but lack segmental content. Their segmental content is provided by a neighboring syntactic element. In both cases there is a morpheme that requires segmental realization. The IMC can plausibly account for the realization of these clitics. The third person plural clitic can be specified as a high tone mora (μ́) while the emphatic clitic can be specified as a low tone mora (μ̀). In either case the mora can be realized as an unmarked vowel via epenthesis or as a copy of the vowel with which the clitic shares a syntactic relation via copying. That copying is preferred is due to the ranking DEP » INTEGRITY. This is the same ranking that is responsible for consonantal copying to improve the marked high tone onsetless syllable that results from gerundial affixation in Yoruba discussed in chapter two. This confirms

that this ranking holds in the grammar of Yoruba. As an illustration the constraint interaction required to derive the third person object clitic is as in (195). The ranking is illustrated in the tableau in (196). Correspondence constraints suffice to derive the output and there is no constraint that encodes the characteristics of the clitic.

(195) *Ranking for the realization of the third person singular object clitic in Yoruba*

MAX, IDENT, DEP » INTEGRITY

(196) *Tableau for the realization of the 3S object clitic in Yoruba*

| Input: kpa + 3SOBJCL$_{\acute{\mu}}$ | MAX | IDENT | DEP | INTEGRITY |
|---|---|---|---|---|
| a. kpa | *! | | | |
| b. kpa **í** | | | *! | |
| c. kpa **kpá** | | *! | | * * |
| d. kpa **à** | | *! | | * |
| e. kpa **a** | | *! | | * |
| f. ☞ kpa **á** | | | | * |

In (196) the input consists of the verb *kpa* and the third person singular object clitic. The latter is specified in the input as a high tone mora. Candidate (a) fails to realize the clitic resulting in the clitic lacking a correspondent in the output. This incurs a fatal violation of MAX. Candidate (b) realizes the clitic as an epenthetic vowel. Since the vowel lacks an input correspondent it incurs a fatal violation of DEP. Candidate (c) avoids a DEP violation by realizing the clitic as a copy of the verb and thus incurs violations of INTEGRITY. More importantly it incurs a fatal violation of IDENT, as the output of the clitic is a high tone syllable rather than a high tone mora. The realization of the clitic as a copy of the vowel of the verb in candidates (d) and (e) is consistent with the clitic being a mora, but its realization on low and mid tone respectively is not consistent with the inherent high tone of the clitic. These candidates thus incur fatal violations of IDENT. The optimal candidate (g) realizes the clitic as a copy of the vowel of the verb with a high tone in conformity with its properties. It thus satisfies all the faithfulness constraints that

relate the input to its output realization, and DEP since the vowel has an input correspondent. It however violates INTEGRITY. Given the low ranking of the constraint this violation is not fatal.

Clitics constitute one example of partially specified morphemes in Yoruba. Another example of a partially specified morpheme in Yoruba is the diminutive ideophonic suffix (Awoyale 1985, 1989 cited in Akinlabi and Liberman 2001). The notable thing about the suffix is that it is CV, with the C specified as *l* which alternates with *n*, when the copied stem vowel is nasal, and the V is unspecified. The V is realized as a copy of the stem vowel. Here again the choices for realizing the vowel are epenthesis and copying, and copying is preferred in consonance with the ranking DEP » INTEGRITY. The tone of the stem is high, and so is that of the suffix. Examples are given (197).

(197) *Ideophone diminutive suffixation in Yoruba* (Akinlabi and Liberman 2001)

| Ideophone | | Diminutive | |
|---|---|---|---|
| dʒáńdʒá | 'small shapeless piece' | dʒáńdʒá-lá | 'very small shapeless piece' |
| tóńtó | 'small roundish piece' | tóńtó-ló | 'very small roundish piece' |
| béńbé | 'small handy object' | béńbé-lé | 'very small handy object' |
| fíńtí | 'tiny particle' | fíńtí-ní | 'very tiny particle' |
| ʃíńʃí | 'small quantity' | ʃíńʃí-ní | 'very small quantity' |

The Tiberian Hebrew (Lowenstamm and Kaye 1986, Prince 1975) definite prefix is like the Yoruba ideophone diminutive suffix in being only partially specified. The definite prefix can be regarded as prosodically bimoraic (Cμμ). While the C is specified as *h*, and the first μ as *a*, the second μ lacks segmental content. The definite prefix can

thus be regarded as /haμ/. The second mora is realized as a copy of the following stem consonant. However when the stem consonant is one that cannot be a geminate, it is realized as a copy of the vowel of the prefix itself. This again is a case of copying, a consequence of the ranking DEP » INTEGRITY. Examples are given in (198).

(198) *Realization of the second mora of the Tiberian Hebrew definite prefix*

| Noun | | Definite | |
|---|---|---|---|
| bajit | 'house' | ha**b**-bajit | 'the house' |
| melek | 'king' | ha**m**-melek | 'the king' |
| ʔiiʃ | 'man' | ha**a**-ʔiiʃ (*ha**ʔ**-ʔiiʃ) | 'the man' |
| ʕiir | 'city' | ha**a**-ʕiir (*ha**ʕ**-ʕiir) | 'the city' |

To account for the copying of the vowel rather than the consonant in some cases, the correspondence constraint MAX, and the constraint against some geminates in the language (*ʔʔ/*ʕʕ) are integrated into the copying schema as in (199). This is illustrated in the tableau in (200).

(199) *Ranking for the realization of the Tiberian Hebrew definite prefix*

MAX, *ʔʔ/*ʕʕ, DEP » INTEGRITY

(200) *Tableau for the realization of the Tiberian Hebrew definite prefix*

| Input: haμ + bajit | MAX | *ʔʔ/*ʕʕ | DEP | INTEGRITY |
|---|---|---|---|---|
| a. ha-bajit | *! | | | |
| b. ha**ʔ**-bajit | | | *! | |
| c. ☞ ha**b**-bajit | | | | * |
| Input: haμ + ʔiiʃ | | | | |
| a. ha-ʔiiʃ | *! | | | |
| b. ha**ʔ**-ʔiiʃ | | *! | | * |
| c. hai-ʔiiʃ | | | *! | |
| d. ☞ ha**a**-ʔiiʃ | | | | * |

In the top tableau in (200) the input is the noun *bajit* and the partially specified definite prefix. Candidate (a) realizes the definite prefix without the second mora, and thus incurs a fatal violation of MAX. Candidate (b) realizes the second mora as an epenthetic consonant, and thus fatally violates DEP. The optimal candidate (c) realizes the second mora of the prefix as a copy of the consonant of the stem, and thus avoids a DEP violation. But since the input consonant has multiple correspondents in the output, the candidate incurs a violation of INTEGRITY, a violation that is not fatal as the constraint is low ranking.

The bottom tableau has as input the noun *ʔiif* and the definite prefix. Candidate (a) realizes the prefix without the second mora, a fatal violation of MAX. Candidate (b) realizes the second mora as a copy of the consonant of the noun stem, as in the parallel candidate in the top tableau. Since the consonant is one that cannot occur as a geminate, it fatally violates *ʔʔ/*ʕʕ. It however satisfies DEP as the consonant has an input correspondent, but violates INTEGRITY. Candidate (c) avoids a *ʔʔ/*ʕʕ violation by having the second mora realized with an epenthetic vowel, a fatal violation of DEP. The optimal candidate (d) does better by having a copy of the vowel of the prefix as the second mora, thus satisfying all constrains but INTEGRITY.

The foregoing establishes the utility of the Integrity Model of Copying for the realization of segmentally empty affixes, morphemes that lack segmental content but with other characteristics, and partially segmentally specified affixes. In all these cases the choice is between epenthesizing unmarked segments and copying input segments. That the latter choice is made is a consequence of the ranking DEP » INTEGRITY that results in

inputs having multiple output correspondents. This view of affixal copying has implications for the reduplication phenomenon. I consider these implications vis-à-vis other models that have been developed to explain this phenomenon in the next section.

*4.5 The IMC and other models of reduplication*

The reduplication phenomenon has fascinated phonologists for several decades. Spaelti (1997) notes that the intriguing facets of the phenomenon that have engaged phonologists include identity between the reduplicated form and the stem (Carrier-Duncan 1979, Marantz 1982, McCarthy 1979, McCarthy & Prince 1993ab, 1994ab, Mester 1986, Steriade 1988, Wilbur 1973, among others), the possible prosodic shape of the reduplicated form (McCarthy & Prince 1986, 1994b), and the restrictions that mitigate identity (McCarthy & Prince 1995, Steriade 1988, Wilbur 1973). McCarthy and Prince's 1995 seminal work brings together insights gained into the phenomenon over the decades with respect to these aspects resulting in the development of an Optimality-Theoretic model of reduplication. Other developments with respect to modeling the phenomenon are variations on the basic theme. The IMC is no different in this respect. There are however important differences between the IMC and McCarthy and Prince's standard model.

The standard model of reduplication considers the input to reduplication as an affix and a stem. The affix is characterized as RED. This is similar to the IMC as shown in the preceding discussion that regards the affix as a segmentally empty morpheme. The fact that the affix is realized as a copy of the stem is responsible for its characterization as RED. But given the wide range of meanings that can be associated with the affix within and across languages (cf. Spaelti 1997) its uniform characterization as RED is rather

restrictive. I have shown that the input is the meaning expressed by the affix, like other affixes with segmental content. Also specified in the input are other inherent characteristics of affix such as prosodic size and tone. The locus of affixation is encoded in the relevant alignment constraint. The realization of the affix as a copy of the input stem is a factor of the interaction between the alignment constraint, correspondence constraints, and the insertion-prohibiting constraints. Thus copying is not a function of the presence of RED in the input but the need to have an output correspondent of the input segmentally empty affix.

The standard model in its full form recognizes a number of correspondence relations that ensure reduplicative identity. These include input-base, input-reduplicant, and base-reduplicant relations. The input-reduplicant relation has undesirable consequences for the model, and McCarthy and Prince limit its role in the model. Instead the basic model with IO and BR correspondence is fully exemplified. The IMC essentially retains the correspondence relations of the standard model but with modifications of the characterization of these relations. Since the IMC regards the input as having multiple output correspondents IO-Faith regulates the relation between the stem input and its stem and affixal outputs. The tendency for the reduplicant to be more faithful to the input sometimes than the base is the reason for the full model with IR-Faith. But given that the affixal and stem copies correspond to the same input, either output suffices to satisfy IO-Faith. On this view IR-Faith can be dispensed with. This is also in tune with other attempts to circumscribe the IR dimension and bring it into the purview of IO, especially as in Struijke's (1998, 2000) Broad Input-Output Correspondence model. Struijke's model like the IMC regards the input as corresponding

to multiple outputs, but these relations are regulated by mechanisms of the standard model, mechanisms that may not have any role in the IMC as I show shortly.

The other correspondence relation that is crucial to the standard model is that between the base and the reduplicant (BR-correspondence). Since the IMC does not treat the relation between the stem and the affix as a base-reduplicant relation but rather as that between multiple outputs, BR-correspondence is characterized as MO-correspondence. The two are however not equivalent as will become apparent shortly. The Correspondence Theory of faithfulness (McCarthy & Prince 1995) is generally designed to regulate input-output mappings of phonological structures. The crucial characteristics of these mappings are completeness, dependence, identity, contiguity, linearity, and anchoring. These are instantiated for IO as well as BR mappings. The question that arises is whether for every IO relation there is a corresponding BR relation as is evident from McCarthy and Prince's discussion. In the foregoing discussion of affixal copying in Nupe there is no reference to any other relation than that between multiple outputs. But the BR relations are easily statable in terms of MO-correspondence. It is however not the case that all such relations are crucial. First MAX-BR requires every segment of the base to have a correspondent in the reduplicant, and hence total reduplication. But in the IMC model the size of the affix is a function of its inherent characteristics as indicated in the input and included in the formulation of the alignment constraint. Thus in Nupe the numeric universal affix is monosyllabic, the numeric distributive affix is disyllabic, and the spatial intensity and temporal distributive affixes are not restricted in size and are thus realized as full copies of the stem. This variability will require different rankings of MAX-BR in the grammar of Nupe. If however the shape of each affix is a function of its

inherent characteristics as encoded in the relevant alignment constraint, then MAX-BR and its corresponding MAX-MO are not required in the theory. MAX and IDENT however ensure that the affix has an output correspondent that reflects its inherent characteristics. There is always the possibility of relativizing MAX-BR or MAX-MO to each affix if this relation needs retaining in the theory.

