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# VOWEL ELISION IN HIATUS CONTEXTS: WHICH VOWEL GOES?

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Among the common strategies for eliminating vocalic hiatus is vowel elision. In some cases, it is the first vowel ($V_1$) that elides, while in others it is the second ($V_2$). Analyses of elision have, virtually without exception, simply stipulated which vowel is elided, for example, by encoding this information directly in a language-specific rule. This implies that the targeted position is not predictable, but simply a matter of which of two equally available options is selected by the language. A cross-linguistic study suggests, however, that this is not strictly the case, but that in some environments the choice of target is universally determined. This article accounts for the observed restrictions on elision target within a constraint-based theory which claims that languages preferentially preserve phonological elements in certain prominent positions.*

**1.** INTRODUCTION. Many languages do not tolerate vowel hiatus. Where hiatus would arise in such languages through morphological or syntactic concatenation, it is typically eliminated. One very common means of resolving hiatus is to elide one of the adjacent vowels. In Etsako (a Niger-Congo language), for example, a word-final vowel is often elided before a following word-initial vowel, as in 1 (data from Elimelech 1976).

(1) a. /dɛ akpa/ → [dakpa] 'buy a cup'
buy cup

b. /ukpo ɛnodɛ/ → [ukpɛnodɛ] 'yesterday's cloth'
cloth yesterday

c. /owa ɔda/ → [owɔda] 'a different house'
house different

d. /umhele ɔtsomhi/ → [umhelɔtsomhi] 'some salt'
salt some

Although elision of the first of two adjacent vowels (henceforth $V_1$) is more common cross-linguistically, elision of the second vowel (henceforth $V_2$) is also attested. This latter type of elision occurs in fact in certain contexts in Etsako, as illustrated in 2, where the vowel subject to $V_2$ elision is in boldface.

(2) a. /ɔna aru **ɔ**li/ → [ɔnaruli] 'that louse'
the louse that

b. /akpa **ɔ**nikeθe/ → [akpanikeθe] 'a small cup'
cup small

c. /ɔna eɤi **ɔ**na/ → [ɔneɤina] 'this tortoise'
the tortoise the

While there have been many analyses of elision phenomena in individual languages, there have been very few cross-linguistic studies of this phenome-

* This article is largely based on material found in my UCLA dissertation (Casali 1996a). An earlier version also appears as Casali 1996b. I would like to thank Bruce Hayes, Chai-Shune Hsu, Peggy MacEachern, Donka Minkova, Keren Rice, Russ Schuh, Donca Steriade, and three anonymous referees for many valuable comments on various versions of this article. Any faults which remain are of course my responsibility.

non.[1] In this study I seek to explain the factors that affect which of two adjacent vowels is elided.[2] I show that although both $V_1$ and $V_2$ elision are attested, the choice of which vowel is elided is not random but is subject to interesting restrictions. In some morphosyntactic contexts in fact, the choice appears to be universally determined. A major theme of this article is that these restrictions on vowel elision are not readily explained in purely formal terms, but arise in response to functional considerations.

The analysis I propose, which is presented within the framework of optimality theory (Prince & Smolensky 1993, McCarthy & Prince 1993), relies fundamentally on the notion that certain prominent morphological and prosodic positions lend themselves more readily to maintaining contrasts among features and segments (Trubetzkoy 1939, Steriade 1993). This notion of position-sensitive faithfulness is not new. Position-sensitive faithfulness constraints have been posited for a variety of positions, including roots (McCarthy & Prince 1995, Casali 1994, Rosenthall & Mous 1995), word-initial position (Casali 1994, Hsu 1995, McCarthy & Prince 1995), and root-initial syllables (Beckman 1995).

My claim is that the set of positions for which position-sensitive faithfulness constraints exist is neither open-ended nor arbitrary: functional reasons dictate that phonological material in these positions should be more resistant to loss or erosion. In some cases the reason may be greater phonetic salience; following Jun (1995) and Steriade (1995), we may assume that languages make a greater effort to preserve material that is auditorily salient (as for example in the well-known tendency for stressed vowels to be more resistant to reduction than nonstressed vowels). In other cases, the reason may be the semantic content encoded in a particular position; for example, we may relate the preference for preservation of root segments and features to the fact that roots typically carry greater semantic content than affixes. Speech processing concerns may also play a role; I consider below the possibility that preferential preservation of word-initial material may be related to the crucial function initial segments play in speech processing (Marslen-Wilson 1984, 1987).

My goal in this study is to show how position-sensitive faithfulness can help to explain a number of surprising and previously unreported cross-linguistic generalizations about the direction of elision in hiatus contexts. In keeping with

[1] One significant cross-linguistic study is Bergman 1968.

[2] It should be cautioned that, whereas my analysis of vowel elision is concerned with the question of which of two adjacent vowels is lost, a full phonological treatment of vowel elision in a particular language will typically address a variety of additional concerns, for example, vowel sequences arising in some environments are resolved by elision while those at other boundaries either remain in hiatus or are subject to a different resolution outcome such as epenthesis of an intervening consonant. The relevance of tonal or accentual properties also varies from language to language, as does the presence or absence of compensatory lengthening with elision. It is also fairly common to find that the choice of which vowel is elided is at least partly sensitive to the identities of the particular vowels comprising the sequence. Vowel length may be relevant as well: there are a number of languages in which long vowels are more resistant to elision than short vowels. Finally, it is not uncommon for particular morphemes (or classes of morphemes) to exceptionally trigger a different hiatus resolution pattern than the one which normally obtains.

the programmatic nature of this study, no attempt will be made to provide an exhaustive list of the positions for which position-sensitive faithfulness constraints should be posited. Here I simply list, for purposes of illustration, a few positions (most of which are discussed in Steriade 1993) for which such constraints might plausibly be posited, based on the criteria outlined in the preceding paragraph:

(3) a. word-initially
b. in root morphemes
c. in content (as opposed to function) words
d. in stressed syllables
e. in long segments

The first three of these positions, 3a–c, will play a particularly important role in the analysis of vowel elision and will accordingly be discussed in some detail in §4. Constraints referring to other positions will be introduced as the need arises.

After introducing the major cross-linguistic generalizations about the choice of vowel targeted by elision in different contexts (§2), I examine the direction of elision in four main contexts: the juncture of two lexical words, the juncture of a lexical word and a nonlexical (function) word, the boundary between a prefix and root, and the boundary between a root and a suffix. In §3 I describe the general constraints whose relative ranking determines whether hiatus will be resolved by elision or by some other means. The position-sensitive faithfulness constraints which form the heart of my general analysis of vowel elision directionality are discussed in §4; the analysis follows in §5. Section 6 contains detailed analyses of vowel elision in Ogori, Emai, Okpe, and Chichewa; §7 contrasts my analysis with rule-based approaches. Issues for further research and a brief conclusion form §§8 and 9.

**2.** $V_1$ AND $V_2$ ELISION: CROSS-LINGUISTIC GENERALIZATIONS. The generalizations in this section are based on my survey of 68 Niger-Congo and 19 non-Niger-Congo languages that have vowel elision in at least some context(s).[3] These languages are listed in the Appendix. The descriptive sources that formed the basis for the survey vary greatly in their clarity and depth of coverage of vowel elision. I was fortunate to find a number of sources that deal very thoroughly with hiatus resolution in particular languages, detailing both the relevant morphosyntactic contexts and the outcome (whether $V_1$ elision, $V_2$ elision, or some other possibility such as glide formation or coalescence) that results from

[3] The survey's bias toward Niger-Congo languages is not planned but is largely due to incidental circumstances. The survey was originally conceived at a time (1990–1991) when I was doing linguistic field work in Ghana. The descriptive sources I had available to me at that time were heavily skewed toward Niger-Congo languages (as were my own linguistic interests). Although I have tried to redress the imbalance more recently by looking at cases of elision in non-Niger-Congo languages, the current survey remains heavily oriented toward Niger-Congo languages. Thus, the results presented here may be viewed as provisional, pending further investigation of a wider variety of languages from other families.

all possible input sequences. Descriptions of this completeness are relatively uncommon, however. In many cases it was not easy to ascertain from a source how general an elision process is in a particular language.

Vowel elision conforms to a number of cross-linguistic generalizations; the most striking of these is that $V_1$ elision is far more common and productive than elision of $V_2$. This asymmetry (first noted, as far as I am aware, by Bergman 1968) is manifested in two ways. First, frequency of occurrence: languages with $V_1$ elision (85 in total) outnumber languages with $V_2$ elision (30 in total) by more than two to one. Second, with the exception of only two languages, Kagate and Basque, every language in the survey with $V_2$ elision also has $V_1$ elision in at least some contexts. It turns out, however, that the overall preference for $V_1$ elision does not apply equally in all morphosyntactic contexts. The elision patterns that obtain at each of the four types of juncture examined in this study are listed below.

1. At the boundary between two lexical words, elision is always of $V_1$. Exceptions occur only under very special circumstances, such as those involving the idiosyncratic behavior of particular vowels in some languages (e.g. the vowel /i/ is elided after a preceding word-final vowel in Yoruba (Pulleyblank 1988), even though elision otherwise generally targets $V_1$). Significantly, although languages which consistently elide $V_1$ at lexical word boundaries are quite common (42 languages in the survey have such elision),[4] I have not found a single example of a language that regularly elides $V_2$ at lexical word boundaries.

2. At the boundary between a lexical word and a following function word, $V_1$ elision also appears to be more common. There are however at least 12 languages in the survey that elide $V_2$ in this environment with at least some function words: Basque, Dangme, Emai, Etsako, Ewe, Isekiri, Isoko, Ivie, Mundani, Sango, Shona, Vata, and possibly Efik and Ogoja Yala. Etsako, for example, elides the initial vowel of /ɔli/ 'that' following a word-final vowel, as in 2a.

3. Only $V_1$ elision generally occurs at the boundary between a (minimally) CV prefix and a root.[5] I have come across no languages that regularly elide $V_2$ in this environment. (My data bearing on how elision treats monosegmental V prefixes in this context is too limited to draw reliable conclusions; however there are reasons to expect V prefixes to pattern somewhat differently from CV prefixes.)

4. At the boundary between a root and a suffix, either $V_1$ or $V_2$ elision is possible. There are 21 languages in the survey that have $V_1$ elision in this

[4] The languages are Au, Babole, Bemba, Bobangi, Bolia, Central Kambari, Chicano Spanish, Chumburung, Ebira, Efik, Eggon, Emai, Engenni, Etsako, Ghotuo, Gichode, Gonja, Igbo, Igede, Isekiri, Isoko, Ivie, Izi, Krachi, Lamba, Lokəə, Logo, LuGanda, Lulobo, Malakmalak, Nawuri, Nupe, Ogbia, Ogoja Yala, Ogori, Owon Afa, Pero, Sango, Urhobo, Yakata, Yoruba, and Zulu.

[5] The languages in my survey which have $V_1$ elision (in many cases very productive) in this context are Avatime, Babole, Bemba, Bobangi, Chagga, Chichewa, Chiyao, Diola-Fogny, Ila, Kamba, KiYaka, Kongo, Lamba, LuGanda, Lugisu, Pero, Shona, Si-Luyana, SiSwati, Tsonga, Uma Juman, West Tarangan, Xhosa, Yakata, Yoruba, Zulu, and possibly Santee Dakota.

context and 14 that have $V_2$ elision.[6] Thus, the behavior of prefixes and suffixes is not symmetric: whereas the vowel elided at a prefix-root boundary (where the prefix is minimally CV) is predictable, this is not the case at a root-suffix boundary. Explaining this asymmetry presents an interesting challenge for any adequate theory of hiatus resolution.

Particularly telling with respect to the asymmetries between lexical and function words and between prefixes and suffixes are languages that display opposite patterns in opposite environments, that is, languages which elide $V_1$ at the juncture of two lexical words but $V_2$ at the boundary between a lexical and a following function word, or which display $V_1$ elision at a prefix-root boundary but $V_2$ elision at a root-suffix boundary. The first asymmetry is displayed by a number of languages, including Etsako, Isoko, Ivie, and Emai. Languages displaying the second type of asymmetry include Chichewa, and (to some extent) Avatime.

The existence of these regular patterns shows strongly that which vowel is elided is not merely an idiosyncratic property of individual languages. In the following sections, I outline an analysis, within the framework of optimality theory, that refers to certain morphological or prosodic positions. This analysis allows for the range of variation that is found to occur while ruling out unattested patterns such as a language which regularly elides $V_2$ at lexical word boundaries.

**3.** GENERAL CONSTRAINTS ON VOCALIC HIATUS. Languages deal with sequences of vowels that arise through morphological or syntactic concatenation in a variety of ways. One alternative of course is to leave the sequence unchanged and syllabify the two vowels into separate syllables. I refer to this alternative as HETEROSYLLABIFICATION. Other possibilities include syllabifying the two vowels into the nucleus of a single syllable (diphthong formation), epenthesizing a consonant, glide formation, vowel elision, and the replacement of the vowel sequence by a third vowel sharing features of both original vowels (vowel coalescence). Examples of these outcomes are shown in 4. (A period is used to represent a syllable boundary.)

(4) a. heterosyllabification (Modern Greek: Kaisse 1977)
/oloena erxome/ → .o.lo.e.na.er.xo.me.
continually I.come 'I continually come'

b. diphthong formation (Ngiti: Lojenga 1994)
/izo ɔkʊ/ → .i.zoɔ.kʊ.
reed sugarcane (type of sugarcane)

c. epenthesis (Axininca: Payne 1981)
/no-N-pisi-i/ → .nom.pi.si.ti.
1s-FUT-sweep-FUT 'I will sweep'

[6] The languages with $V_1$ elision are Afar, Aghem, Avatime, Daga, Diola-Fogny, Igede, Iraqw, KiYaka, Lamba, LuGanda, Moba, Nawuri, Nupe, Niaboua, Ogbia, Santee Dakota, Shilluk, Shona, Tabla, Tsonga, and Vata. The languages with $V_2$ elision are Afar, Aghem, Avatime, Basque, Chichewa, Dangme, Daga, Diola-Fogny, Edo, Kagate, Lulobo, Niaboua, Okpe, and Vata. (Notice that several languages have both $V_1$ elision and $V_2$ elision in this context, eliding $V_1$ with some suffixes and $V_2$ with others.)

d. glide formation (Igede: Bergman 1971)
/gu ɔba/ → .gwɔ.ba.
weave mat 'weave a mat'
e. elision (Igede: Bergman 1971)
/da eɲi/ → .de.ɲi.
do rain 'to rain'
f. coalescence (Anufɔ: Adjekum et al. 1993)
/fa-i/ → .fɛɛ.
take-3SG 'take it'

Within the framework of optimality theory, the particular way in which hiatus is resolved in a given language will depend on the relative ranking of a series of constraints that favor or disfavor particular outcomes. I briefly describe below the constraints primarily relevant to this issue under my analysis. My analysis largely follows proposals made in Casali 1994 and Rosenthall 1994.

The constraint ONSET (Prince & Smolensky 1993) expresses the cross-linguistic preference for syllables with onsets. This constraint is violated by heterosyllabic V.V sequences; in languages in which ONSET is not crucially dominated, V.V sequences will not be permitted. A second constraint, NODIPH (Rosenthall 1994, Casali 1994), expresses the relative markedness of tautosyllabic sequences of non-identical vowels (i.e. diphthongs). Where the low ranking of NODIPH relative to other constraints dictates that such sequences are permitted in a particular language, vocalic hiatus may be rectified by reanalyzing the vowels as tautosyllabic.

The constraint DEPIO (McCarthy & Prince 1995) expresses a requirement that output representations should be 'dependent on' the input, in the sense that segments present in the output should have a corresponding segment in the input, i.e. should be present underlyingly.[7] This constraint is violated by epenthesis. The significance of DEPIO (henceforth simply DEP) for our purposes is that its ranking will determine whether or not a language will rectify vowel hiatus by epenthesizing an intervening consonant. (This consonant would be syllabified with the second vowel, providing an onset for the syllable to which this vowel belongs.) This will be possible only in languages in which DEP is dominated by ONSET (and also the constraints militating against other forms of hiatus resolution).

The constraint MAXIO (McCarthy & Prince 1995) dictates that underlying input segments should be maximally represented in the output, that is, every input segment should correspond to some segment on the surface. This constraint thus militates against segmental elision. In languages in which vowel

[7] Although I employ the correspondence theory of faithfulness developed in McCarthy & Prince 1995, the basic viewpoint I advocate does not depend crucially on anything specific to this version of faithfulness, but could readily be translated either into the original containment theory of faithfulness formulated in Prince & Smolensky 1993 and McCarthy & Prince 1993, or a number of other conceivable approaches. I have adopted correspondence theory here because of its wide theoretical currency. I stress that the focus of this article is on the fundamental claim that there are faithfulness constraints sensitive to particular positions, and not on the particular way in which these constraints are technically implemented.

elision occurs, MAXIO (henceforth MAX) must be dominated by ONSET and the constraints that rule out other forms of hiatus resolution.

To allow for the fact that many languages do not permit glide formation (as well as for the fact that many languages do not tolerate [Cw] or [Cy] onsets arising from other sources), I assume a constraint *CG, previously proposed in Casali 1994, which penalizes these onsets. Finally, consider the case of coalescence. This violates a constraint UNIFORMITY (McCarthy & Prince 1995) that disallows a situation in which two segments that are distinct in the input are merged as a single segment in the output. Coalescence also violates a constraint IDENT, which requires an output segment to be identically specified for every feature that is present in the corresponding input segment.

As a first approximation, we may identify each of the hiatus resolution outcomes described earlier with the particular constraint violation(s) it entails (Casali 1994, Rosenthall 1994), as summarized in Table 1.

| RESULT | CONSTRAINT VIOLATED |
|---|---|
| heterosyllabification | ONSET |
| epenthesis | DEP |
| diphthong formation | NODIPH |
| vowel elision | MAX |
| glide formation | *CG |
| coalescence | UNIFORMITY, IDENT |

TABLE 1. Constraints violated by different forms of hiatus resolution.

Since each possibility typically violates exactly one constraint, the outcome selected will normally depend only on which constraint is ranked lowest. (The exception here is coalescence, which violates both UNIFORMITY and IDENT and is therefore predicted to occur only when both of these constraints are dominated by all other hiatus resolution constraints.) This analysis is clearly oversimplified however, since it does not allow for the possibility that two or more different hiatus outcomes may cooccur in the same language. In fact, it is very common for languages with glide formation and/or coalescence to also have elision, i.e. sequences involving certain vowels will be subject to glide formation or coalescence while other sequences will be resolved by elision. Perhaps somewhat less commonly, other combinations of hiatus outcomes can coexist in the same language as well. A thorough discussion of how my account should be expanded to allow for the cooccurrence of multiple forms of hiatus resolution is beyond the scope of this paper. (For discussion see Rosenthall 1994, Casali 1996a.) There are however situations in which elision cooccurs with other hiatus processes (in particular, glide formation) in the languages examined in detail in §6. Additional mechanisms required to account for these situations will be presented as the need arises.

**4.** POSITION-SENSITIVE MAX CONSTRAINTS. It is relatively straightforward to devise a ranking of well-motivated constraints that gives rise to vowel elision, as opposed to other possible hiatus resolutions such as epenthesis. Predicting WHICH of two adjacent vowels elides poses a more interesting challenge: optimality theory provides no direct mechanism for simply stipulating which vowel

is elided. Rather, the choice must be determined by the extent to which the output forms resulting from the two types of elision satisfy various constraints. What renders the matter difficult here is the fact that the phonological makeup of the two outputs is so nearly identical that it is not obvious what well-motivated constraints might distinguish between them. For one thing, the surface syllabifications resulting from both processes are identical:

(5) a. $V_1$ elision: $CV_1\ V_2CV \rightarrow .CV_2.CV.$
b. $V_2$ elision: $CV_1\ V_2CV \rightarrow .CV_1.CV.$

This means that constraints like ONSET that refer to syllable structure are equally satisfied by either candidate. It is not immediately clear that faithfulness constraints like MAX can effectively distinguish between the outputs, since both candidates involve the loss of exactly one segment.