The other BR correspondence that is crucial for the standard model is DEP-BR that requires every segment of the reduplicant to have a correspondent in the base. This ensures that there are no epenthetic segments in the reduplicant, or more importantly, it prohibits fixed segments in the reduplicant. The appearance of epenthetic segments in the base may be due to phonological factors or partial specification of the affix. If it is a factor of the phonology then DEP-IO suffices to regulate it. If on the other hand it is due to partial specification of the affix, then it is not mediated by BR-correspondence but rather by IO-correspondence. In effect DEP-BR has no role in the theory, neither does the corresponding DEP-MO. At this point the question arises as to the relevance of MO-correspondence.

The other dimension of correspondence is IDENT-BR that requires reduplicant correspondents of the base segments to be featurally identical. It is this relation that captures the totality of the various identity effects between the base and reduplicant such as emergence of the unmarked (McCarthy & Prince 1994a), underapplication, and overapplication (cf. McCarthy & Prince 1995, and references therein). These effects are either a result of general markedness considerations or of phonological processes interacting with the reduplication phenomenon. The standard model provides significant insights into these effects, insights that derive from the interaction of IDENT-BR with

general markedness constraints and the phonotactic constraints effective in particular languages. These significant insights are important for any account of the reduplication phenomenon, and thus makes IDENT-BR a BR-correspondence relation that needs retaining in the theory. Though the discussion of segmentally empty affixes in Nupe does not involve any changes in identity between the multiple output correspondents, the important identity effects require the corresponding IDENT-MO. Since multiple output correspondents are from the same input it is only appropriate that they be identical. The only correspondence relation required in the IMC is IDENT-MO. This is true for cases of affixal copying as well as nonaffixal copying. In the discussion of hiatus resolution in loanwords from Classical Arabic in the preceding chapter it was shown that vowels are copied to serve as onset for the second vowel where they are corresponding glides. In this case the vowels and glides are multiple outputs of the input vowel. The relation between the vowels and the glides is that of IDENT-MO as they are required to be featurally identical. The effects of IDENT-MO are visible in the discussion of gerundial affixation in Nupe undertaken in section 5. But before then an examination of other models of reduplication that deal with the perceived inadequacies of the standard model.

*4.5.1 The Reduplicate! model*

Spaelti's (1997) Reduplicate! model of correspondence assumes that reduplication does not involve affixation, it is subject to normal faithfulness constraints especially those that regulate input-output mappings, and only MAX and IDENT, but not DEP constraints are active in both IO and BR dimensions. The assumption that reduplication does not involve affixation is informed by the fact that reduplication is not subject to ordering generalizations like regular segmental affixes since its position is a function of prosodic

considerations. To the extent that the stems to which regular affixes attach can be prosodically characterized, the tendency for segmentally empty affixes to seek out prosodically prominent stems is a factor of their inherent properties as expressed in the relevant alignment constraint. So the locus of affixation is relative to the stem, it can be left or right of it. All affixes can thus be prefixal or suffixal, and when they circumscribe material giving the appearance of occurring within the word, a function of their inherent properties, either characterization suffices. This last possibility is often described as infixation, and it is with respect to such possibilities that Spaelti questions the status of reduplication as affixation.

On subjecting reduplicated segments to regular faithfulness constraints of the IO type, Spaelti suggests that they are especially subject to DEP-IO. This requires that they be associated with an underlying form. Since this is not the case then they have to be associated with the underlying form of the segments that they copy. The effect is that the underlying form is in correspondence with both the reduplicant and the base. Since the base-reduplicant distinction is sometimes obscured Spaelti refers to the base (unreduplicated form) as the BASEFORM and the reduplicant and the base together as the REDUPLICATED FORM (REDFORM). On this view the underlying form is in correspondence with the redform. Reduplication is thus a double realization of underlying segments. This is the same as the claim of the IMC. There are however differences between the IMC and the Reduplicate! model. The baseform is related to the redform by IO-correspondence while BR-correspondence is internal to the redform. This is as in IMC, except that the relation between the two copies is a function of MO-correspondence. In the Reduplicate! model MAX-IO has no effect on the redform and

does not enforce total copying. In the IMC however MAX ensures that the affix has a correspondent in the output. Unlike IMC that eliminates MAX-BR, the R! model still requires it to enforce total copying. In the IMC, when the affix lacks any specified prosodic size, MAX ensures that it is realized as a full copy of the stem.

Spaelti addresses the implication of the R! model to the effect that reduplication happens for free. The issue is that of the constraint or condition that reduplication violates. The obvious choice is INTEGRITY. Spaelti recognizes this and equates this with Yip's (1995) *REPEAT (NOECHO) as both enforce biuniqueness. But he dismisses both of them, preferring instead to rule out unnecessary reduplication, reduplication not forced by some constraint, by *STRUC. In the rest of the dissertation there is no reference to the constraint that forces reduplication and one that bars unnecessary reduplication. But since Spaelti regards RED as being in the input, it is safe to assume it has to have some output realization. Since this output lacks underlying input correspondents the violated constraint is DEP-IO. Nevertheless since the reduplicated segments are associated with underlying segments of the baseform, they do not incur violations of DEP. There is therefore no need for both DEP-IO and DEP-BR in the theory. DEP-IO suffices, and it is only violated when some segment appears in the redform that is not in the baseform. The IMC and the R! model agree in this respect., and consequently segments associated with RED do not enjoy any special status.

The R! model treats IDENT-BR as internal to the redform. This is consistent with the claim of IMC to the effect that the multiple output correspondents are in MO-correspondence and that only identity issues are relevant. But one other pertinent issue addressed by Spaelti is that of the prosodic shape of the reduplicant. This has been

handled under previous accounts by appealing to the template, a notion that Spaelti describes as an extraneous device. In the standard model however the variation in size between the reduplicant and the base is due to prosodic considerations and emergence of the unmarked effects (McCarthy & Prince 1994b). In this approach, templatic effects follow from syllabic parsing and footing. This eliminates templatic constraints from the theory, a desirable consequence given the apparently stipulative nature of these constraints. Templatic constraints are replaced by a set of constraints collectively referred to as 'size restrictors'. These are defined prosodically and structurally. When the relevant size restrictor constraint dominates MAX-BR, partial reduplication ensues, an emergence of the unmarked effect. If however it is dominated by MAX-BR, then total reduplication takes place. But for a model such as IMC that eliminates MAX-BR, there is no obvious way of enforcing size restriction, as the constraint is not available to be ranked. But since IMC assumes that segmentally empty affixes, like other affixes and lexical free forms, have preferred prosodic shapes, the size of the affixal copy is a function of this as indicated in the input and encoded into the relevant alignment constraint. Encoding the size of the affixal copy in the input and the alignment constraint removes the need for templatic constraints and the problems associated with ranking such constraints in the grammar of particular languages. Any modification to the shape of the affix is a factor of markedness constraints that are active in such grammars. The same is true of identity of corresponding elements. Since the underlying form has multiple output correspondents either output is susceptible to any modification demanded by such markedness constraints. Since either form suffices to satisfy the relevant IO constraint, the instances in which the reduplicant appears to be more faithful to the underlying form pose no

particular problem. In effect the IMC accords with the a-templatic program (McCarthy & Prince 1999) without recourse to size restrictors. In addition no extra mechanism is required to handle the tendencies requiring IR-correspondence in the standard model, tendencies which the R! model seeks to address. A significant, but unexplored insight of Spaelti's work is the different functions of reduplication. These different functions are responsible for the multiple patterns of reduplication within and across languages. If each such function has associated with it certain characteristics such as prosodic shape and locus of affixation as the IMC assumes, then multi-pattern reduplication receives a straightforward explanation.

### *5.5.2 Morphological Doubling Theory*

Morphological Doubling Theory (MD theory) (Inkelas & Zoll 2000) is another model of reduplication aimed at addressing the perceived problems of the standard model. The central claim of the MD theory is that reduplication is purely morphological and is not a result of phonological copying as the standard model assumes. According to Inkelas and Zoll reduplication is a construction which calls twice for the same morphosyntactic unit. The construction doubles a morphosyntactic feature bundle rather than a phonological string. On this view the reduplicant is not a morpheme. Consequently, there is no intrinsic asymmetry between reduplicant and base, nor phonological correspondence relation between them. The notions BASE and RED are dispensed with, and alternatively characterized as the two copies in the reduplication construction.

The reduplication construction involves the concatenation of two stems that meet the same morphosyntactic description. Either or both constituents can undergo phonological modifications. Every case of reduplication is assumed to have the same

morphological structure to the effect that the reduplicated output stem derives from two inputs with the same morphosyntactic features. The output has these same features plus the meaning contributed by the so-called reduplicant. The MD theory is similar to the IMC in eliminating RED as input to reduplication and the consequent nonformal status of base and reduplicant. The two also share the notion that the so-called reduplicant is a feature bundle that contributes some meaning. The difference is that the IMC considers this meaning contribution as carried by the relevant affix that is in the input, while the MD theory considers both inputs to be made up of the same features, and the meaning contribution of the reduplicant is only visible in the output. If the inputs have identical feature bundles the question that immediately arises is why two stems when one suffices. To the extent that the output has a different meaning from both of the inputs, it must be the case that one stem contributes a basic meaning and the meaning of the reduplicated stem that is different from this basic meaning is a factor of the other stem. On this view the second stem is no more than an affixal morpheme despite Inkelas and Zoll's claim to the contrary.

The MD theory eliminates BR correspondence from the theory of reduplication making use of only IO-correspondence. Each stem and its output is regulated by the relevant though independent IO constraint. The challenge to the theory is the morphotactic or phonological distinctness that may occur between the two otherwise identical stems. Inkelas and Zoll's response is to appeal to morphologically specific constraint rankings in the form of cophonologies (cf. Inkelas 1997, 1999, Inkelas, Orgun & Zoll 1997, Mester & Itô 1995, and Orgun 1996, 1997). The problem with cophonologies is that they are different rankings of the same constraints with each

ranking making a different prediction. There are at most three cophonologies to account for the reduplication construction—one for each of the stems, and a third for the reduplicated form. The last one concatenates the two stems and handles any morphotactic or phonological differences. The purpose of the cophonologies is to account for the asymmetries between the stems, their outputs, and the reduplicated form. But if the MD theory seeks to simplify the theory by eliminating BR correspondence, the cophonologies introduce unnecessary complications and lead to a loss of generalization with respect to emergence of the unmarked effects, underapplication, and overapplication—the significant insights of the standard model. One more thing, the MD theory departs from the a-templatic program by resorting to templatic constraints that require outputs to have a particular prosodic shape.

The R! and MD models of reduplication provide significant insights into the reduplication phenomenon and address some of the problems associated with the standard model. They are however not without problems of their own as is evident from the preceding discussion. In this respect the IMC fares better in addressing the problems associated with the standard model. But there are other approaches to the reduplication phenomenon that appeal to INTEGRITY. I examine these approaches next.

### *4.5.3 INTEGRITY-based approaches*

Rose (1997) appeals to INTEGRITY to account for instances of consonant doubling in the Ethio-Semitic languages of Chaha, Tigrinya, and cases of double reduplication found in languages such as Lushootseed (Urbanczyk 1995, 1996) in which two reduplicative affixes correspond to a single base. Accordingly she treats these as cases of multiple correspondence. Since INTEGRITY punishes multiple correspondence she interprets the

constraint with respect to the base-reduplicant relation rather than the input-output relation. In this respect the input base is regarded as having two reduplicants as correspondents. Essentially this differs from the interpretation of INTEGRITY assumed by the IMC. According to the IMC the base as well as the reduplicative affixes are multiple correspondents of the input. Therefore whether the reduplicant is single or double, it is related to the input and INTEGRITY violations result. Rose's use of multiple correspondence is informed by the standard model's BR-correspondence.

An interesting aspect of Rose's account is the constraint interaction that results in consonant doubling and double reduplication. She claims that INTEGRITY violations are forced by the need to express the meaning of the relevant affix. There is therefore a constraint that requires an input morphological category to be realized in the output—MORPHOLOGICAL EXPRESSION. The ranking MORPHOLOGICAL EXPRESSION » INTEGRITY results in consonant copying or double reduplication. Though reduplication is warranted by the need to express the meaning of an affix, it is not the only choice available. Rose's proposal does not go far enough, and thus differs from the IMC. The former makes reduplication as the only choice for giving segmental content to segmentally empty affixes, while the latter offers the possibility of epenthesizing unmarked segments, a consequence of the DEP-INTEGRITY interaction. This is also true of instances of consonant doubling.

The constraint MORPHOLOGICAL EXPRESSION is an instruction that the affix be expressed in the output. In the IMC this function is attributed to MAX. The presence of the affix in the input suffices to ensure its realization in the output. This is why in the standard model there is MAX-IO, but no corresponding MAX-RED. The latter is what

would assure that the affix characterized as RED is realized in the output. That it is realized as a copy of the base is therefore a given. Rose however does not have RED in the input to reduplication. Instead she presents the input as the consonantal root and the meaning (e.g. frequentative) that the reduplicated from expresses. This accords with the assumption of the IMC that the input to reduplication is not RED but a semantically contentful, but segmentally empty affix. One more difference between Rose's approach and the IMC is that she derives the prosodic shape of the affix by appealing to templatic constraints. The IMC makes this is a characteristic of the affix as indicated in the input and expressed in the relevant alignment constraint.

More recent work according INTEGRITY a central role in the reduplication phenomenon is Pulleyblank 2000. The approach is similar in several respects to the one developed here. Nevertheless the two approaches differ in some respect. The thrust of Pulleyblank's approach to the reduplication phenomenon, with specific reference to multiple patterns observed in Yoruba, is that reduplication-specific faithfulness constraints as in the standard model are not required in the theory. Instead the reduplication phenomenon should be governed by the same constraints that regulate nonreduplicative input-output configurations. Pulleyblank's stated goal is consistent with that of the Morphological Doubling theory (Inkelas & Zoll 2000) and the IMC developed in the present effort. Eliminating BR-correspondence constraints from the theory makes for analytical economy. Since these constraints depend on the recognition of RED, if it can be demonstrated that this abstract category is not required then the constraints that refer to it can be successfully eliminated. This being the case, RED does not feature in the input to the reduplication phenomenon in the analyses of the various patterns in Yoruba.

To derive the Yoruba patterns Pulleyblank appeals to morphological identity à la MD theory and INTEGRITY with varying results.

For patterns of reduplication in which the so-called reduplicant is identical to the base in every respect, including size, Pulleyblank appeals to the presence in the input of two identical stems. The realization of both stems in the output is assured by MAX-IO. Though Pulleyblank demonstrates that the standard model can achieve the same results, appealing to BR-correspondence introduces redundancy into the theory. But if the morphological identity approach suffices for instances of complete identity between base and reduplicant it cannot be extended to cases of partial identity between the base and reduplicant. For these cases Pulleyblank appeals to INTEGRITY.

The problem presented by partial reduplication is that the reduplicant is prosodically limited in size. These cases may not be motivated by morphological identity. But these do not pose any problems for the MD theory that appeals to cophonologies to account for them. Pulleyblank argues that such cases do not involve specifications of morphological identity. In foot-size reduplication that indicates distributivity in Yoruba, Pulleyblank regards the prefix as a foot. A templatic constraint (DISTRIBUTIVE = FOOT) is motivated accordingly. This according to Pulleyblank suffices to derive reduplication without any formal constraints that refer to reduplication. But as he rightly notes this is a return to templatism (Marantz 1982). In this regard the approach deviates from the a-templatic program that the standard model so correctly captures and that is assured in the IMC. Consequently, the input to the reduplication phenomenon is the stem and prosodic shape of the affix. The constraint hierarchy includes the templatic constraint. There are two options for realizing the input's prosodic constituent, nonrealization or as unmarked

segments. These two options are due to the interaction between DEP-IO and the templatic constraint with the former dominating the latter. Nonrealization violates the templatic constraint while realization as unmarked segments violates DEP-IO. Since neither realization is reduplicative, Pulleyblank considers a third option. The option is to realize the prosodic template as copies of the input stem. The result is that the outputs correspond directly or indirectly to the input stem. Either way, DEP-IO is satisfied since every segment in the reduplicated form corresponds to an input segment. Any reference to BR-correspondence is thus unnecessary. But the input ends up having multiple output correspondents. This option results in violations of INTEGRITY. Pulleyblank concludes that the constraint interaction needed to derive the third option is DEP-IO » DIST = FOOT » INTEGRITY.

Pulleyblank's approach makes the same claim as the IMC. However the IMC does not directly appeal to templatic constraints. Given that the properties of the affix are not restricted to its prosodic shape, this shape in addition to other characteristics as indicated in the input and encoded in the alignment constraint removes the need for the templatic constraint. The alignment constraint and the correspondence constraints ensure that only the segments necessary to meet its prosodic shape are copied. The crucial interaction then is DEP-IO » INTEGRITY, which assures that the affix is not realized as unmarked segments.

Though Pulleyblank entertains direct and indirect correspondence between the affixal copy and the input stem, he opts for the indirect one. Thus there is only surface correspondence between the segments of the affix and the output of the input stem segments rather than the stem and affixal segments simultaneously corresponding to the

stem input segments. Indirect correspondence mirrors the standard model view of reduplication, a model that Pulleyblank argues against. Furthermore it is not obvious that indirect correspondence results in violations of INTEGRITY, since the affixal output is not directly linked to the input but to the stem output in the familiar BR-correspondence model. In this respect the approach is different from the IMC which assumes direct correspondence as well as correspondence between the multiple outputs. Missing from Pulleyblank's account is the relation between the affixal copy and the stem copy.

The choice between direct and indirect correspondence, according to Pulleyblank, is not dependent on INTEGRITY violations as both involve equal violations of the constraint. The choice between the two representations is determined by LINEARITY (McCarthy & Prince 1995), which requires corresponding elements to maintain their linear order in the input-output mapping. In this regard direct correspondence introduces contradictory precedence relations while indirect correspondence does not. To the extent that the affix is located outside the stem, and inputs have multiple output correspondents, the precedence relations can only be violated if the linear order of the affixal copy differs from that of the stem copy. Since the precedence relations are respected in the input as well as the multiple outputs, LINEARITY should not determine the choice of indirect correspondence over direct correspondence. Moreover direct correspondence better captures INTEGRITY violations.

A fallout of Pulleyblank's analysis of complete and partial reduplication is that two mechanisms are required to handle the reduplication phenomenon. Pulleyblank argues that morphological identity and prosodically-driven reduplication require the different mechanisms, and the two must be kept distinct. The argument for keeping both

is that instances of total reduplication cannot be the result of the satisfaction of a prosodic template, as they do not conform to any particular prosodic characterization. On the other hand instances of partial reduplication cannot be handled by morphological identity combined with a prosodic delimiter as it makes the wrong prediction. But as the discussion of the Nupe patterns above show the segmentally empty affixes vary between monosyllabic (numeric universal), disyllabic, that is, foot (numeric distributive), or unspecified (spatial intensity and temporal distributive). The last is akin to complete reduplication that is claimed to be morphologically induced in the morphological identity approach. When the affix lacks a specified prosodic shape, MAX ensures that is realized as a full copy of the stem. If the shape of the affix is a function of its inherent properties, then all segmentally empty affixes can be uniformly characterized. Their realization is a consequence of the interaction of alignment and correspondence constraints with DEP and INTEGRITY. In effect there is no distinction per se between the multiple reduplication patterns. The ultimate shape is a function of the characteristics of each affix. In this regard templatic constraints are not required, and the IMC suffices to derive the varying patterns of reduplication without a return to templatism. In addition the IMC achieves the goal of eliminating reduplicant-specific correspondence constraints, thereby simplifying the theory without loss of important insights of the standard model. In the next two sections I demonstrate the significance of these insights especially with respect to the emergence of the unmarked and underapplication. These crucially depend on correspondence between input and multiple outputs as well as between multiple outputs.

## 5. Gerundial Affixation

Gerunds are derived from verbs in one of two ways depending on the structure of the verb. Gerunds are derived from simple verbs by copying, indication that the gerundial affix is a segmentally empty affix. Complex verbs as noted in section 2.4.2 fall into two classes. The first group includes those composed of two verbal elements. These form gerunds the same way that simple verbs do. The second group of complex verbs comprise those composed of verbal and nominal elements. The second group forms gerunds by inversion—the verbal-nominal order is reversed. Though such complex verbs almost always do not form gerunds via copying, Smith (1969) observes that in a few cases gerunds may be derived from such complex verbs by reduplication or inversion. The greater tendency however is for such verbs to invert to derive gerunds. The tendency for inversion can be attributed to the fact that the complex verb has a nominal element, and the gerund being a nominal, the gerundial affix will be redundant in such situations. Instead the nominal element is foregrounded. This choice is neither available to the simple verbs nor complex verbs both of whose elements are verbal. Examples of gerundial formation from complex verbs of the verbal-nominal structure are given in (201).

(201) *Gerundial formation from complex verbs by inversion*

| Verb | Gerund | |
|---|---|---|
| lo-tũ | etũ-lo | 'work; working' |
| bi-tʃi | etʃi-bi | 'run; running' |
| le-jé | ejé-le | 'see; seeing' |
| ba-gwa | egwa-ba | 'wave; waving' |

| | | |
|---|---|---|
| la-mi | emi-la | 'ridicule; ridiculing' |
| tá-mi-dã̀ | emi-tádã̀ | 'greet; greeting' |
| pa-tukpa | tukpa-pa | 'remind; reminding' |
| kpà-wúlélé | wùlélé-kpà | 'ululate; ululating' |
| dì̀-gbàró | gbàró-dì̀ | 'stand up; standing' |
| dzu-jìlà | jìlà-dzu | 'go mad; going mad' |
| fo-fòrò | fòrò-fo | 'squat; squatting' |
| fu-jèkò | jèkò-fu | 'be cold; being cold' |
| ko-jénà | jènà-ko | 'procrastinate; procrastinating' |
| kpò-ruwó | ruwó-kpò | 'hawk; hawking' |

The examples in (201) need no further analysis. Of particular interest is gerundial formation from simple verbs and complex verbs of the verbal-verbal structure. In these cases the gerundial affix is segmentally empty, though is has other characteristics. These characteristics determine its realization relative to the verb stem to which it attaches, as with other segmentally empty affixes discussed in the preceding section. The gerundial affix is realized as a copy of the verb stem, the vowel of the affix is always high whatever the height of the stem vowel, and the tone is always mid (Hyman 1970a, Kawu 1998, 2000b, and Smith 1969). The various patterns classified according to the stem vowel are given in (202).

(202) *Gerundial formation from simple verbs*

a. High stem vowel

| Verb | Gerund | |
|---|---|---|
| gí | **gi**-gí | 'eat; eating' |

| | | | |
|---|---|---|---|
| | li | **li**-li | 'choose; choosing' |
| | jì | **ji**-jì | 'call; calling' |
| | dzú | **dzu**-dzú | 'wear; wearing' |
| | ku | **ku**-ku | 'gather; gathering' |
| | lù | **lu**-lù | 'stew; stewing' |
| b. | Nonhigh unround stem vowel | | |
| | bé | **bi**-bé | 'come; coming' |
| | tʃé | **tʃi**-tʃé | 'throw; throwing' |
| | fe | **fi**-fe | 'snatch; snatching' |
| | gbè | **gbi**-gbè | 'hunt; hunting' |
| | tá | **ti**-tá | 'tell; telling' |
| | gba | **gbi**-gba | 'read; reading' |
| | pà | **pi**-pà | 'pound; pounding' |
| c. | Nonhigh round stem vowel | | |
| | gó | **gu**-gó | 'tie; tying' |
| | gbó | **gbu**-gbó | 'bark; barking' |
| | zo | **zu**-zo | 'finish; finishing' |
| | ko | **ku**-ko | 'iron; ironing' |
| | dzò | **dzu**-dzò | 'sow; sowing' |
| | sò | **su**-sò | 'crawl; crawling' |
| d. | Nasalized stem vowel | | |
| | tʃí | **tʃi**-tʃí | 'descend, descending' |
| | pĩ | **pĩ**-pĩ | 'roll; rolling' |

| | | |
|---|---|---|
| dì | **dī**-dì | 'pull; pulling' |
| kǘ | **kū**-kǘ | 'sell; selling' |
| tũ | **tũ**-tũ | 'vomit; vomiting' |
| tsù̃ | **tsũ**-tsù̃ | 'roll up; rolling up' |
| tã́ | **fi**-tã́ | 'hurt; hurting' |
| wã | **wĩ**-wã | 'shave; shaving' |
| jà̃ | **jĩ**-jà̃ | 'smoke (fish); smoking' |

The data in (202) show that the gerundial affix is monosyllabic (CV), a prefix, the vowel is high but shares the other features of the stem vowel, and the tone is mid. Since the verbs in (202) are simple verbs, it is not evident what the shape of the affix is. In complex verbs of the verbal-verbal type the pattern is the same as with simple verbs. The affix is realized as a copy of the first verb as in (203).