In developing an explicit formal analysis of the directional asymmetries of vowel elision, I rely on a notion that goes back to Trubetzkoy (1939) that certain prominent positions lend themselves more readily to maintaining contrasts among particular kinds of features and/or segments (see also Steriade 1993). In keeping with this idea, we might expect that vowel features or segments will be more resistant to deletion in certain environments. I propose that the universal set of constraints includes a family of position-sensitive constraints of the form MAXP which favor preservation of segments in certain morphological or prosodic positions (P), including those listed previously in 3. For our purposes, the contexts which are most relevant are 3a–c.

Corresponding to word-initial position, I posit a constraint MAXWI that demands preservation of word-initial segments.

(6) MAXWI: Every word-initial segment in the input must have a corresponding segment in the output.

The treatment of the other two positions, in 3b and 3c, is less straightforward. On the one hand, the most obvious treatment would be to simply propose one position-sensitive MAX constraint corresponding to each of these positions, as in (7):

(7) a. MAXROOT: Every root segment in the input must have a corresponding segment in the output.
b. MAXCONTENT: Every input segment in a lexical (content) word must have a corresponding segment in the output.

Here the constraint MAXROOT (7a) might be regarded as simply an instance of the root faithfulness family of constraints proposed in McCarthy & Prince 1995. On the other hand, it seems intuitively reasonable to suppose that the observed preference for preserving segments in roots (as opposed to affixes) and the preference for preserving segments in content (as opposed to function) words arise from a more general functional motivation, a preference for maintaining phonological material belonging to elements that typically encode greater semantic content. I therefore propose to subsume the two constraints in 7 under a single more general constraint requiring preservation of segments that occur in words or morphemes which encode lexical (as opposed to grammatical) information.

(8) MAXLEX: Every input segment in a lexical word or morpheme must have a corresponding segment in the output.

The effect of the constraint MAXLEX will depend on how the distinction between lexical and nonlexical (i.e. 'function') elements is precisely defined. This is not a trivial matter. On the one hand, there are categories of words, such as nouns, verbs, and adjectives, which seem indisputably lexical, as well as other types, determiners for example, which few would hesitate to treat as nonlexical. On the other hand, the status of words such as prepositions and pronouns is not so clear. As a first approximation, I will assume that nouns, verbs and adjectives/adverbs are lexical words, while all other words are nonlexical. With regard to word-internal contexts, I will treat all roots as lexical and all affixes as nonlexical.

I assume that position-sensitive MAX constraints are universally ranked above general (non-position-specified) MAX, as expressed in 9.

(9) Universal Rankings
  a. MAXWI $\gg$ MAX
  b. MAXLEX $\gg$ MAX

Fixed rankings of this type are proposed in slightly different form in Casali 1994 and 1996a. The ranking MAXLEX $\gg$ MAX is also in the spirit of McCarthy and Prince's (1995) metaconstraint ROOTFAITH $\gg$ AFFIXFAITH, which stipulates universal ranking of faithfulness constraints referring to roots over corresponding constraints referring to affixes.

Although these position-sensitive MAX constraints play a crucial role in accounting for the direction of vowel elision, it must be emphasized that their effects are not limited to hiatus resolution. Instead, they are motivated by a variety of synchronic and diachronic phenomena which suggest that languages go to greater length to preserve segments in word-initial position and in lexical elements.

In the case of word-initial position, languages often maintain contrasts word-initially that are neutralized in other positions (Steriade 1993), and while there are many languages in which word-final or word-medial vowels are lost historically or synchronically,[8] the loss of word-initial vowels seems to be comparatively rare. (Here I am speaking of vowel loss in general and not just in hiatus contexts.) The strong tendency to maintain contrasts and preserve segments in word-initial position is conceivably a consequence of the fact that there is often a greater degree of both length and amplitude associated with the beginnings of words. This additional measure of length and/or amplitude presumably serves to render featural cues more salient in word-initial position. If we assume that languages make a greater effort to preserve phonological material in contexts where it is more salient (as argued by Jun 1995 and Steriade 1995), we

[8] Synchronic loss of medial or final vowels occurs for example in Akan (Schachter & Fromkin 1968), French (Schane 1973), Lardil (Itô 1986), Nawuri (Casali 1995b), Tonkawa (Kenstowicz & Kisseberth 1979), and Yawelmani (Kisseberth 1970). Historical loss of medial or final vowels occurred in English (Minkova 1982), French (Schane 1973), Ojibwa (Kenstowicz & Kisseberth 1979), and several Guang languages (Snider 1986).

might expect the greater acoustic prominence of word-initial position to lead to preferential preservation of elements in this context.

Preservation of word-initial segments may also be favored by speech processing considerations. According to one influential view of processing, the cohort model (Emmorey 1987, Marslen-Wilson 1984, 1987), word recognition proceeds in two stages. First, a cohort set is constructed consisting of all words in the hearer's mental lexicon that match the incoming percept in their first one or two phonemes. This cohort set is then progressively reduced by eliminating words whose further segments fail to match the word being received at some point or whose semantic content is incompatible with the discourse context. In many cases, this allows a word to be recognized before all of its segments have been processed. The word *dwindle* for example can be recognized after its first three segments have been heard, since there are no other English words that begin with the sequence /dwɪ/ (Emmorey 1987:36). Thus, accurate recognition of segments in the latter part of a word is often not crucial to word recognition. Accurate recognition of word-initial segments, however, is clearly critical, since it is these segments that serve to determine the initial cohort.

Loss of individual features may also be less common in word-initial position. Obstruent devoicing, for example, is common word finally, but seemingly unattested word initially.[9] In the case of vowel features, a representative example of the kind of asymmetry that may arise between word-initial and noninitial positions is found in Nawuri (Casali 1995a, b). This language (and several related North Guang languages discussed in Snider 1989a, b) has a process in which front vowels centralize interconsonantally, in both closed and open syllables. Crucially, while the process may apply to word-final vowels when followed by a word-initial consonant, it never applies to word-initial vowels which follow a word-final consonant.[10]

In the case of the lexical-functional distinction, it is well known that languages frequently support a greater variety of contrasts in roots than in affixes (Steriade 1993, McCarthy & Prince 1995). It is also generally true that affix segments are more likely to undergo assimilation to root segments than vice versa. Consider for example that vowel harmony is commonly root-controlled (Clements 1976). Diachronically, there are cases where historical reduction processes have taken place only (or earlier) in affixes. For example, Donwa-Ifode (1989) argues that vowel contrasts were lost earlier in prefixes than roots in a number of Edoid languages.

Similarly, we might expect to find that lexical words tend to support a wider

[9] On grounds of phonetic naturalness alone, this fact is rather surprising, given that articulatory considerations favor voicelessness in word-initial obstruents (at least postpausally) just as they do in word-final obstruents (Westbury & Keating 1986). Nevertheless, it is quite rare to find languages that neutralize a voicing contrast word-initially; if a language has a voicing contrast at all, it will tend to preserve this contrast in word-initial position. The existence of MAXWI (but no corresponding constraint favoring preservation of features word-finally) provides a possible reason for this surprising fact.

[10] The greater resistance of word-initial features to erosion suggests a constraint IDENT-WI, analogous to MAXWI, which requires preservation of individual features in word-initial position.

range of contrasts than function words and that segments in lexical words will be less likely to undergo reduction or assimilation processes. Thus, in English, it is particularly common for function words to have reduced or weak forms and for final nasal consonants of function words to undergo place assimilation (Selkirk 1984). There are a number of segmental reduction processes in English that are manifested only or more readily in certain function words, as in the common contractions involving auxiliaries, infinitival markers, pronouns, and negative markers, e.g. *I will* → *I'll*, *want to* → *wanna* (but not **want two* → *wanna*), *them* → *'em*, *cannot* → *can't* (Postal & Pullum 1978, Zwicky 1970). While fully explicit analyses remain to be worked out, all of these facts lend support to the notion that languages make more effort to preserve elements of lexical than nonlexical items. This makes sense from a functional point of view: since lexical morphemes typically encode more semantic content, their accurate recognition is more critical for speech processing.

**5.** $V_1$ VS. $V_2$ ELISION: AN ANALYSIS. While each of the MAXP constraints is universally ranked above general MAX, the ranking of MAXWI and MAXLEX with respect to each other is not fixed, but varies from language to language. It is this variability that gives rise to the different patterns of elision that are found cross-linguistically at word boundaries, as I now seek to show.

When hiatus arises at the boundary between two lexical words MAXLEX can have no effect on the outcome (nor of course can general MAX), since it is violated by elision of either vowel. The decisive constraint is MAXWI. Since this constraint is violated by elision of $V_2$ (i.e. the word-initial vowel) but not by elision of $V_1$ (the word-final vowel), we predict that elision must universally target $V_1$ in this context, as illustrated in 10.[11]

(10) $V_1$ elision at lexical word boundaries

| /... $CV_1$##$V_2C$.../ | MAXWI | MAXLEX | MAX |
|---|---|---|---|
| ☞ ... C<$V_1$>$V_2$C... | | * | * |
| ... $CV_1$<$V_2$>C... | *! | * | * |

This prediction holds true almost without exception. The only recalcitrant cases in the survey involve the elision of particular weak vowels in $V_2$ position in a number of languages, and the occurrence of $V_2$ elision with particular combinations of lexical items in Yoruba and perhaps one or two other languages. Significantly, while there are many languages with fully regular $V_1$ elision at the boundary between two lexical words, I have yet to find a single example of a language which consistently elides $V_2$ in this context.