(203) *Gerundial formation from complex verbs*

| Verb | Gerund | |
|---|---|---|
| fipà | **fi**-fipà | 'fall on; falling on' |
| fija | **fi**-fija | 'go out; going out' |
| beja | **bi**-beja | 'overflow; overflowing' |
| kefi | **ki**-kefi | 'come upon; coming upon' |
| látsa | **li**-látsa | 'mix; mixing' |
| jákpe | **ji**-jákpe | 'stoop; stooping' |
| gãdã | **gĩ**-gãdã | 'enter; entering' |

| | | |
|---|---|---|
| kutá | **ku**-kutá | 'stand; standing up' |
| zṹtú | **zũ**-zṹtú | 'cross; crossing' |
| kókpe | **ku**-kókpe | 'wrinkle; wrinkling' |
| tsòba | **tsu**-tsòbà | 'be near; being near' |

The patterns of gerundial affixation with both simple and complex verbs confirm the monosyllabic and prefixal nature of the affix. Using the standard model of reduplication Kawu (1998, 2000b) analyzes the presence of only high vowels in the reduplicant and mid tone as emergence of the unmarked (McCarthy & Prince 1994a, 1995). The emergence of the unmarked effect is simply that a phonotactic constraint whose effects are not visible in the input-output mapping asserts itself in the base-reduplicant mapping and thus leads to identity differences between the base and reduplicant. That the phonotactic constraint does not affect the input-output mapping is assured by the ranking IO-FAITH » PHONO-CONSTRAINT. The effect of the phonotactic constraint in the base-reduplicant mapping is assured by the ranking PHONO-CONSTRAINT » BR-FAITH. This results in the emergence of the unmarked schema IO-FAITH » PHONO-CONSTRAINT » BR-FAITH. In the specific case of Nupe the phonotactic constraint is one against high vowels, given that high vowels are universally considered less marked than nonhigh vowels.

Though gerundial affixation lends itself to the emergence of the unmarked analysis, such an analysis is inconsistent with the assumptions of IMC with respect to the nature of segmentally empty affixes. Since the affixes may be specified for some properties, the gerundial affix should not be an exception. In addition, motivating the emergence of the unmarked ranking for gerundial affixation in Nupe has the implication

that it should hold for all instances of affixal copying in the language. Since this does not generalize to other instances of affixal copying, I treat the gerundial affix like other segmentally empty affixes. Its inherent properties are specified in the input and encoded in an alignment constraint. The relevant alignment constraint is as in (204).

(204) ALIGN([GERUND]$_{CV[+high]}$, R, STEM$_{VERB}$, L)

The mid tone syllable ($CV_{[+high]}$) gerundial affix is aligned with the left edge of the verb stem.

The gerundial affix, like other segmentally empty affixes, can be realized as a copy of the verb or as epenthetic segments. Its realization as a copy of the verb stem is mediated by its input characteristics. This might result in differences in identity between the input and its multiple output correspondents on the one hand, and the multiple correspondents on the other. Though IDENT-IO suffices to regulate the relation between the input and the multiple outputs, it does not discriminate this from inputs with single outputs. A possible way to distinguish the two is to subscript IDENT-IO as in IDENT-IO$_M$ for the correspondence between input and multiple outputs. As pointed out earlier, the multiple outputs stand in MO-correspondence. The question arises as to whether IDENT-IO$_M$ and IDENT-MO are required. Any structure that satisfies IDENT-IO$_M$ necessarily satisfies IDENT-MO. It may happen that a structure that satisfies IDENT-MO may be suboptimal relative to one that satisfies IDENT-IO$_M$. When there is such a conflict the constraints are independently ranked. Otherwise IDENT-IO$_M$ suffices to regulate identity between the input and multiple output correspondents.

The constraint interaction required to derive the optimal output of gerundial affixation is as in (205). The ranking is illustrated with a tableau in (206).

(205) *Ranking for gerundial affixation*

ALIGN([GERUND]$_{CV[+high]}$, R, STEMVERB, L) » IDENT-IO$_M$(high), DEP » INTEGRITY

(206) *Tableau for gerundial affixation*

| Input: GER $_{CV[+high]}$ + bé | ALIGN([GERUND]$_{CV[+high]}$, R, STEMVERB, L) | IDENT-IO$_M$(high) | DEP | INTEGRITY |
|---|---|---|---|---|
| a. hi-bé | | | *! *! | |
| b. be-bé | *! | | | * * |
| c. bí-bé | *! | * | | * * |
| d. ☞ bi-bé | | * | | * * |

In (206) the input consists of the verb and the gerundial affix, consistent with the assumptions of the IMC. The affix is specified as a mid tone syllable with the vowel as [+high]. These characteristics are also encoded in the alignment constraint. Any output with properties inconsistent with the input is assessed a violation of the alignment constraint. Candidate (a) realizes the affix with unmarked segments. This incurs fatal violations of DEP. Candidate (b) avoids a violation of DEP by realizing the gerund as a copy of the verb stem. The vowel is however nonhigh, a fatal violation of the alignment constraint. Candidate (c) realizes the affix with a high vowel, but with a high tone. Since this is different from the input mid tone of the affix, it incurs a fatal violation of the alignment constraint. It however satisfies IDENT-IO$_M$(high). Though IDENT-MO(high) is not featured in the hierarchy, it is also satisfied by this output. The optimal candidate (d) realizes the output with a high vowel and thus satisfies the alignment constraint. Since the multiple outputs are not identical, it incurs a violation of IDENT-IO$_M$(high). This violation is however not fatal given the ranking ALIGN([GERUND]$_{CV[+high]}$, R, STEMVERB, L) » IDENT-IO$_M$(high).

The foregoing discussion of gerundial affixation without appeal to the emergence of the unmarked achieves a unified account for the realization of segmentally empty affixes. Motivating the emergence of the unmarked ranking in the grammar of Nupe would mean having all the affixes derived by the same constraint interaction. Since this cannot be generalized to all affixes in Nupe, the realization of the affixes is a function of their inherent characteristics as specified in the input and as encoded in the alignment constraints.

The constraint interaction necessary for gerundial affixation was illustrated with simple verbs. But this extends very easily to gerundial affixation to complex verbs. The various possibilities require appealing to other constraints to determine an output that is consistent with the analysis of gerundial affixation to simple verbs. I illustrate this by positing plausible candidates and indicating the constraint that each violates fatally to make it suboptimal. The gerund for the complex verb *kókpe* 'wrinkle' is ***kukókpe*** 'wrinkling'. The suboptimal candidates and the constraints violated are given in (207).

(207) *Gerundial formation from complex verbs*

| Candidate | Constraint violated |
|---|---|
| **kpi**kókpe | MINDIST |
| kókpe**kpi** | ALIGN |
| kó**kpi**kpe | CONTIGUITY |
| **kukpi**kókpe | ALIGN |
| **ki**kókpe | IDENT-IO$_M$(round) |

The above concludes the discussion of gerundial affixation that follows a regular pattern with respect to the vowel of the affix. The affixal vowel is either [i] or [u],

agreeing in rounding and nasality with the stem vowel of which it is a copy. In some instances the affixal vowel varies between [i] and[u] resulting in optionality. These cases are considered next.

*5.1 Optionality in gerundial affixation*

Smith (1969) observes that despite the regular patterns of affixation with [i] and [u] some verb stems present an exception to the generalization. He notes that monosyllabic verbs of the form /Co/ and three homophonous verbs of the form /Cu/ reduplicate either with regular [u] or irregular [i]. In all but one of the examples cited by Smith the C in each case is a labial consonant. The exception is *do* 'praise, shock'. According to Smith it reduplicates either as *dudo* or *dido*. The *dido* option is not attested in my speech. A check with other speakers show that only *dudo* is accepted as the gerundial of *do*. In addition all verb forms in which C is labial and the vowel is either [u] or [o] show this alternation contrary to Smith's claim that some do not. Examples of the alternating patterns are given in (208).

(208) *Optionality in gerundial affixation*

| Verb | Gerund | |
|---|---|---|
| fù | **fu**-fù ~ **fi**-fù | 'fly; flying' |
| fúba | **fu**-fúba ~ **fi**-fúba | 'shrink; shrinking' |
| mú | **mu**-mú ~ **mi**-mú | 'suck; sucking' |
| múbò | **mu**-múbò ~ **mi**-múbò | 'crowd around; crowding around' |
| vũ | **vũ**-vũ ~ **vĩ**-vũ | 'muddle, muddling' |
| wú | **wu**-wú ~ **wi**-wú | 'teach; teaching' |
| wǜ | **wũ**-wǜ ~ **wĩ**-wǜ | wipe; wiping' |

| | | |
|---|---|---|
| bó | **bu**-bó ~ **bi**-bó | 'de-husk; de-husking' |
| fo | fu-fo ~ fi-fo | 'wash; washing' |
| po | **pu**-po ~ **pi**-po | 'roast; roasting' |
| vò | **vu**-vò ~ **vi**-vò | 'rot; rotting' |
| voja | **vu**-voja ~ **vi**-voja | 'elude; eluding' |
| wo | **wu**-wo ~ **wi**-wo | 'hear; hearing' |
| wò | **wu**-wò ~ **wi**-wò | 'worship; worshipping' |
| wòja | **wu**-wòja ~ **wi**-wòja | 'slip away; slipping away' |

The examples in (208) introduce another dimension to the grammar of gerundial affixation. If the ranking motivated thus far to account for the regular patterns were to be maintained it is not obvious how the alternations in the above forms may be accounted for. Since the difference between the alternating forms is in rounding (labiality), a constraint requiring the multiple outputs of the input vowel to agree in labiality—IDENT-MO(labial) is necessary. This constraint is vacuously satisfied in the nonalternating forms as the vowel of the affix agrees in rounding with the stem vowel. But in the alternating forms the [u] alternants satisfy IDENT-MO(labial), while the [i] alternants violate it. The question that arises is what compels the violation of IDENT-MO(labial) in the latter alternants. I attribute this to the Obligatory Contour Principle (OCP) (Leben 1973, McCarthy 1986, Yip 1988, among others). On this view the [u] alternants have adjacent labial segments, the labial consonant and the labial vowel. The relevant OCP constraint is as formulated in (209).

(209) OCP(labial)

Adjacent labial segments are prohibited.

On the assumption that OCP(Place) is a general constraint that bars adjacent segments with the same place features, OCP(labial) can be regarded as a special version of the constraint. It interacts with IDENT-MO(labial) to make different predictions. The ranking IDENT-MO(labial) » OCP(labial) makes the [u] alternants optimal, while the reverse ranking OCP(labial) » IDENT-MO(labial) makes the [i] alternants optimal. Since both alternants are optimal, admitting both rankings in the grammar engenders a ranking paradox. For the grammar to allow both alternants implies that a strict dominance relation cannot hold between IDENT-MO(labial) and OCP(labial). If the two constraints are not ranked with respect to each other, the prediction of each possible ranking is kept, resulting in optionality. Before demonstrating the constraint interaction that results in more than one optimal output, one issue needs addressing.

It is obvious from the data showing optionality that the [i] ~ [u] alternation happens only with the affixal copy and not the stem copy. This is a typical case of the emergence of the unmarked with the affix, rather than the stem, responding to markedness considerations, given that OCP(labial) is a markedness constraint. But since I have not appealed to the emergence of the unmarked in the analysis, I need an alternative way for ensuring that the OCP is not effective in the stem output. I relativize IDENT-IO to the stem output as in IDENT-IO$_S$. Ranking this high in the hierarchy ensures that only the affixal output responds to the OCP constraint. Putting aside other constraint interactions motivated for gerundial affixation, the ranking in (210) accounts for the optionality observed in the forms in (208). The ranking is illustrated in the tableau in (211).