The situation is different when hiatus arises at the boundary between a lexical

[11] Here and in subsequent tableaux in this section I assume that resolution of hiatus is forced by highly ranked ONSET and that the other hiatus resolution strategies, epenthesis, diphthong formation, glide formation, and coalescence, are ruled out by the sufficiently high ranking of the constraints DEP, NODIPH, *CG, UNIFORMITY, and IDENT, which militate against these strategies.

word and a following function word. Here the constraint MAXLEX IS relevant; it is violated by elision of $V_1$ (i.e. the final vowel of the lexical word), but not by elision of $V_2$ (the initial vowel of the function word). With MAXWI, the situation is exactly opposite: this constraint is violated by elision of $V_2$, but not by elision of $V_1$. Thus we correctly predict that both $V_1$ elision and $V_2$ elision are possible in this context: the former will occur when MAXWI is ranked above MAXLEX, as illustrated in 11, while the latter will take place under the opposite ranking, as shown in 12. (Here and subsequently I employ lowercase *c*'s and *v*'s to indicate segments belonging to a function word or affix.)

(11)

| /... $CV_1$##$v_2$c .../ | MAXWI | MAXLEX | MAX |
|---|---|---|---|
| ☞ ... C<$V_1$>$v_2$c ... | | * | * |
| ... $CV_1$<$v_2$>c ... | *! | | * |

(12)

| /... $CV_1$##$v_2$c .../ | MAXLEX | MAXWI | MAX |
|---|---|---|---|
| ... C<$V_1$>$v_2$c ... | *! | | * |
| ☞ ... $CV_1$<$v_2$>c ... | | * | * |

Notice that the ranking MAXLEX ≫ MAXWI gives rise to $V_2$ elision only in cases where a function word FOLLOWS a lexical word. If the function word precedes the lexical word, then $V_1$ elision is predicted instead, since this violates neither MAXLEX nor MAXWI, whereas $V_2$ elision violates both of these constraints. In this connection it is interesting to consider the behavior of the Etsako word /ɔna/ 'the' in ex. 2c, repeated here as 13.

(13) /ɔna eɤi ɔna/ → [ɔneɤina] 'this tortoise'
the tortoise the

Here /ɔna/ occurs both before and after a noun of the form VCV.[12] As predicted by the ranking MAXLEX ≫ MAXWI, the prenominal instance of /ɔna/ triggers $V_1$ elision, while the postnominal instance triggers $V_2$ elision. This example strongly supports the notion that what is at work here is not a simple preference for eliding the vowel that occurs in a particular linear position ($V_1$ or $V_2$); rather, the language displays a greater willingness to sacrifice a segment of /ɔna/ than a segment of an adjacent noun. This preference is very plausibly related to the nonlexical status of /ɔna/, providing strong support for the constraint MAXLEX.

Consider next the boundary between a prefix and a following root. For simplicity I assume we are dealing with a word-initial CV prefix. In this context,

[12] Although Elimelech (1976) glosses the prenominal instance of /ɔna/ as 'DA' ('definite article') and the postnominal instance as 'this', he states (p. 40) that 'the DA /ɔna/ and the demonstrative adjective /ɔna/ are identical morphemes or homonyms'. All that is actually important here is that, whether or not we are dealing with a single morpheme, both instances of /ɔna/ are nonlexical.

the relevant constraints are MAXLEX, which favors preservation of the root-initial vowel, and general MAX, which is violated by elision of either vowel. These circumstances predict, correctly, that elision in this context will always target $V_1$, as shown in 14:

(14) $V_1$ elision at prefix-root boundary:

| /##cv$_1$+V$_2$C . . . / | MAXLEX | MAX |
|---|---|---|
| ☞ c<v$_1$>V$_2$C . . . | | * |
| cv$_1$<V$_2$>C . . . | *! | * |

I have represented the prefix (indicated by lowercase letters) as having the shape CV, which is easily the most common prefix form to occur before a vowel-initial root in the languages covered by my survey. In the case of word-initial prefixes of the shape V, on the other hand, I predict that either $V_1$ elision or $V_2$ elision is possible, depending on the relative ranking of MAXLEX and MaxWI. Where MAXLEX is ranked above MAXWI, $V_1$ elision is favored, as shown in 15, while ranking of MAXWI above MAXLEX gives $V_2$ elision in preference to $V_1$ elision, as shown in 16.

(15)

| /##v$_1$+V$_2$C . . . / | MAXLEX | MAXWI | MAX |
|---|---|---|---|
| ☞ <v$_1$>V$_2$C . . . | | * | * |
| v$_1$<V$_2$>C . . . | *! | | * |

(16)

| /##v$_1$+V$_2$C . . . / | MAXWI | MAXLEX | MAX |
|---|---|---|---|
| <v$_1$>V$_2$C . . . | *! | | * |
| ☞ v$_1$<V$_2$>C . . . | | * | * |

I have only a single example of a language that employs elision in this context: West Tarangan (Nivens 1992) elides the vowel of both CV and V prefixes before a vowel-initial root, as in the examples in 17.[13]

[13] The other cases of hiatus resolution at/##V+[$_{root}$VC . . . / boundaries in my survey are as follows. First, there are eight languages, Shona (Fortune 1955), SiSwati (Herman 1995), Lamba (Doke 1922), Bemba (Givón 1970a), Aghem (Hyman 1979), Yakata (Motingéa 1993), LuGanda (Clements 1986) and Chagga (Nurse & Philippson 1977), in which an initial V prefix (usually a high vowel /i/ or /u/, but sometimes a mid front or round vowel) will, in at least some instances, undergo glide formation before a V-initial root. Second, three languages, Bemba (Givón 1970a, Sambeek 1955), Chagga (Nurse & Philippson 1977), and Santee Dakota (Shaw 1980), resolve (at least some) /##V+[$_{root}$VC . . . / sequences by coalescence. Third, three languages, Yakata (Motingéa 1993), Lango (Noonan 1992), and Santee Dakota (Shaw 1980), retain hiatus with at least some /##V+[$_{root}$VC . . . / sequences. Finally, epenthesis of an intervening consonant apparently occurs in some instances in Chagga (Saloné 1980) and Santee Dakota (Shaw 1980).

(17) a. /i-ɛkar/ → [ɛkar]
3SG-receive '(s)he receives'
b. /mu-ɛkar/ → [mɛkar]
2SG-receive 'you receive'

This behavior follows from the assumption that West Tarangan has the ranking in 15.

Finally, consider the boundary between a root and a following suffix. As things stand, the situation in this case is simply the mirror image of the prefix-root case, that is, we expect universal elision of the initial vowel of the suffix ($V_2$) in preference to elision of the preceding root vowel ($V_1$), since the former violates only MAX while the latter violates MAXLEX also. This prediction is incorrect: although seven languages (Basque, Chichewa, Dangme, Edo, Kagate, Lulobo, and Okpe) in my survey show only $V_2$ elision at a root-suffix boundary, there are fourteen languages (Igede, Iraqw, KiYaka, Lamba, LuGanda, Moba, Nawuri, Nupe, Ogbia, Santee Dakota, Shilluk, Shona, Tabla, and Tsonga) which show only $V_1$ elision at a root-suffix boundary and seven (Afar, Aghem, Avatime, Daga, Diola-Fogny, Niaboua, Vata) which have both types of elision in this context.

If we look at the facts in more detail, it turns out that in a considerable number of cases where a root vowel is elided before a suffix vowel, the suffix consists of a single vowel only, and that there is a clear asymmetric preference for $V_1$ elision with this type of suffix. Thus, seventeen languages (Aghem, Avatime, Daga, Igede, Iraqw, Lamba, LuGanda, Moba, Nawuri, Niaboua, Nuni, Nupe, Ogbia, Santee Dakota, Shilluk, Tabla, and Vata) display $V_1$ elision at the boundary between a root and a V suffix (eliding the root vowel), while only eight (Aghem, Avatime, Niaboua, Vata, Basque, Dangme, Lulobo, and Okpe) display $V_2$ elision (i.e. elision of the suffix vowel) in this context. (Notice here that four languages, Aghem, Avatime, Niaboua, and Vata, have both $V_1$ elision and $V_2$ elision in this type of context, displaying $V_1$ elision with some suffixes and $V_2$ elision with others.) With minimally VC suffixes, however, things appear to be more balanced: $V_1$ elision occurs in nine languages (Afar, Avatime, Daga, Diola-Fogny, Lamba, Niaboua, Shona, SiSwati, and Tsonga) while $V_2$ elision occurs in eight (Afar, Avatime, Daga, Diola-Fogny, Niaboua, Basque, Chichewa, and Kagate). (Here again, note that several languages manifest both types of elision with VC suffixes.)

Furthermore, of the four languages (Avatime, Daga, Lamba, Niaboua) that have $V_1$ elision before both V and longer suffixes, in at least one, Avatime, $V_1$ elision is more common than $V_2$ elision with V suffixes, while $V_2$ elision is more common with longer suffixes (Schuh 1995). Presumably, the reason for this is a functional one: if the vowel in a V suffix is elided, there is no remaining segmental trace of the suffix. In some languages, nonsegmental cues are possible, in the form of compensatory lengthening of the final root vowel and/or the retention of the elided suffix's tone on the root vowel (i.e. the phenomenon of TONE STABILITY). Even in such cases we can imagine that the loss of all segmental features of a morpheme places an undesirable burden on the hearer faced

with the challenge of recovering the morphemic content of an utterance. This is in fact precisely the explanation proposed by Schuh (1995:55).

It seems reasonable to formally represent the nonoptimality of this type of situation as involving the violation of a constraint requiring preservation of features in monosegmental morphemes.

(18) MAXMS: Every input segment which is the only segment in its morpheme must have a corresponding segment in the output.

In languages in which MAXMS is ranked above MAXLEX, we now predict that $V_1$ elision will occur before suffixes of the form V:

(19)

| /. . . $CV_1+v_2$/ | MAXMS | MAXLEX | MAX |
|---|---|---|---|
| ☞ $C<V_1>v_2$ | | * | * |
| $CV_1<v_2>$ | *! | | * |

With longer suffixes, in contrast, $V_2$ elision is predicted, since this violates only MAX, whereas elision of $V_1$ (the root vowel) violates the more highly ranked MAXLEX.

(20)

| /. . . $CV_1+v_2c$/ | MAXMS | MAXLEX | MAX |
|---|---|---|---|
| $C<V_1>v_2c$ | | *! | * |
| ☞ $CV_1<v_2>c$ | | | * |

In languages where MAXLEX ranks above MAXMS, the prediction is that $V_2$ elision will occur with both V and minimally VC suffixes.

(21)

| /. . . $CV_1+v_2$/ | MAXLEX | MAXMS | MAX |
|---|---|---|---|
| $C<V_1>v_2$ | *! | | * |
| ☞ $CV_1<v_2>$ | | * | * |

(22)

| /. . . $CV_1+v_2c$ . . ./ | MAXLEX | MAXMS | MAX |
|---|---|---|---|
| $C<V_1>v_2c$ | *! | | * |
| ☞ $CV_1<v_2>c$ | | | * |

Although a considerable number of the cases of $V_1$ elision at a root-suffix boundary occur when the suffix is monosegmental, cases of $V_1$ elision before

a minimally VC suffix, as in the SiSwati data in 23 (adapted from Cahill 1994), are also not uncommon.

(23) a. /inʃe-ana/ → [inʃa:na] 'small ostrich'
ostrich-small
b. /imbisi-ana/ → [imbisa:na] 'small hyena'
hyena-small
c. /umut'i-ana/ → [umut'a:na] 'small homestead'
homestead-small

The other languages in my survey that display $V_1$ elision before (at least some) VCX suffixes are Afar, Aghem, Avatime, Daga, Diola-Fogny, Niaboua, Shona, Tsonga, and Vata.[14]

To account for the possibility of $V_1$ elision in this situation, I tentatively propose an additional constraint that favors preservation of features in morpheme-initial position.

(24) MAXMI: Every morpheme-initial segment in the input must have a corresponding segment in the output.

Ranked above MAXLEX, this constraint will give rise to $V_1$ elision before a VC . . . (or V) suffix:

(25)

| /. . . CV+$v_2$c . . ./ | MAXMI | MAXLEX | MAX |
|---|---|---|---|
| ☞ C<$V_1$>$v_2$c . . . | | * | * |
| C$V_1$<$v_2$>c . . . | *! | | * |

To summarize, we have considered several different contexts in which vowel hiatus might arise. The constraints violated by $V_1$ and $V_2$ elision in each context are shown in Table 2.

| CONTEXT | SUBCONTEXT | $V_1$ elision violates: | $V_2$ elision violates: |
|---|---|---|---|
| 1. two lexical words | | MAXLEX, MAX | MAXWI, MAXLEX, MAX |
| 2. lexical word and function word | a. lexical word precedes: | MAXLEX, MAX | MAXWI, MAX |
| | b. function word precedes: | MAX | MAXWI, MAXLEX, MAX |
| 3. prefix + root | a. CV prefix: | MAX | MAXMI, MAXLEX, MAX |
| | b. V prefix: | MAXWI (if prefix is word-initial), MAXMI, MAXMS, MAX | MAXMI, MAXLEX, MAX |
| 4. root + suffix | a. V suffix: | MAXLEX, MAX | MAXMI, MAXMS, MAX |
| | b. VCX suffix: | MAXLEX, MAX | MAXMI, MAX |

TABLE 2. Constraints violated by elision of $V_1$ or $V_2$ in different contexts.

[14] Several of these languages, Aghem, Avatime, Daga, Diola-Fogny, and Vata have $V_1$ elision with certain suffixes but $V_2$ elision with other suffixes of the same shape (whether V or VC . . . ). A treatment of these cases will not be attempted here.

In three of these cases—at the boundary between two lexical words, where a function word precedes a lexical word, and at the juncture of a CV prefix and a root—the constraints violated by $V_1$ elision constitute a subset of those violated by $V_2$ elision. In these contexts, therefore, I predict that only $V_1$ elision is possible. In each of the remaining environments, there is at least one constraint violated only by $V_1$ elision and at least one constraint violated only by $V_2$ elision. In these cases either $V_1$ elision or $V_2$ elision is predicted to be possible, depending on the relative ranking of the constraints in the particular language. These predictions, which are far from trivial, are in good agreement with the available facts presented in §2.

In addition to the elision contexts just considered, there is at least one other environment for which my analysis makes predictions: where hiatus arises through the juxtaposition of two prefixes or two suffixes. Data bearing on this context is however less substantial than for the four contexts treated above, both because there are fewer languages in the survey that display elision in this context, and because many of the sources that do show elision have little to say about it. I will not consider this context further here.[15]

**6.** VOWEL ELISION IN PARTICULAR LANGUAGES. The framework developed so far gives rise to at least two types of testable predictions. First, it predicts that a number of elision patterns which otherwise might plausibly be expected to occur are ruled out, for example, a language that regularly elides $V_2$ at lexical word boundaries. Second, it predicts the possibility of some interesting asymmetries within individual languages. For example, the fact that MAXLEX is violated by $V_2$ elision at a prefix-root boundary but by $V_1$ elision at a root-suffix boundary predicts the possibility (in a case in which MAXLEX is not crucially dominated by other relevant constraints) of a language that displays $V_1$ elision in the former context but $V_2$ elision in the latter.

The first type of prediction was discussed in §5; in this section, I address asymmetries in elision patterns by examining the elision patterns found in Emai, Okpe, and Chichewa, three languages that exemplify different directional possibilities in different contexts. Emai is of interest because it exemplifies a predicted asymmetry in which elision across word boundaries consistently targets $V_1$ except in the special instance in which the second word is a function word, in which case $V_2$ is elided. Chichewa displays a comparable asymmetry word internally: $V_1$ is elided in prefixal contexts and $V_2$ in suffixal contexts. Both types of asymmetry provide justification for the constraint MAXLEX. This constraint also plays a crucial role in the analysis of Okpe, in which it displays an interesting interaction with the constraint MAXMS, giving rise to a particularly intricate pattern.

Although the directional asymmetries in Emai, Okpe, and Chichewa will command most of our attention, I first set the stage with a straightforward example of a language that lacks any such asymmetry. In Ogori, elision, which

[15] For some discussion see Casali 1996a.

occurs at word boundaries, consistently targets $V_1$, regardless of the lexical or functional status of the words involved.

**6.1.** OGORI. Ogori, a Benue-Congo language spoken in Nigeria, is described by Chumbow (1982a, b). Chumbow describes hiatus arising at word boundaries, discussing cases where both words are lexical, and also those in which a lexical word precedes a function word. According to Chumbow, hiatus is resolved in both instances by elision of $V_1$.[16] This is illustrated in 26, where both words are lexical, and 27, in which the second word is nonlexical.[17]

(26) a. /ɔtɛ́lɛ́ ɔkɛ̀ka/ → [ɔtɛ́lɔ́kɛ̀ka] 'big pot'
pot big

b. /ébí óbòrò/ → [ébóbòrò] 'good water'
water good

c. /íjá ɔ̀súdá/ → [íjɔ́súdá] 'old woman'
woman old

(27) a. /ɔbɛ̀lɛ̀ ɔnɛ/ → [ɔbɛ̀lɔ̀nɛ] 'this mat'
mat this

b. /ójí ɔnɛbɛ/ → [ójɔ́nɛbɛ] 'that rope'
rope that

As discussed in §5, elision at the boundary between two lexical words (as in 26) is predicted to universally target $V_1$ in preference to $V_2$, because $V_1$ elision violates only MAXLEX and general MAX, whereas $V_2$ elision violates, in addition, MAXWI. The occurrence of $V_1$ elision in 27, in which a lexical word precedes a function word, is diagnostic of the ranking MAXWI ≫ MAXLEX. This is illustrated below for the case of 27a.

(28)

| /ɔbɛlɛ ɔnɛ/ | MAXWI | MAXLEX | MAX |
|---|---|---|---|
| ☞ ɔbɛl<ɛ>ɔnɛ | | * | * |
| ɔbɛlɛ<ɔ>nɛ | *! | | * |

Chumbow (1982b) also provides examples like the following, in which the final (or only) vowel of a pronoun is elided before a following word-initial vowel (in some cases with compensatory lengthening of the latter).[18]

[16] Although Chumbow explicitly describes only cases of $V_1$ elision, there is one example (for which I offer no analysis at present) in Chumbow 1982b (86) that appears to involve elision (with compensatory lengthening) of the last two vowels in a three-vowel sequence: /ni deki-fisɛ-a isisi/ 'you make him disappear all the time' → [nidekifisɛɛsisi].

[17] In giving examples throughout this section, I ignore certain irrelevant phonetic details. I also occasionally employ different phonetic symbols than those used in the original sources. Although I show compensatory lengthening where it occurs, I make no attempt to explicitly account for it in my analyses. Thus, in displaying tableaux, I do not show competing candidates differing only in whether or not they manifest lengthening. (For an account of compensatory lengthening within the framework of optimality theory, see Rosenthall 1994.)

[18] Alternatively, we might view the process in 29b as one of total assimilation of $V_1$ to $V_2$. This is in fact the view adopted by Chumbow. Within the version of correspondence theory employed

(29) a. /tí á-mà-wɔ́-nɔ̀/ → [támàwɔ́nɔ̀]
we INC-NEG-hear-you 'we are not hearing you'
b. /è á-né èbàtà/ → [àánéèbàtà]
he INC-fling shoe 'he is flinging his shoe'

Assuming that pronouns are nonlexical, the occurrence of $V_1$ elision in 29a is predicted under any ranking of the constraints, since elision of the pronoun vowel violates only general MAX, while elision of the following vowel violates MAXWI (and MAXLEX) in addition. The case of the V pronoun in 29b is slightly more complicated, since the attested elision of $V_1$ in this case violates MAXMS and MAXWI in addition to general MAX. Elision of $V_2$, on the other hand, would violate MAXWI and MAXLEX (as well as general MAX). The fact that $V_2$ is preserved indicates that MAXLEX, the constraint violated uniquely by $V_2$ elision, must outrank MAXMS, the constraint violated only by $V_1$ elision.