(210) *Ranking for optionality in gerundial affixation*

IDENT-IO$_S$(labial) » OCP(labial), IDENT-MO(labial)

(211) *Tableau for optionality in gerundial affixation*

| Input: GER + bó | IDENT-IO$_S$(labial) | OCP(labial) | IDENT-MO(labial) |
|---|---|---|---|
| a. **bi-bí** | *! | | |
| b. ☞ **bi-bó** | | *~~!~~ | * |
| c. ☞ **bu-bó** | | *~~!~~ * | |

In (211) candidate (a) best satisfies OCP(labial) as the stem and affix have no identical adjacent labial segments. This is however done at the expense of changing the labiality of the input segment. This results in a fatal violation of IDENT-IO$_S$(labial), and the suboptimality of candidate (a). Notice that candidate (a) vacuously satisfies IDENT-MO(labial). But it will otherwise violate IDENT-IO$_M$(labial) as neither output of the input is identical to it in labiality. This is one reason for having both constraint types in the grammar. The optimal candidates (b) and (c) avoid violations of IDENT-IO$_S$(labial) as the labiality of the input stem vowel is not changed. Each candidate incurs a violation of OCP(labial) for the adjacent stem labial segments. The violations do not count for optimality, hence the strikethrough violation marks. With the strikethrough violation marks, the action is narrowed down to the affix. In this respect candidate (b) satisfies OCP(labial) while violating IDENT-MO(labial). Candidate (c) on the other hand satisfies IDENT-MO(labial) while violating OCP(labial). Since the two constraints are crucially unranked with respect to each other, both candidates are optimal. This has implications for the computation of optimality. I address these implications in the context of other approaches to optionality in OT in section 5.3. Before then I examine another kind of optionality in gerundial affixation that is not OCP-induced but arises from input complexity.

*5.2 Input complexity induced optionality*

The examples of verb stems in the preceding sections have simple vowels. There are no examples of gerundial affixation to verb stems with the light diphthongs [ja] and [wa] and their nasalized counterparts [jã] and [wã]. The analysis of light diphthongs put forward in Kawu 2000a is that they are complex segments. Their complexity consists in their being specified for two place features—[coronal, dorsal] for [ja] and [labial, dorsal] for [wa]. Though Smith (1969) regards the glide in [Cja] and [Cwa] sequences as part of the consonant, he observes that verbs with the structure [C$^{j}$V] reduplicate regularly with [i]. Those of the structure [C$^{w}$V] on the other hand reduplicate with regular [i] or irregular [u] resulting in two possible forms. Examples with gerundial formation from verb stems with light diphthongs are given in (212).

(212) *Gerundial formation from verb stems with light diphthongs*

a. [ja]/[jã] verb stem

| Verb | Gerund | |
|---|---|---|
| fja | **fi**-fja | 'drift; drifting' |
| kjà | **ki**-kjà | 'mow; mowing' |
| pjá | **pi**-pjá | 'graze; grazing' |
| tjá | **ti**-tjá | 'be mild; mildness' |
| rjája | **ri**-rjája | 'prune; pruning' |
| tjã́ | **fi**-tjã́ | 'be thin; thinness' |

b. [wa]/[wã] verb stem

| | | |
|---|---|---|
| bwá | **bi**-bwá ~ **bu**-bwá | 'unwrap; unwrapping' |
| kpwa | **kpi**-kpwa ~ **kpu**-kpwa | 'be cheap; cheapness' |

| | | |
|---|---|---|
| lwà | **li-lwà ~ lu-lwà** | 'heed; heeding' |
| rwa | **ri-rwa ~ ru-rwa** | 'pour; pouring' |
| twá | **ti-twá ~ tu-twá** | 'trim; trimming' |

Of the examples in (212b) Smith claims that *bwá* reduplicates only as *bibwá*, but never as *bubwá*. The [u] alternate is however possible. A possible explanation for Smith's claim is the OCP(labial) violation that the [u] alternate incurs. But as indicated in the discussion in the previous section the OCP is not strongly enforced, allowing for forms that violate it to be optimal. What then needs explaining is the lack of optionality in the forms in (212a) in contrast to those in (212b). Given that the light diphthongs consist of two root segments the affix is free to copy either the glide half or the vowel half. For the light diphthong [ja] the glide half and the vowel half, both being nonlabial, the affixal correspondent can only be the nonlabial [i]. The light diphthong [wa] on the other hand has the glide half as labial, and the vowel half as nonlabial. The affixal vowel can either correspond to the labial glide half resulting in the [u] alternates, or to the nonlabial vowel half resulting in the [i] alternates. Optionality then is a result of the multiple choices offered by the complex input.

The properties of the gerundial affix as encoded in the alignment constraint results in the difference in identity between the input vowel and its multiple output correspondents. The difference in this case is in the place features of the input light diphthong and its correspondents in the affix and the stem. Putting aside other interactions relevant for gerundial affixation as discussed previously, the constraint interaction required to account for optionality in the examples in (212b) is then

ALIGN([GERUND]$_{CV[+high]}$, R, STEM$_{VERB}$, L) » IDENT-MO(Place). This interaction is illustrated in the tableau in (213).

(213) *Tableau for input complexity induced optionality*

| Input: GER + twá | ALIGN([GERUND]$_{CV[+high]}$, R, STEM$_{VERB}$, L) | IDENT-MO(Place) |
|---|---|---|
| a. **twa**-twá | *! | |
| b. **tui**-twa | *! | * |
| c. ☞ **ti**-twá | | * |
| d. ☞ **tu**-twá | | * |

In (213) candidate (a) with the affix and stem vowel identical for place incurs a fatal violation of the alignment constraint, as the affixal vowel is nonhigh. The stem and affix vowels are identical, and IDENT-MO(Place) is satisfied. Candidate (b) has the high vowels corresponding to each half of the light diphthong of the stem, as in the case of simple vowels. This also incurs a fatal violation of the alignment constraint. This is due to the fact that the affix requires a single vowel. In addition it incurs a violation of IDENT-MO(Place) as the affix [i] differs in place from its corresponding [a] in the stem. In all other instances of gerundial affixation involving a low stem vowel IDENT-MO(Place) is violated due to the [+high] specification of the vowel of the affix. In view of this the violation of IDENT-MO(Place) is not crucial for the optimal candidates. Candidate (c) has the affixal vowel corresponding to the nonlabial place of the stem light diphthong. Since there is no correspondent for the labial place of the stem it incurs a violation of IDENT-MO(Place). Candidate (c) on the other hand has the affixal vowel corresponding to the labial place of the stem vowel but not to the nonlabial place, a violation of IDENT-MO(Place). Since both candidates satisfy the alignment constraint, but violate IDENT-MO(Place) to the same degree the grammar does not make a choice between either, and both emerge as optimal.

The difference between the OCP(labial)- and input complexity-induced optionality is that the former involves both optimal candidates violating constraints that are crucially unranked with respect to each other, while the latter involves candidates that violate the same constraint to the same degree. The implications of both types of optionality for OT are examined in the context of other approaches to the phenomenon in the next section.

But before examining these implications, a look at apparent blocking of optionality noted by Smith (1969). According to Smith some verbs with the light diphthong [wa] reduplicate with irregular [u], but never with [i]. The peculiarity of the examples cited by Smith is that the stem consonant in each case is a strident. Recall the distribution of stridents from chapter 2, section 3 to the effect that alveolar stridents are found before the vowels and light diphthongs [a, u, ũ, o, wa, wã], while the palatals are found before the vowels and light diphthongs [i, ĩ, e, ja, jã]. This distribution is attributed to the constraint AGREE(anterior) that requires coronal strident-vowel sequences to agree in anteriority. Since the stem [wa] can have the affix vowel as either [i] or [u] as in the examples in (212b), the [i] alternate will have a coronal strident-vowel sequence disagreeing in anteriority in violation of AGREE(anterior). Though these sequences are not permitted they are allowed in affixal copying and instantiate underapplication as discussed shortly in section 6. The examples in (214) show the grammaticality of the [u] alternates, and the [i] alternates, contrary to Smith's observation. The forms with the coronal strident-vowel sequences agreeing in anteriority are not attested.

(214) *Optionality in gerunds from verb stems with strident-wa structure*

| Verb | Gerund | |
|---|---|---|
| dzwa | **dzu**-dzwa ~ **dzi**-dzwa (***dʒi**-dzwa) | 'cut up; cutting up' |

| | | |
|---|---|---|
| dzwã́ | **dzũ**-dzwã́ ~ **dzĩ**-dzwã́ (***dʒĩ**-dzwã́) | 'flash; flashing' |
| tswá | **tsu**-tswá ~ **tsi**-tswá (***tʃi**-tswá) | 'take care; taking care' |
| tswa | **tsu**-tswa ~ **tsi**-tswa (***tʃi**-tswa) | 'forge; forging' |
| tswã́ | **tsũ**-tswã́ ~ **tsĩ**-tswã́ (***tʃi**-tswã́) | 'winnow; winnowing' |
| tswãni | **tsũ**-tswãni ~ **tsĩ**-tswãni (***tʃi**-tswãni) | 'wring out; wringing out' |

*5.3 Other approaches to optionality in OT*

Optionality is one kind of variation that has attracted the most attention in the OT literature. The reason is simple. The theory assumes that for each input there is one optimal output that results from the interaction of constraints that are in a strict dominance hierarchy. Optionality, as the foregoing examples demonstrate, results in the input having more than one optimal analysis. The challenge then for the theory is how to capture this without weakening the fundamentals of the theory. While some researchers have argued that there is nothing in the architecture of OT that bars multiple optimal outputs (Hammond 1994, 2000), others have suggested various ways for the theory to accommodate optionality (Anttila 1995, 1997, Itô & Mester 1997, Kiparsky 1993, 1994, Liberman 1994, Reynolds 1994, Sells, Rickford & Wasow, among several others). These suggestions are based on standard OT. I do not consider approaches to optionality in stochastic OT (Asudeh 2000, Boersma 1997, 1998, to appear, Boersma & Hayes 1999). Notions that have been used to account for optionality include competing grammars, partial rankings, free ranking, alternative ranking, tied constraints, floating constraints, and incomplete hierarchies. I examine these notions in turn in the context of the instances of optionality in Nupe gerundial affixation discussed in the preceding section.

### *5.3.1 Competing grammars*

The competing grammars approach to optionality (Kiparsky 1993, 1994) is informed by the fundamental OT assumption that each constraint ranking instantiates a grammar. Since optionality involves more than one optimal analysis of a given input, each output must be attributed to a different ranking of the same set of constraints. Since the rankings are different they instantiate different grammars. Thus in the case of gerundial affixation in Nupe from labial consonant-vowel verb stems the ranking IDENT-MO(labial) » OCP(labial) constitutes a grammar, while the ranking OCP(labial) » IDENT-MO(labial) constitutes another grammar. Since each ranking predicts a different optimal output, each is displayed in a different tableau.

Though the notion of constraint reranking is designed to derive cross-linguistic variation, the competing grammars model allows for ranking paradoxes in the same grammar. It is these paradoxes that have been demonstrated not to be desirable for other instances of variation examined in the preceding chapters. If the competing grammars model can derive the instances of optionality of the type that result from different rankings of the same set of constraints, it is not obvious how it accounts for instances that do not involve reranking a set of constraints but from the alternants satisfying or violating the same constraint to the same degree as in the case of input complexity induced optionality in Nupe gerundial affixation (§5.2). In addition, if the OT ideal is to derive the grammar of a language from a single constraint hierarchy, the competing grammars approach to optionality fails to meet this ideal. On the other hand the proposal that the constraints whose satisfaction or violation results in more than one optimal output be

crucially unranked with respect to each other allows for both constraints to be encoded in a single constraint hierarchy.

*5.3.2. Partial rankings*

The partial rankings approach to variation in general, and optionality in particular, features in various works by Anttila (Anttila 1995, 1997, and Anttila & Cho 1996). The leading idea is that grammars are partial orders rather than total orders as assumed in standard OT. This allows for some constraints not to be mutually ranked. The unranked constraints constitute a partial order. However the partially ordered constraints can in turn be ranked with respect to each other resulting in total orders. The overall result is not unlike allowing multiple rankings as in the competing grammars approach.