(30)

| /ɛ anɛ/ | MAXWI | MAXLEX | MAXMS | MAX |
|---|---|---|---|---|
| ☞ <ɛ>anɛ | * | | * | * |
| ɛ<a>nɛ | * | *! | | * |

The constraint rankings required for Ogori are summarized in Table 3.

| RANKING | REASON(S) |
|---|---|
| {NODIPH, ONSET, DEP, *CG, UNIFORMITY, IDENT} ≫ {MAXLEX, MAX} | The constraints that militate against diphthong formation, heterosyllabification, epenthesis, glide formation, and coalescence must be ranked above the MAX constraints that are violated in Ogori in order to yield elision in preference to one of these other hiatus outcomes. |
| MAXWI ≫ MAXLEX | MAXWI must be ranked above MAXLEX to yield $V_1$ elision where a lexical word precedes a function word. |
| MAXLEX ≫ MAXMS | Required to yield $V_1$ elision in cases like 29b, in which a V pronoun precedes a V-initial lexical word. |
| MAXWI, MAXMI, MAXMS, MAXLEX ≫ MAX | (universal) |

TABLE 3. Constraint rankings for Ogori.

**6.2.** EMAI. Emai is a Benue-Congo language spoken in Nigeria. It is of interest here primarily because it provides a clear example of the predicted asymme-

here (which is based on McCarthy & Prince 1995), these two viewpoints correspond to two very different analyses: whereas elision with compensatory lengthening violates MAX, the assimilation analysis satisfies MAX (since both vowels are retained in the output) but incurs multiple IDENT violations (since $V_1$ has lost its underlying place features, assuming those of $V_2$). I can see no facts of Ogori that clearly vindicate one or the other of these analytical possibilities, a detailed comparison of which would take us well beyond the scope of this article.

try between lexical and function words under elision.[19] According to Schaefer (1987:5, 6), vowels in function words are more likely targets of elision than those in lexical words: 'Most susceptible to elision are vowels which are part of the sound shape of grammatical markers or function words ... Overall, elision tends to obscure the sound shape that a function word exhibits in isolation, since its initial or final vowel is omitted'. Schaefer lists the following representative sample of Emai function words:

(31) a. /isi/ associative marker
b. /li/ indirect object marker (with nouns)
c. /ni/ indirect object marker (with pronouns)
d. /li/ relative clause marker
e. /ki/ negative focus marker
f. /βi/ locative marker

Schaefer gives examples of function words occurring both before and after lexical words. He also shows instances of hiatus involving lexical words only.

Consider first a situation in which a function word precedes a lexical word; among the examples Schaefer gives illustrating this particular case are those in 32.

(32) a. /βi oa/ → [βoa]
in house
b. /ɔli oa/ → [ɔloa]
the house
c. /ɔli ebe/ → [ɔlebe]
the book

In this context, $V_1$ elision violates only general MAX, while $V_2$ elision would violate not only MAX, but MAXLEX and MAXWI as well. Hence, only $V_1$ elision is possible in this environment, irrespective of the relative rankings of MAXLEX and MAXWI.

[19] The analysis of Emai in this section is based primarily on data in Schaefer 1987. (A few examples are also taken from Folarin-Schleicher 1992). More recently, since this article was written and revised for *Language*, I discovered an additional descriptive source on Emai vowel elision, Egbokhare 1990. This source, which provides numerous examples of elision in a wide variety of contexts, largely underscores the generalizations presented in Schaefer. In particular, there is further clear evidence of differential behavior of lexical and function words, including a telling contrast in which hiatus arising in noun-plus-modifier constructions is resolved by $V_1$ elision if the modifier is another noun (e.g. /ɛ̀kpà ɔ́kà/ 'bag of maize' → [ɛ̀kpɔ̀ká]), but $V_2$ elision if the modifier is a determiner or possessive pronoun (e.g. /ébè ɔ̀nǎ/ 'this book' → [ébénǎ]). At the same time, however, Egbokhare presents a number of additional facts not discussed by Schaefer, some of which call for extension or modification of the analysis presented here. The most challenging of these is the fact that the initial vowel of a pronoun is not consistently elided when it immediately follows a verb ending in a vowel, as my analysis would predict (because of the ranking I posit of MAXLEX above MAXWI); in some cases the vowel of the verb is elided instead. I forego an analysis of these facts (whose full and precise statement appears to be rather complex) here, leaving this matter, along with the treatment of certain other facts found in Egbokhare, to future research. It is also of interest to note that Egbokhare seeks to explain the various patterns of hiatus resolution in Emai in terms of a number of ranked functional principles, very much in the spirit of the approach advocated in the present work, though the substance of his proposals differs considerably from my own.

Where a function word FOLLOWS a lexical word, Emai displays $V_2$ elision instead of $V_1$ elision, as seen in the additional data in 33.

(33) a. /ukpode ɔna/ → [ukpodena]
road this

b. /ebe ɔna/ → [ebena]
leaf this

c. /ɔli oa ɔna/ → [ɔloana]
the house this

d. /oa isi ɔi/ → [oasɔi]
house of his

As discussed in §5, $V_2$ elision in this context occurs when MAXWI (which is violated by elision of $V_2$) is ranked below MAXLEX (which is violated by elision of $V_1$). Note that this is the exact opposite ranking of the one established for Ogori, in which entirely analogous utterances (like those in 27) are subject to $V_1$ rather than $V_2$ elision.

The last two examples in 33 are particularly interesting. In 33c, the lexical word /oa/ 'house' is flanked by two function words, both of which lose their vowels. In 33d, a single VCV function word occurs between a vowel-final lexical word and a vowel-initial function word. Here, as the ranking MAXLEX ≫ MAXWI predicts, this VCV function word loses BOTH its vowels, while the other words survive intact.

At the boundary between two lexical words, elision in Emai consistently targets $V_1$, as shown in 34. As shown previously, this follows (universally) from the fact that only $V_2$ elision violates MAXWI. MAXLEX and MAX cannot affect the outcome in this context, because they are both violated by $V_1$ elision and $V_2$ elision alike. (Ex. 34b–d are taken from Folarin-Schleicher 1992. Note that the nasality of an elided $V_1$ is preserved, showing up on $V_2$.)[20]

(34) a. /kɔ ema/ → [kema]
plant yam

b. /tɔ̀ ɛ́wè/ → [tɛ̃́wè]
roast goat

c. /fá édì/ → [fɛ̃́dì]
pluck palm.nut

d. /kɛ̀ ɔ́kà/ → [kɔ̃́kà]
share maize

Hiatus also arises in some instances at the boundary between two roots in a compound. Here again, elision regularly targets $V_1$.

(35) a. /ɔ-da-ɛɲɔ̃ → [ɔdɛɲɔ̃]
PREFIX-drink-wine 'drunkard'

b. /u-kpe-akɔ̃/ → [ukpakɔ̃]
PREFIX-wash-teeth 'chewstick'

[20] Although short $V_1$s are regularly subject to elision or glide formation, these processes are blocked when $V_2$ is long. According to Schaefer, these underlying long vowels do however 'tend to be shortened'. Thus, he transcribes the outcome of /kɔɔ ebe/ 'read a book' as [kɔebe], with a short [ɔ] rather than a long [ɔɔ]. Resistance of long vowels to elision is not unusual; similar effects are found in a number of other languages, including Central Kambari (Hoffman 1972), Engenni (Thomas 1978), Ila (Smith 1907), Moba (Russell 1985), and Nawuri (Casali 1988, 1995b).

That $V_1$ elision occurs in this context follows from the fact that this satisfies the constraint MAXMI, while $V_2$ elision does not. Both types of elision violate MAXLEX (since both roots are of course lexical morphemes) and general MAX, which therefore have no effect on the outcome. MAXWI is of course irrelevant since we are dealing with a word-medial environment, as is MAXMS, since neither of the roots is monosegmental.

The rankings required to account for the directional behavior of elision in Emai are summarized in Table 4.[21]

| RANKING | REASON(S) |
|---|---|
| {NODIPH, ONSET, DEP, UNIFORMITY, IDENT} ≫ {MAXLEX, MAXWI, MAX} | The constraints that militate against diphthong formation, heterosyllabification, epenthesis, and coalescence must be ranked above the MAX constraints that are violated in Emai in order to yield elision in preference to one of these other hiatus outcomes. |
| MAXLEX ≫ MAXWI | MAXLEX must be ranked above MAXWI to yield $V_2$ elision where a lexical word precedes a function word. |
| MAXWI, MAXMI, MAXMS, MAXLEX ≫ MAX | (universal) |

TABLE 4. Constraint rankings for Emai.

**6.3.** OKPE. Okpe, a Benue-Congo language spoken in Nigeria, is described by Hoffman (1973) and Omamor (1988) (see also Pulleyblank 1986). This language shows glide formation of a final high vowel of a verb root before a V suffix. Examples are shown in 36; note that the choice of suffix allomorph is determined by [ATR] vowel harmony.[22]

(36) Infinitive suffix /o/ ~ /ɔ/

a. /è-tí-ó/ → [ètyó] 'to pull'
INF-pull-INF

b. /è-rú-ó/ → [èrwó] 'to do/make'
INF-do-INF

[21] In addition to elision, Emai also displays glide formation in some cases, for example /fi ɔpia/ 'throw cutlass' is realized as [fyɔpia], while /u-su-ema/ 'tuber of yam' is realized as [uswema]. Although the coexistence of glide formation and elision within the same language is a common occurrence whose treatment within optimality theory is straightforward in principle (Rosenthall 1994, Casali 1995c, 1996a), glide formation in Emai exhibits a number of complexities which, while they are of considerable interest in their own right, cannot be adequately addressed without taking us too far afield from our main topic. I will therefore not provide an analysis of glide formation in Emai here. (A more straightforward case of glide formation, found in Okpe, is treated in the next section.)

[22] Here and throughout I generally use IPA symbols for vowels which Omamor symbolizes using orthographic or other symbols. I follow Omamor in distinguishing nine vowels phonetically. Hoffman does not distinguish [e] from [ɪ] nor [o] from [ʊ] phonetically, although he proposes that they are distinct phonologically. For evidence that they are distinct phonetically as well see Omamor 1973.

c. /è-sú-ɔ́/ → [èswɔ́] 'to sing'
INF-sing-INF

Imperfective suffix /ɛ/ ~ /a/

d. /á-↓dú-á/ → [á↓dwá] 'is big'
IMPF-be.big-IMPF

e. /é-↓fú-ɛ́/ → [é↓fwɛ́] 'is swollen'
IMPF-be.swollen-IMPF

f. /á-↓rí-á/ → [á↓ryá] 'is eating'
IMPF-eat-IMPF

Future suffix /o/ ~ /ɔ/

g. /rí-ɔ́/ → [ryɔ́] 'will eat'
eat-FUT

h. /bí-ó/ → [byó] 'will be black'
be.black-FUT

i. /hú-ó/ → [hwó] 'will die'
die-FUT

If however the final vowel of the verb root is a nonhigh vowel, glide formation does not apply and the suffix does not surface. Following Pulleyblank 1986, I regard this as due to $V_2$ elision.

(37) a. /è-sé-ó/ → [èsé] 'to fall'
INF-fall-INF

b. /è-dɛ́-ɔ́/ → [èdɛ́] 'to buy'
INF-buy-INF

c. /é-↓nɛ̃́-ɛ́/ → [é↓nɛ̃́] 'is defecating'
IMPF-defecate-IMPF

d. /á-↓zɛ́-á/ → [á↓zɛ́] 'is running'
IMPF-run-IMPF

e. /fé-ó/ → [fé] 'will be rich'
be.rich-FUT

f. /dɛ́-ɔ́/ → [dɛ́] 'will buy'
buy-FUT

The occurrence of glide formation in the examples in 36 requires, at a minimum, ranking of MAXLEX and either MAXMI or MAXMS above *CG. (For concreteness, I will assume that both MAXMI and MAXMS are ranked above *CG.) Given this ranking, an input sequence like /ti-o/ (cf. 36a) will be resolved by glide formation in preference to elision of $V_1$ or $V_2$.

(38)

| /ti-o/ | MAXLEX | MAXMS | MAXMI | *CG |
|---|---|---|---|---|
| ☞ tyo | | | | * |
| t<i>o | *! | | | |
| ti<o> | | *! | * | |

To rule out other candidates, involving diphthong formation, heterosyllabifica-

tion, epenthesis, or coalescence, I further assume that the constraints NoDiph, Onset, Uniformity, and Ident dominate *CG.

To account for the fact that only high vowels undergo glide formation, I assume the additional constraint (39), previously proposed in Casali 1995c.[23]

(39) HiG: Glides must be [+high].

Since realizaton of an underlying [−high] vowel as a semivowel violates this constraint, crucial ranking of HiG above MaxLex (essentially following proposals in Rosenthall 1994 and Casali 1994) will favor elision over this realization. Of course, candidates in which an underlying [−high] vowel corresponds to a [+high] glide on the surface must also be ruled out. While such a candidate satisfies HiG, mapping of a [−high] vowel onto a [+high] glide violates Ident, since the segment's surface specification for [high] is not identical to its underlying specification. Ranking of both HiG and Ident above the constraints, MaxMS and MaxMI, which are violated by elision of a V suffix, therefore correctly allows for glide formation when $V_1$ is high (since this satisfies both Ident and HiG), while yielding elision in preference to glide formation when $V_2$ is nonhigh. This is illustrated in 40 for the case in which $V_1$ is high and 41 for the case where $V_1$ is nonhigh.

(40)

| /ti-o/ | HiG | Ident | MaxMS | MaxMI | *CG | Max |
|---|---|---|---|---|---|---|
| ti<o> | | | *! | * | | * |
| ☞ tyo | | | | | * | |

(41)

| /se-o/ | HiG | Ident | MaxMS | MaxMI | *CG | Max |
|---|---|---|---|---|---|---|
| ☞ se<o> | | | * | * | | * |
| seo | *! | | | | * | |
| syo | | *! | | | * | |

Not considered so far in these tableaux is the possibility of $V_1$ elision. The fact that this possibility actually loses out to $V_2$ elision in cases like 41 requires the additional ranking of MaxLex (which is violated by $V_1$ elision in this context) above both MaxMS and MaxMI (which are violated by $V_2$ elision). This is demonstrated in 42.

[23] HiG is similar in spirit to the constraint {A} = V (originally proposed in McCarthy & Prince 1993) employed by Rosenthall 1994. The two constraints differ however in that {A} = V, but not HiG, is satisfied by a nonsyllabic vocoid lacking any specification for [high]. Evidence that such glides exist and that HiG is the appropriate statement of the relevant constraint is presented in Casali 1995c.

(42)

| /se-o/ | HIG | IDENT | MAXLEX | MAXMS | MAXMI | *CG | MAX |
|---|---|---|---|---|---|---|---|
| ☞ se<o> | | | | * | * | | * |
| s<e>o | | | *! | | | | |
| sẹ-o | *! | | | | | * | |
| syo | | *! | | | | * | |

Our attention has so far been confined to root-plus-suffix contexts. In addition, Omamor (1988) describes cases of elision at the boundary between two words, the first of which is a pronoun. These are shown below. (Here the sequence /asa ma/ (or /asa me/) in 43a, b, d, and e constitutes one way of marking future tense in Okpe; Omamor does not indicate the relative meaning contributions of the two constituent parts of this sequence. The construction in 43c and f is described as a common stylistic variant of the /asa ma/ ~ /asa me/ construction.)[24]

(43) a. /wù á ↓ sá mà nyá/ → [wá ↓ sámànyá]
you go 'you are going to go'

b. /wù á ↓ sá mè rhé/ → [wá ↓ sámèrhé]
you know 'you are going to know'

c. /wù é ↓ séè fé/ → [wé ↓ séèfé]
you be.rich 'you are going to be rich'

d. /ɔ́ á ↓ sá mà nyá/ → [ɔ́ ↓ sámànyá]
he go 'he is going to go'

e. /ɔ́ á ↓ sá mè rhé/ → [ɔ́ ↓ sámèrhé]
he know 'he is going to know'

f. /ɔ́ á ↓ sáà dɛ́/ → [ɔ́ ↓ sáàdɛ́]
he buy 'he is going to buy'

What is surprising about these examples is that the pronoun /wʊ/ 'you' and /ɔ/ 'she/he' give rise to different results: while /wʊ/ triggers $V_1$ elision, /ɔ/ triggers $V_2$ elision.[25] This very interesting asymmetry follows automatically from our analysis, provided we adopt the not unreasonable assumption that neither the subject pronouns nor the future marker /asa/ are fully lexical words and hence

[24] Omamor's data does not actually show any tone mark on the initial vowel of the word /asa/ in ex. 43a and d. This appears to be simply an error, since vowels are regularly marked for tone throughout and this same initial vowel in /asa/ appears elsewhere with high tone. It is also not entirely clear whether the tone of the elided vowel in 43 is preserved (yielding a contour on the adjacent vowel), although Omamor's discussion and notation give the impression that it is not.

[25] Although we might have expected gliding of /ʊ/ in 43a–c instead, given that these vowels are regularly subject to glide formation elsewhere in the language, the failure of glide formation to apply in this case can presumably be attributed to the ill-formedness of the [ww] sequence that would result. In fact, exemption of /wU + V/ (and /yI + V/) sequences from glide formation would seem to be the norm in languages that have this process.

are not subject to the constraint MAXLEX.[26] Consider first exx. 43 d–f involving the third person pronoun /ɔ/. Here elision of either /ɔ/ ($V_1$) or the initial vowel /a/ of the future marker will violate MAXWI, as well as general MAX. Neither elision possibility violates MAXLEX. The outcome will therefore be decided by the remaining MAX constraint, MAXMS, which is violated by elision of /ɔ/ but not by elision of /a/:

(44)

| /ɔ asa/ | MAXLEX | MAXMS | MAXWI | MAX |
|---|---|---|---|---|
| ☞ ɔ<a>sa | | | * | * |
| <ɔ>asa | | *! | * | * |

As a consequence, elision of /a/ is preferred under any relative ranking of these MAX constraints.

In the case of the second person pronoun /wʊ/, in contrast, it is the constraint MAXWI, which in this context is violated only by $V_2$ elision, that is decisive; the constraints MAXLEX and MAXMS are not violated by either $V_1$ or $V_2$ elision, while general MAX is of course violated by both. Thus, $V_1$ elision is necessarily the result:

(45)

| /wʊ asa/ | MAXLEX | MAXMS | MAXWI | MAX |
|---|---|---|---|---|
| /wʊ<a>sa | | | *! | * |
| ☞ w<ʊ>asa | | | | * |

Notice that since this result does not depend on the relative rankings of the MAX constraints, I claim that it must hold universally, that is we expect that $V_1$ elision will always apply in preference to $V_2$ elision at the boundary between two nonlexical words, provided that the first word is minimally CV. Likewise in 44, the outcome is not affected by reordering of the MAX constraints, and so we are committed to the prediction that elision will universally target $V_2$ in cases of this type, in which a V function word precedes a longer vowel-initial function word.

The $V_2$ elision outcome in 44 depends crucially on the fact that both words are nonlexical, so that neither $V_1$ elision nor $V_2$ elision violates MAXLEX. If, instead, the pronoun /ɔ/ were to be followed by a lexical word, the result would necessarily depend on the relative ranking of MAXMS and MAXLEX, since elision of /ɔ/ would violate the former, while $V_2$ elision would violate the latter. (The two elision candidates would continue to tie with regard to their satisfaction of each of the other constraints.) I have already argued however that, in

[26] Proposals that pronouns are not lexical elements are discussed for example in Emonds 1985, Golston 1991, Postal 1969, Stockwell et al. 1973.

Okpe, it is MAXLEX which is ranked above MAXMS. Thus, the analysis necessarily predicts $V_1$ elision as the outcome in this context, as demonstrated in 46 (where the sequence /ata/ is used to represent a hypothetical lexical word).