Anttila (1997) however points out that there is a difference between multiple rankings and partial orders. Though multiple rankings and partial orders correspond to different grammars, the different grammars in the competing grammars model do not converge. In the case of the partial orders however, the grammars converge by way of a set inclusion relation. The result is that grammars include or are included in other grammars. So the multiple rankings are of a different kind. As different from the familiar OT ordering of constraints the partially ordered constraints are hierarchical rather than linear. In effect the resulting grammars with the linear typology are mutually exclusive while those with the hierarchical typology are mutually inclusive. The idea of constraints not ranked with respect to each other as used to account for optionality in Nupe gerundial affixation is in the spirit of the partial ranking approach. The difference is that the constraints are never ranked at any point in the grammar, and they still form part of a linear typology. The linear typology presents a more graphic relation between constraints

and allows for total orders as well as partial orders to define a grammar without each instantiating a different grammar. Thus in the relevant Nupe situation, the relation IDENT-MO(labial), OCP(labial) is a partial order while IDENT-IO$_S$(labial) » IDENT-MO(labial), OCP(labial) constitutes a total order. While the partial order correctly models optionality, the grammars within grammars notion amounts to recognizing multiple grammars and falls short of meeting the goal of deriving the grammar from a single constraint hierarchy. Furthermore, as pointed out by Asudeh (2000), to the extent that the partially ordered constraints can be ranked with respect to other constraints in a way that the partial order between such constraints is obscured, the predicted optionality may be lost.

*5.3.3 Free ranking*

The free ranking approach to optionality is similar in spirit to partial rankings and has engendered the notions of alternative rankings, and tied rankings. Free ranking however adheres to the standard linear ordering of constraints rather than the hierarchical order of partial rankings. The observations about free ranking are valid for its various interpretations as I point out in the following discussion. The free ranking notion derives from Prince and Smolensky's (1993) views with respect to dominance relations between constraints. Though total ranking is required to hold between constraints, Prince and Smolensky observe that a total ranking may impose noncrucial dominance relations. Constraints with such noncrucial relations can be ordered either way without any effect on the optimal output. In standard OT practice such noncrucial relations are presented by commas in linear constraint orders and by broken lines in the constraint tableau. They however entertain the possibility of crucial nonranking where neither constraint dominates the other and both rankings are allowed. Since there was lack of evidence for

this situation at that point in OT research Prince and Smolensky conclude that there is a total order on a constraint set and all nonrankings are noncrucial. But optionality is evidence for crucial nonranking since each ranking gives a different output, each of which is optimal. The free ranking approach to optionality is explored in Hayes & MacEachern 1996, Itô & Mester 1997, Kager 1994, Kiparsky 1993, Liberman 1994, Müller 1995, Reynolds 1994, Sells, Rickford & Wasow 1994, Smolensky 1996, among others to different effects. The discussion of free ranking in Itô and Mester represents the various dimensions of the approach and the notions it engenders, and it this that informs the following review.

According to Itô and Mester free ranking is the situation in which two (at least) constraints are unranked with respect to each other. The lack of ranking between the constraints is interpreted as a violation of either counting as dominating a violation of the other with the choice left open by the grammar. In the case of Nupe a violation of IDENT-MO(labial) will dominate a violation of OCP(labial), and vice versa. Despite the free ranking deriving two winners Itô and Mester show that this is only possible in a two competition (two-tableau) scenario. In this respect a domination relation holds between the two constraints in one tableau to give one optimal output, and the reverse domination relation holds in another tableau to give the other optimal output. Other constraints feature in each tableau. In effect the two optimal outputs are not derived in a single competition. It is this two-tableau scenario that engenders the notion of alternative ranking. The otherwise crucially unranked constraints are alternatively ranked and each ranking results in a different optimal output. This interpretation however obscures the fact that the grammar simultaneously derives the optimal candidates in a single

competition as demonstrated for the cases of optionality in Nupe above. The alternative ranking approach has a further implication to the effect that there will be as many alternative rankings as there are crucially unranked constraints. Though nothing in principle rules this out, it does not make for analytical economy. A single competition tableau deriving from a single constraint ranking maintains the crucial nonranking of the constraints and the various choices offered by the grammar. What is desirable therefore is to be able to read the various choices off a single tableau indicating all the ranking relations, crucial and noncrucial. Itô and Mester maintain that in the free ranking approach strict domination holds within each competition, a relation that does not hold within the entire grammar, that is, the overall constraint ranking. It is however this overall constraint ranking that defines the grammar, and that should predict the existence of more than one optimal output in a single competition tableau.

The need to derive the multiple winners from a single competition tableau engendered the notion of tied constraints. The tied constraint interpretation is to the effect that strict domination does not hold for the individual competitions. On this view the crucially unranked constraints are considered equivalent as no violation of one dominates a violation of the other. The implication is that a single competition yields two or more optimal candidates. In the tableau the tied constraints are presented in a single column without a separating vertical line. A number of issues arise with respect to the tied constraint interpretation of free ranking. The first is whether constraints can really be considered equal. To the extent that constraints make different demands on structural well-formedness, no two constraints can be considered equivalent.

The other pertinent issue with respect to tied constraints is the role of other constraints ranked below the tied constraints. The claim is that the tied constraint interpretation derives two or more winners in a single tableau competition only when the candidates perform equally well with respect to all other constraints, including lower-ranked ones. A lower-ranked constraint may be violated by one of the otherwise optimal candidates. If this happens then the candidate becomes suboptimal. The prediction of the multiple tableau competition on the alternative ranking interpretation is lost. The issue is what status to accord to violations of constraints ranked lower than crucially unranked constraints. Specifically, can the violations of such constraints, where they can be plausibly motivated, be fatal given that the violations of the higher crucially unranked constraints are not fatal? The tableau in (211) for optionality in gerundial affixation can be modified to include IDENT-IO$_A$(labial) to illustrate the point as in (215). For a clearer illustration of the tied constraint interpretation of crucially unranked constraints, the strikethrough violation marks are omitted.

(215) *Tableau for optionality in gerundial affixation*

| Input: /bó + GER/ | IDENT-IO$_S$(labial) | OCP(labial) | IDENT-MO(labial) | IDENT-IO$_A$(labial) |
|---|---|---|---|---|
| a. **bi**-bí | *! | | | |
| b. ☞ **bi**-bó | | | * | * |
| c. ☞ **bu**-bó | | * | | |

In (215) candidate (b) violates IDENT-MO(labial), while candidate (c) violates OCP(labial). However candidate (b) in addition violates the lower-ranked IDENT-IO$_A$(labial). Under the tied constraint interpretation this violation should be fatal. But if it is then candidate (c) emerges as sole winner. Since the grammar allows for both candidates to be optimal the status of the lower-ranked constraint has to be defined

relative to the crucially unranked constraints. In order to ensure that the violation of the lower-ranked constraint in this situation is not fatal I propose the principle in (216).

(216) FATALITY PRINCIPLE

For any set of constraints *x*, *y*, *z*, if *x* and *y* are crucially unranked, but *x* » *z*, and *y* » *z*, the nonfatal violation of *x* or *y* precludes any violations of *z* from being fatal.

Given the FATALITY PRINCIPLE, a single competition tableau in which the multiple winners derive from a single constraint hierarchy with the crucially unranked constraints presented in different columns separated by a broken vertical line appropriately displays the predictions of the grammar to the effect that it offers two optimal choices. Whatever choice the language user makes is extraneous to what the grammar offers.

*5.3.4 Floating constraints*

Another approach to optionality in particular, and phonological variation in general, in OT is the floating constraints concept (Morris 1998, Reynolds 1994, Reynolds & Nagy 1994). Reynolds' original proposal is to the effect that constraints whose ranking with respect to each other is not categorical (and thus engender variation) should float relative to those that are crucially ranked. In this regard either of the constraints that are unranked with respect to each other may be a floating constraint. Thus in the Nupe situation the constraint OCP(labial) will float with respect to IDENT-MO(labial) which is ordered in the hierarchy IDENT-IO$_S$(labial) » {IDENT-MO(labial)} » IDENT-IO$_A$(labial). The floating constraint may be ranked above or below the constraint in braces with which it is considered to be unranked. In Reynolds view variable ranking represents a change in the linguistic system, the floating constraint moves up or down the hierarchy from a particular initial position to a particular final position. Variation is a result of the speakers

not having firmly reranked the floating constraint with respect to other fixed constraints in the hierarchy. In principle any constraint can float. The question that arises is whether optionality is actually a change in progress. If it is, the point in time it is established in the fixed constraint hierarchy to assure one optimal output is indeterminable. Moreover the floating constraint concept may work for crucially unranked constraints, but it may not work for situations that involve no such constraints as in the optimal forms violating the same constraint to the same degree as in the input complexity induced optionality examples in Nupe.

Anttila (1997) identifies some other inadequacies of the floating constraints approach to variation. He points out that the advantage of identifying constraints as floating and others as fixed is unclear. In addition the distinction is not intuitive. In other words there is no principled way for determining which constraint should float especially given Reynolds' claim that any constraint can indeed float. Thus if a grammar with two mutually unranked constraints can be alternatively ranked there is no way of determining which is floating and which is fixed.

The foregoing approaches to optionality acknowledge it as a challenge for OT which predicts a unique optimal analysis for any given input that results from the interaction of constraints for which strict domination holds. There is however another approach that makes the contrary claim to the effect that there is nothing in the architecture of OT that precludes multiple winners in a single competition. It is the incomplete hierarchies approach (Hammond 1994, 2000).

### *5.3.5. Incomplete hierarchies*

The incomplete hierarchies approach to optionality was first put forward by Hammond (1994) in his account of Walmatjari stress. More recently (Hammond 2000) extends the argument with the claim that there is nothing in the architecture of OT that bars multiple optimal outputs in a single competition. The claim of incomplete hierarchies is that optionality results from the constraint hierarchy not being complete and hence does not converge on a single optimal output. The difference between this and the partial order, free ranking, and the crucial nonranking approaches and is that strict domination holds within the hierarchy. This is the situation in the input complexity induced optionality in Nupe in which the constraints are crucially ranked and yet there are two optimal outputs. In this regard, that the hierarchy does not converge on a single output implies that the grammar is incomplete. It can however be said that the fact that the grammar accounts for attested patterns in the language as reflected in the hierarchy suffices to make the hierarchy complete.

The input complexity induced optionality in Nupe is what Asudeh (2000) characterizes as true optionality as the candidates are tied in the hierarchy. Their constraint profile is identical. Though Asudeh acknowledges the advantage of this approach to optionality to the effect that it does not introduce any extra mechanisms, he raises objections to it. Of particular relevance is the claim that it is unlikely that candidates remain tied in an OT grammar with many constraints. At some point down the hierarchy one of the candidates might violate one constraint that the other does not. The implication is that optionality is lost. Asudeh acknowledges the enormity of the task that is required to fine-tune the grammar to the point that no constraint differentiates the

candidates required for optionality. This is the essence of the incomplete hierarchies concept. Asudeh adds that it is improbable that the language learner receives no information during the entire acquisition process that differentiates the candidates with respect to one constraint. This need not be the case. As pointed out earlier, the fact that the grammar offers multiple winners implies its completeness, and this makes motivating other constraints that distinguish them to the point of converging on only one of the outputs unnecessary.

For practical purposes consider the input complexity induced optionality in Nupe. The hierarchy ALIGN([GERUND]$_{CV[+high]}$, R, STEM$_{VERB}$, L) » IDENT-MO(Place) can be said to be incomplete in the sense that it does not converge on a single output, hence the optimal outputs *ti-twá* and *tu-twá*. Both candidates tie on the two constraints, satisfying one and violating the other. It should not be difficult to motivate other constraints in the hierarchy to differentiate the two candidates. The comparative nature of OT simplifies the task of motivating such other constraints. What is required is to consider the differences between the candidates and motivate a constraint that encodes each such difference. This is definitely computable. In the case of *ti-twá* and *tu-twá* the candidates differ with respect to place identity, [i] is nonlabial, and the corresponding [wa] is [labial, dorsal]. On the other hand [u] is labial and the corresponding [wa] is [labial, dorsal]. In each case the correspondents differ with respect to one feature. Comparing the two candidates further, there is a difference in height between the corresponding segments. The constraint IDENT-MO(high) can thus be motivated. Consider how the two candidates fare on this constraint. [i] is [+high] and the corresponding [wa] is [+high, +low], and the same is true for [u] and [wa]. Thus *ti-twá* and *tu-twá* tie on IDENT-MO(high). Consider

next a difference in rounding and motivate the appropriate constraint IDENT-MO(round). In this regard [i] is [-round] while the corresponding [wa] is [+round, -round]. On the other hand [u] is [+round] and the corresponding [wa] is [+round, -round]. Yet another tie. The dimensions on which candidates can differ is thus finite, so is the constraint space. When the comparative possibilities are exhausted and it is found that one constraint differentiates the optimal candidates, all others on which they tie would have been crucially unranked and the FATALITY PRINCIPLE kicks in to make the violation of this constraint nonfatal, and thus maintain optionality.

Optionality in OT can thus be modeled with crucial nonranking, and where there is strict domination, optionality is a result of the grammar not distinguishing between the optimal outputs. The advantage of the crucial nonranking approach is that it maintains the fundamentals of the theory with respect to deriving the grammar of particular languages from a single constraint ranking. While some constraints in the hierarchy are crucially ranked, others may be noncrucially unranked, and yet some others may be crucially unranked. Whatever the case may be the linear structure of the constraint hierarchy presents a complete picture of the predictions of the grammar with respect to phonological phenomena. In every such case the hierarchy is complete. Optionality is however not the only kind of variation that gerundial affixation in Nupe engenders. It also engenders underapplication, the subject of the next section.

## 6. Underapplication

Underapplication (Wilbur 1973) according to McCarthy & Prince (1995) is one of the effects of the identity-preserving interactions between phonology and reduplication, the other being overapplication. Accordingly a phonological process underapplies when there

is a lack of expected disparity between the input stem and the output. When the phonological process is not motivated in the base, it fails to apply in the reduplicant where the conditions for its application are met. Underapplication thus introduces a kind of variation since the predictions of the phonology are not borne out in the morphology, on the view that reduplication is a morphological process. There are two instances of underapplication in Nupe—failure of strident palatalization and elision.

*6.1 Underapplication of strident palatalization*

In chapter 2, it was demonstrated that alveolar stridents in Nupe are found before anterior vowels, and their palatal counterparts are found before nonanterior vowels. This distribution of the palatals is a result of strident palatalization. In the examples of gerundial affixation considered thus far verb stems with palatal stridents were not given. Verb stems with palatals result in affixal copies being palatal with no identity differences between both copies as in the examples in (217).

(217) *Gerundial formation from verb stems with palatal stridents*

| Verb | Gerund | |
|---|---|---|
| ʃi | **ʃi**-ʃi | 'buy; buying' |
| ʃé | **ʃi**-ʃé | 'fill; filling' |
| ʒí | **ʒi**-ʒí | 'return; returning' |
| ʒè | **ʒi**-ʒè | 'copy; copying' |
| ʒetú | **ʒi**-ʒetú | 'cross; crossing' |
| tʃí | **tʃi**-tʃí | 'descend, descending' |
| tʃé | **tʃi**-tʃé | 'throw; throwing' |

| | | |
|---|---|---|
| tʃjà | **tʃi-tʃjà** | 'begin; beginning' |
| dʒĩ | **dʒĩ- dʒĩ** | 'do; doing' |
| dʒè | **dʒi-dʒè** | 'flow; flowing' |

In the above examples the verb stems comprise strident-vowel sequences agreeing in anteriority. This is due to the ranking AGREE(anterior) » IDENT-IO(anterior). Since the verb stems are the output of strident palatalization, affixation has no access to the input alveolar-vowel sequence, the affix copies the stem faithfully. Since both the stem and affixal copies are multiple output correspondents of the input, the identity between them is expected. So the issue of whether strident palatalization is motivated in the stem and also in the affix is immaterial, since either way there is perfect identity between the multiple copies.

Verb stems comprising alveolar strident vowel sequences present a different situation. Besides the front vowels that have [i] as correspondent in the affixal copy, [a] is the other vowel that has this correspondent. When gerunds are formed from verb stems with the alveolar strident-*a* structure the affixal copy has the alveolar strident-*i* structure resulting in strident-vowel sequences disagreeing in anteriority, a violation of AGREE(anterior). Examples are given in (218).

(218) *Underapplication of strident palatalization in gerundial affixation*

| Verb | Gerund | | |
|---|---|---|---|
| sá | **si-sá** | (***ʃi-sá**) | 'cut; cutting' |
| sà | **si-sà** | (***ʃi-sà**) | 'be pretty; prettiness' |
| sã | **sĩ-sã** | (***ʃĩ-sã**) | 'swell; swelling' |

| | | | |
|---|---|---|---|
| sãtú | **sĩ**-sãtú | (***ʃĩ**-sãtú) | 'remind; reminding' |
| za | **zi**-za | (***ʒi**-za) | 'wander; wandering' |
| zã́ | **zĩ**-za | (***ʒĩ**-zã́) | 'flood; flooding' |
| tsá | **tsi**-tsá | (***tʃi**-tsá) | 'defecate; defecating' |
| tsa | **tsi**-tsa | (***tʃi**-tsa) | 'embroider; embroidering' |
| tsà | **tsi**-tsà | (***tʃi**-tsà) | 'choose; choosing' |
| tsa | **tsi**-tsa | (***tʃi**-tsa) | 'rattle; rattling' |
| dzá | **dzi**-dzá | (***dʒi**-dzá) | 'snap; snapping' |
| dzã́ | **dzĩ**-dzã́ | (***dʒĩ**-dzã́) | 'rinse; rinsing' |

Verbs stems with alveolar stridents followed by labial vowels have [u] as the affixal vowel. It corresponds in labiality to the stem vowel. The stridents do not vary between the alveolars and palatals as the alveolar stridents only occur before noncoronal vowels. Examples are given in (219).

(219) *Gerundial formation from verb stems with alveolar strident-labial vowels*

| Verb | Gerund | |
|---|---|---|
| só | **su**-só | 'hide; hiding' |
| sò | **su**-sò | 'crawl; crawling' |
| sũ | **sũ**-sũ | 'bear fruit; bearing fruit' |
| zo | **zu**-zo | 'finish; finishing' |
| zò | **zu**-zò | 'be difficult; being difficult' |
| zṹ | **zũ**-zṹ | 'slaughter; slaughtering' |

| | | |
|---|---|---|
| tso | **tsu**-tso | 'catch up; catching up' |
| tsò | **tsu**-tsò | 'set; setting (a trap)' |
| tsú | **tsu**-tsú | 'wade; wading' |
| tsu | **tsu**-tsu | 'die; dying' |
| tsṹ | **tsũ**-tsṹ | 'meet; meeting' |
| tsũ̀ | **tsũ**-tsũ̀ | 'roll up; rolling up' |
| dzò | **dzu**-dzò | 'plant; planting' |
| dzú | **dzu**-dzú | 'lift; lifting' |
| dzu | **dzu**-dzu | 'pierce; piercing' |
| dzũ̀ | **dzũ**-dzũ̀ | 'appear; appearing' |

In the examples in (218), were strident palatalization to apply normally, the starred forms in parentheses should be the optimal outputs. But since this is not the case the affix has a strident-vowel sequence disagreeing in anteriority. In the standard model of reduplication underapplication is accounted for by base-reduplicant identity having priority over the markedness constraint. In the Integrity Model of Copying identity between the stem and affix strident stems from the fact that they are linked to the same input. For this reason there should be no identity difference. This will require the ranking IDENT-IO$_M$(anterior) » AGREE(anterior). Recall from chapter two that the ranking motivated for strident distribution was AGREE(anterior) » IDENT-IO(anterior). The IDENT-IO(anterior) here is that between input and single output correspondents. This necessitates the distinction between this and IDENT-IO$_M$. If this distinction is not made underapplication would require the ranking IDENT-IO » AGREE(anterior). This ranking contradicts the one motivated for strident palatalization in chapter two. It however

guarantees that the output of an input strident is identical to it, be the output single or multiple. Since this introduces a ranking paradox, an alternative is required.

In the standard model of reduplication, underapplication is a result of ranking base-reduplicant identity over the markedness constraint. In the present approach this can be encoded as IDENT-MO(anterior) » AGREE(anterior). Though this ranking guarantees identity between the output stridents it does not preclude both outputs of the input alveolar strident from being palatals as I show shortly. It must thus be the case that the failure of strident palatalization in the affixal output is due to the direct correspondence between input alveolar strident and its multiple outputs as encoded in the IDENT-$IO_M$(anterior) constraint. Here the distinction between $IO_M$- and MO-correspondence comes to the fore. The hierarchy required to account for underapplication of strident palatalization in gerundial affixation is as in (220). I show only the interaction between the correspodence constraints and AGREE(anterior). The ranking is illustrated in the tableau in (221).

(220) *Ranking for underapplication of strident palatalization in gerundial affixation*

IDENT-$IO_M$(anterior) » IDENT-MO(anterior) » AGREE(anterior)

(221) *Tableau for underapplication of strident palatalization in gerundial affixation*

| Input: GER + sá | IDENT-$IO_M$(anterior) | IDENT-MO(anterior) | AGREE(anterior) |
|---|---|---|---|
| a. ʃi-sá | *! | * | |
| b. ʃi-ʃá | * *! | | |
| c. ☞ si-sá | | | * |

In (221), candidate (a) with the affixal strident agreeing in anteriority with the vowel incurs a fatal violation of IDENT-$IO_M$(anterior) since one of the multiple output correspondents of the input alveolar strident is not identical to it. It also incurs a fatal violation of IDENT-MO(anterior) as the multiple outputs are not identical.

AGREE(anterior) is however satisfied in both the stem and affix. Candidate (b) does better on IDENT-MO(anterior) as the affix and stem stridents are identical. This is however at the expense of changing the anteriority of the stem strident. This change results in the multiple outputs of the alveolar input being palatals. This leads to fatal violations of IDENT-IO$_M$(anterior) as neither output is identical to the input in anteriority. The optimal candidate (c) has the multiple correspondents of the input alveolar strident as alveolar. It thus satisfies IDENT-MO(anterior) as well as IDENT-IO$_M$(anterior) since the multiple outputs of the input alveolar are both alveolar. It however violates AGREE(anterior) as the affix consists a coronal strident-vowel sequence disagreeing in anteriority. In effect underapplication follows straightforwardly from the assumption of the IMC that the stem and affixal outputs are multiple correspondents of the stem input which in turn stand in a correspondence relation.

*6.2 Underapplication of elision*

In chapter three, section 6, elision was identified as one of the hiatus resolution strategies in Nupe. It was said to affect the nominal prefix *e* in nouns of the form *e*-CV. Elision however fails to occur in the relevant context in affixal copying. Recall from section 4 the realization of the numeric distributive affix and the temporal distributive affix. When the numeral or noun stem is of the form *e*-CV, either affixation results in the final vowel of the stem copy and the initial vowel of the affix copy being in hiatus as in the examples in (222).

(222) *Hiatus in affixation to e-initial stems*

| Stem | Affixation | |
|---|---|---|
| eʃi | eʃi-**eʃi** | 'twenty; in twenties' |

| | | |
|---|---|---|
| efo | efo-**efo** | 'day; daily' |
| etswa | etswa-**etswa** | 'month; monthly' |
| eja | eja-**eja** | 'year; yearly' |

The analysis of hiatus resolution in the preceding chapter predicts that the nominal prefix *e* should delete in each case. This is however not the case. Hiatus is resolved quite all right but not by elision. Instead glide formation or assimilation is used to resolve hiatus depending on the quality of $V_1$, that is the vowel of the stem copy. Hiatus resolution is accordingly effected as in (223).

(223) *Underapplication of elision in affixation*

| | | | | |
|---|---|---|---|---|
| e**ʃi**-e**ʃi** | → | e**ʃʃ**-e**ʃi** | (*e**ʃi**-**ʃi**) | 'twenty; in twenties' |
| efo-**efo** | → | efw-**efo** | (*efo-**fo**) | 'day; daily' |
| etswa-**etswa** | → | etswe-**etswa** | (*etswa-**tswa**) | 'month; monthly' |
| eja-**eja** | → | eje-**eja** | (*eja-**ja**) | 'year; yearly' |

In the standard model of reduplication the ill-formed outputs in (223) will be attributed to high-ranking MAX-BR since the reduplicant is not a total copy of the base. Since there is no corresponding MAX-MO constraint in the IMC model, the facts need to be accounted for differently. In the IMC approach the prosodic shape of the segmentally empty affix is an inherent property of the affix indicated in the input and encoded in the relevant alignment constraint. Thus as indicated in earlier discussion the numeric distributive affix is disyllabic while the temporal distributive affix is unrestricted in shape, taking the shape of the stem to which it attaches. Having the affix be any other size as in the forms in parentheses above will not conform to the properties of the affix. Underapplication of elision can thus be accounted for by ranking the alignment constraint

above the elision subhierarchy motivated in chapter three. The resulting hierarchy, especially for underapplication in numeric distributive affixation, is as in (224). The ranking is illustrated in the tableau in (225). I show only part of the hierarchy that forces underapplication of elision in the tableau.

(224) *Ranking for underapplication of elision in numeric distributive affixation*

NOHIATUS, ALIGN([NUMERIC DISTRIBUTIVE]$_{\sigma\sigma}$, L, STEM$_{NUM}$, R), MAX-IO-ROOT » ANCHOR-FEATURE-IO » *COMPLEX[$V_iV_j$] » IDENT-IO(vocalic) » *COMPLEX-NUC » MAX-IO-AFFIX

(225) *Tableau for underapplication of elision in affixation*

| Input: eʃi + NUMDIST$_{\sigma\sigma}$ | NO HIATUS | MAX-IO-RT | ALIGN | ANC-FT-IO | IDENT-IO(voc) | *COMP-NUC | MAX-IO-AF |
|---|---|---|---|---|---|---|---|
| a. e.ʃi.e.ʃi | *! | | | | | | |
| b. e.ʃi.ʃi | | | *! | | | | * |
| c. e.ʃe.ʃi | | *! | | | | | |
| d. e.ʃee.ʃi | | | | *! | | * | |
| e. ☞ e.ʃje.ʃi | | | | | * | | |

In (225) candidate (a) with the vowels heterosyllabified fatally violates NOHIATUS. It however satisfies all other constraints. Candidate (b) resolves hiatus by deleting the affix's nominal prefix as predicted in the analysis in the preceding chapter. The affix however ceases to be disyllabic, a fatal violation of ALIGN. Candidate (c) satisfies ALIGN as the numeric distributive is realized as disyllabic. But it does so by deleting a root vowel, a fatal violation of MAX-IO-ROOT. Candidate (d) also satisfies ALIGN. The root vowel assimilates the features of the nominal prefix. But this results in a fatal violation of ANCHOR-FEATURE-IO. The candidate also violates *COMPLEX-NUC. The optimal candidate (e) resolves hiatus by glide formation and thus satisfies NOHIATUS as well as ALIGN. It avoids violations of other constraints except IDENT-IO(vocalic). But given the

place of the constraint in the hierarchy, the violation is not fatal. All candidates except (b) satisfy MAX-IO-AFFIX. Candidate (b) is the only one that incurs a fatal violation of ALIGN. This is indication that the disyllabic size of the numeric distributive affix ensures that the nominal prefix is not elided.

## 7. Summary

This chapter has been an excursus into Nupe morphology. I identified the characteristics of the major lexical categories in Nupe such as nouns, verbs, adjectives, and adverbs. I compared these characteristics with the claims of OT about such categories. I identified the extent to which the major lexical categories conform to these characteristics.

I examined affixation in Nupe and distinguished segmentally contentful and segmentally empty affixes. The characteristics of affixes include segmental composition, tonal content, prosodic shape, choice of host stem, and locus of affixation. These characteristics are specified in the input and encoded in alignment constraints. These determine their realization when they occur with stems. The difference between the segmentally contentful and empty affixes is that the latter may be realized as unmarked segments or as copies of the stems to which they attach. The realization of segmentally empty affixes was used to motivate the Integrity Model of Copying that unifies phonological copying and morphological copying. The implications of the model vis-à-vis the standard model and other models developed to account for the reduplication phenomenon were identified.

Affixation exemplifies one kind of variation, the running theme of this dissertation, namely optionality. Two types of optionality were identified, markedness induced optionality and input complexity induced optionality. The former was attributed

to the crucial nonranking of the constraints violated by each optimal output, while the latter was attributed to the optimal outputs violating the same constraint to the same degree. The crucial nonranking approach to optionality in OT was compared with other approaches and areas of convergence and divergence were pointed out.

Finally, underapplication, another kind of variation engendered by affixation, was examined. In the relevant contexts strident palatalization and elision underapply. These are instances in which the predictions of the phonology are not borne out in the morphology.

# CHAPTER FIVE

# CONCLUSION

The foregoing chapters of the dissertation addressed the challenge that intralinguistic variation poses for Optimality Theory. The challenge consists in accounting for variation within a language with respect to the same phonological phenomenon. The mechanism of constraint reranking used to account for interlinguistic variation leads to ranking paradoxes in the context of intralinguistic variation. The general approach to intralinguistic variation defended in the preceding chapters involved the motivation of special constraints. The special constraints were related to general constraints present in the hierarchy that accounted for nonvariable phenomena. In some instances the general constraints were assumed, as they did not have any direct bearing on the analysis of nonvariable phenomena. The approach resulted in an adequate account of interstratal variation, intralinguistic typological variation, and optionality that manifest primarily in the phonology and morphology of Nupe. The analysis was extended at relevant points to other languages.

The discussion of interstratal variation centered on the divergence between the native and loan strata. The failure of loanwords to conform to the structure of the target language was accounted for by appealing to loan faithfulness constraints that require loans to be faithful to their forms in the source language. Loan faithfulness constraints were also needed to account for convergence between the native and loan strata. Convergence was the result of subordinating a loan faithfulness constraint to the hierarchy of the target language. Strident distribution in the native and loan strata in Nupe, and the resolution of marked structures in Yoruba gerundial affixation were

instances of interstratal variation. The syllabic simplification of loanwords was an instance of stratal convergence.

A model of lexical stratification that partitioned the lexicon into a native stratum and a nonnative stratum was developed. Though loans may be of different origins, they may behave uniformly with respect to the constraints of the native stratum. Only when they differ with respect to a particular phenomenon of the target language are the relevant loan faithfulness constraints relativized to the source language. These mechanisms ensured that the lexicon derives from a single constraint hierarchy. The account of stratal divergence and convergence raises a number of issues worthy of further investigation.

Emphasis in the discussion of loan phonology was on the phonotactics and syllable structure of the target language. The modification of loanwords also involves segments and prosody. Though segments of the source language not attested in the target language are modified accordingly, the principles that underlie such modifications need to be investigated. In the same way the prosody of the source language as effected in the target language needs further investigation. Loan phonology does provide an insight into the phonology of the target language. It is however conceivable that the modifications that loanwords undergo provide an insight into the phonology of the source language. This is an issue worth investigating in future research.

The assumption behind the loan faithfulness constraints is that speakers know the source of the loanwords. At the point of contact this is not a farfetched assumption. But as the loans are passed down the generations, the source may not be known to later generations. The question arises as to what forms the later generations are being faithful to. To the extent that loanwords have other characteristics that mark them as distinct from

native vocabulary items in spite of the modifications that may have taken place, the speakers are able to tell them apart from native vocabulary items. They are thus able to relate them to some source language. Accounting for loans passed down the generations in OT is an enterprise worth undertaking in a future research effort. This may be complemented by a study of old and new loans with the aim of identifying and explaining any significant similarities and differences.

The markedness of heterosyllabic vowel sequences in Nupe, as in other languages, necessitated a number of hiatus resolution strategies. Glide formation was argued to be the primary hiatus resolution strategy in Nupe. High and mid vowels turn into corresponding glides. Assimilation takes place when the low vowel [a] occurs as the first vowel in hiatus. It assimilates the features of the following qualitatively distinct vowel. Elision of the other hand was demonstrated to be a special strategy that affects the nominal prefix in nouns of the form *e*-CV. A typology of hiatus resolution strategies was developed based on the markedness constraints against heterosyllabic vowel sequences and tautosyllabifying input vowels, and correspondence constraints that monitor input-output mappings.

Hiatus not only arises in morphological and syntactic concatenation, but also word-internally. In view of these possibilities it was necessary to uniformly capture the syllabic affiliation of the input vowels. Syllabification was argued to be a function of a syllable structure constraint that bars associating more than one vowel to a syllable nucleus. Though this allows for unifying all vowel sequences, there is a sense in which vowel sequences that arise from morphological and syntactic concatenation differ from word-internal sequences. It can be argued that the vowel sequences have syllabic

affiliation prior to the concatenation. Maintaining such affiliation creates hiatus. Hiatus is thus resolved accordingly. The resolution should be able to refer to the syllabic affiliation. The same cannot be said of word-internal sequences. For these sequences the question arises as to what prompts hiatus resolution since the vowels are not syllabified in the input. In order for hiatus to take place the vowels must first be associated to different syllable nuclei. This initial syllabification then prompts hiatus resolution. The difference between the two kinds of hiatus creating situations needs to be encoded in the grammar. How this should be done is a subject for future research.

The investigation of hiatus resolution in Nupe was restricted to vowel contact situations in syntactic concatenation. The adaptation of loanwords from Classical Arabic illustrated an instance of hiatus that arises from deletion of input segments. This is indication that hiatus may be created by other phonological processes. It should be possible to relate hiatus resolution in such sequences to that not involving any such processes. In the loanword examples the difference in strategy was attributed to the need to be faithful to the identity of the vowels in the loan input. When a similar situation arises in syntactic concatenation the parallel can be more easily established. It may happen that consonants are deleted in a stretch of utterance leading to vowels coming into contact. The conditions under which such deletions take place and the parallel with other instances of hiatus are issues that can be further investigated.

The vocalic inventory of Nupe, to a large extent, had a bearing on the attested hiatus resolution patterns. It would be interesting to investigate hiatus resolution patterns in languages with a similar inventory. On a broader scale the typology of hiatus resolution strategies can be connected with the typology of vowel inventories.

The study of variation in Nupe phonology and morphology ended with a discussion of affixation. The major lexical categories and their characteristics were identified. The characteristics distinguish one lexical category from another. These characteristics were compared with the claims of OT about such categories and areas of compliance and noncompliance were identified. Affixes consist of segmentally contentful and segmentally empty ones with different characteristics. Their ultimate realization was argued to be a factor of these inherent characteristics. Alignment constraints were used to encode the characteristics of the affixes. It is worth considering in a future research endeavor if the characteristics of the major lexical categories can be captured in a similar way, and if constraints other than alignment constraints can encode the characteristics of affixes.

I demonstrated that the Integrity Model of Copying mediates the realization of segmentally empty affixes. The implications of the model for the reduplication phenomenon were identified. Some of the correspondence relations in the standard OT account of the phenomenon were dispensed with. Though the correspondence relations recognized by the IMC mirror those of the standard model, the only relevant relations are those that deal with identity between the input and the multiple outputs and that between the multiple outputs. To a large extent the two might converge. But since this is not always the case it was argued that both relations should be kept. It may also be necessary to make distinctions between the different copies of the input segments. The utility of such distinctions needs to be further investigated in the context of other reduplication systems.

Optionality has been the most discussed case of intralinguistic variation. This is due to the fact that the principle of constraint ranking by which strict domination holds within the hierarchy ensures that there is a unique output for a given input. The possibility of more than one optimal output for a given input, as in the case of gerundial affixation to certain verb stems in Nupe, is especially problematic for the theory. The recognition of crucial nonranking in the constraint hierarchy leaves open the possibility of multiple optimal outputs. Once two constraints enter into this relationship any lower ranked constraint cannot determine the choice between one of the multiple optimal candidates. This is assured by the fatality principle. The issue that arises is the mechanism for implementing the fatality principle in a tableau. A possible suggestion is to parenthesize the violation marks of the constraints ranked below the crucially unranked constraints. This indicates that the violations do not count for the computation of optimality.

The general problem of intralinguistic variation is that different generalizations hold for the same phonological phenomenon within the same language. Since each generalization is a captured by a ranking a set of constraints, the different generalizations have the potential for introducing ranking paradoxes. I have in this dissertation developed an approach to intralinguistic variation based on deploying special constraints that encode the context of variation. Ranking the special constraints allows for deriving the generalizations with respect to each phonological phenomenon from a single constraint hierarchy.

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# Curriculum Vitae

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## Education

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## Publications

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