(46)

| /ɔ ata/ | MAXLEX | MAXMS | MAXWI | MAX |
|---|---|---|---|---|
| ɔ<a>ta | *! | | * | * |
| ☞ <ɔ>ata | | * | * | * |

While sequences of this type occur in Okpe, there is some question about the actual facts. Omamor (1988:49, 50) gives examples in which the third person singular subject pronoun /o/~/ɔ/ 'he/she' occurs before a vowel-initial verb:[27]

(47) a. /ò é ↓ né/ 'he/she/it is defecating'
b. /ɔ̀ á ↓ zé/ 'he/she/it is running (away)'

Although she does not provide actual surface forms for these examples, Omamor's verbal description clearly indicates that it is the vowel of the pronoun (i.e. $V_1$) that is elided.[28] This would give the phonetic forms in 48, which are those predicted by my analysis.

(48) a. /ò é ↓ né/ → [é ↓ né] 'he/she/it is defecating'
b. /ɔ̀ á ↓ zɛ́/ → [á ↓ zɛ́] 'he/she/it is running (away)'

In contrast, Hoffman (p.99) has [ɔ́ ↓ zé] (which evidently involves elision of $V_2$) as the surface form of 47b.[29] He also provides a number of parallel examples of this type, which also show preservation of the /o/~/ɔ/ pronoun, e.g. [ó ↓ só]

[27] Word-initial /a/~/e/ in these examples is an imperfective prefix that undergoes [ATR] harmony with the root vowel. I assume that some mechanism analogous to bracket erasure ensures that the internal morphemic composition of words is invisible postlexically, so that elision of the prefix vowels in these examples would not violate MAXMS. This assumption does not however affect the outcome my analysis predicts for these examples: $V_1$ elision is predicted regardless of whether $V_2$ elision violates MAXMS, as the reader may verify. The pronoun /ò/~/ɔ̀/ bears no tone mark in these examples in Omamor's original data. I assume that this is simply an error and that these vowels are in fact low toned.

[28] She describes (p.50) the process to which the forms in 47 are subject as one of 'assimilation' of the pronoun vowel to the imperfective prefix, which is the initial vowel of the verb. Other examples in her paper make it clear that her use of assimilation is equivalent to my elision (with no compensatory lengthening).

[29] Hoffman does not actually describe this example as involving elision, but rather treats the vowel /ɔ/ in this example as a portmanteau morpheme marking both person-number and continuous tense. He posits portmanteau pronouns for the other person-number combinations as well. In every one of these other cases, however, the sequence Hoffman describes as a single morpheme simultaneously marking person-number and aspect is readily decomposable into the ordinary person-number pronoun found in other contexts followed by a segment /a/ that may be assumed to signal continuous aspect, e.g. [mìá] ([mya] in Omamor's data). The sequence that appears in the first person singular continuous is straightforwardly analyzable as /mi/ 'I' plus /a/ (continuous tense), while [wa] derives (via $V_1$ elision) from /wɪ/ 'you' plus the same /a/. I therefore follow Omamor in assuming that the third person singular continuous forms also involve an underlying aspect marker /a/ following the subject pronouns.

'he is stealing', [ɔ́ ↓ ryá] 'he is eating'. I do not know whether the apparent discrepancy between the facts as presented by Omamor and those described by Hoffman can be attributed to differences in the dialects being described. In any event, it is clear that the surface forms given by Hoffman are not presently accounted for by my analysis. While there are various ways in which we might seek to modify the analysis in order to accommodate these examples, I will not pursue a resolution of this matter here.[30]

In order to rule out forms of hiatus resolution not attested in Okpe—diphthong formation, heterosyllabification, epenthesis, and coalescence—we must posit the further ranking {NoDiph, Onset, Dep, Uniformity, Ident} ≫ {MaxMI, MaxMS, MaxWI, Max}. The rankings needed to handle the Okpe facts may now be summarized as in Table 5.

| Ranking | Reason(s) |
|---|---|
| {NoDiph, Onset, Dep, Uniformity, Ident} ≫ {MaxMS, MaxMI, MaxWI, Max} | The constraints that militate against diphthong formation, heterosyllabification, epenthesis, and coalescence must be ranked above the Max constraints that are violated in Okpe in order to yield elision in preference to one of these other hiatus outcomes. |
| MaxLex ≫ {MaxMS, MaxMI} | MaxLex must be ranked above both MaxMS and MaxMI to yield $V_2$ elision rather than $V_1$ elision with V suffixes. |
| MaxWI, MaxMI, MaxMS, MaxLex ≫ Max | (universal) |
| MaxLex ≫ *CG. | Required to yield glide formation rather than $V_2$ elision when $V_1$ is high. |
| {HiG, Ident} ≫ {MaxMS, MaxMI, MaxWI} | Required to yield $V_2$ elision rather than glide formation when $V_1$ is nonhigh. (HiG, Ident} ≫ MaxWI is required to prevent glide formation in examples involving the /ɔ/ subject pronoun in $V_1$ position.) |

Table 5. Constraint rankings for Okpe.

[30] One obvious alternative to pursue is the possibility that the pronouns in these examples come under the purview of some additional MaxP constraint that makes reference to initial position in some higher level syntactic or phonological constituent such as the phonological phrase. Another possibility would be to split the single constraint MaxLex into two separate constraints (as in 7), one which dictates preservation of root segments and the other which requires preservation of segments in lexical words. The ranking MaxMS ≫ MaxContent would then predict $V_2$ elision as the outcome for examples like /ɔ́ á ↓ zɛ́/ (47b), in accordance with Hoffman's data. At the same time, the ranking MaxRoot ≫ {MaxMS, MaxMI} would fill exactly the same role as the ranking MaxLex ≫ {MaxMS, MaxMI} under the present analysis, maintaining the prediction that $V_2$ elision will occur in the examples involving V suffixes in 37. Both of these alternatives (as well as several others that can be envisioned) constitute reasonable possibilities that may well be worth exploring on independent grounds. This fact simply underscores the programmatic nature of the proposals presented here: although the essence of the model is clear enough in broad outline, it is to be expected that a satisfactory statement of the full set of position-sensitive Max constraints will require considerable refinement, based on further empirical investigation, of these initial proposals.

**6.4.** CHICHEWA. Vowel elision in Chichewa (a Bantu language spoken in Malawi) is described in Mtenje (1980, 1992) and Watkins (1937). For our purposes, the Chichewa facts are of interest primarily because of different directional behaviors exhibited in prefixal and suffixal contexts. We shall see that these differences are handled straightforwardly by the analysis I am developing here.

Chichewa has both $V_1$ and $V_2$ elision. $V_2$ elision occurs at the boundary between a noun root and a demonstrative suffix of the form VCV.[31] (Clear instances of V suffixes do not occur in Mtenje's data.) Examples (adapted from Mtenje 1992:67) are shown in 49.

(49) a. /mwana-uyɔ/ → [mwanayɔ]
child-that 'that child'
b. /bambɔ-awa/ → [bambɔwa]
man-this 'this man'
c. /ɲimbɔ-izi/ → [ɲimbɔzi]
songs-these 'these songs'
d. /khasu-ili/ → [khasuli]
hoe-this 'this hoe'

The occurrence of $V_2$ elision with these examples is correctly predicted if we assume that Chichewa has the ranking MAXLEX ≫ MAXMI.[32] This is illustrated in the tableau in 50. (Here we must of course also assume the ranking of the other hiatus resolution constraints ONSET, NODIPH, DEP, UNIFORMITY, and IDENT above MAXMI, although this has not been shown in 50.)

(50)

| /khasu-ili/ | MAXLEX | MAXMI | MAX |
|---|---|---|---|
| khas<u>ili/ | *! | | * |
| ☞ khasu<i>li | | * | * |

Here $V_1$ elision incurs a fatal violation of MAXLEX; $V_2$ elision, whose most serious violation is of the lower ranked MAXMI, is therefore to be preferred.

In prefix-plus-root contexts, elision consistently targets $V_1$. I illustrate $V_1$ elision at this type of juncture with the examples in 51, from Watkins (1937: 30, 38). (The prefixes /mu/ and /tʃi/ in these examples are singular noun class prefixes.)

[31] Certain VCV demonstrative suffixes, in particular several of the shape /Vja/, unexpectedly fail to undergo elision; in such cases, hiatus is retained (Mtenje 1992:67, 68).

[32] There is some question as to whether the demonstratives in 49 are really suffixes. Although Mtenje's 1992 paper treats them as such, his 1980 thesis analyzed them as separate words, a treatment apparently supported by the fact that they can also precede the noun they modify in some instances, as in /uyu ndi mwana/ 'this is a child' (cf. 49a above). If it turned out that they are in fact separate words, then it is only necessary to rank MAXLEX above MAXWI. The effect of this ranking would be exactly analogous to the word-internal ranking MAXLEX ≫ MAXMI assumed in the present analysis.

(51) a. /mù-ɔ̀nɔ̀/ → [mɔ̀:nɔ̀] 'fish trap'
NOUN CL-fish.trap
b. /mù-ɔ́tɔ̀/ → [mɔ́:tɔ̀] 'fire'
NOUN CL-fire
c. /tʃì-ákà/ → [tʃá: kà] 'year'
NOUN CL-year
d. /tʃì-ámbà/ → [tʃá:mbà] 'hemp'
NOUN CL-hemp

As stated in §5, my constraints predict that elision in this context (provided that the prefix is minimally CV, so that MAXMS is irrelevant) will universally target $V_1$, since this violates only general MAX, whereas $V_2$ elision violates MAXLEX in addition.

Elision also consistently targets $V_1$ at the boundary between a CV prefix and a following V prefix, as in 52 (from Mtenje 1992:67). (Such contexts arise in verbs and adjectives, but not in nouns, in which the root is apparently preceded by at most one prefix, viz. the class prefix.)

(52) a. /si-u-pita/ → [supita]
NEG-2SG-go 'you will not go'
b. /ti-a-bwɛla/ → [tabwɛla]
1PL-PERF-come 'we have come'
c. /tʃi-a-bwinɔ/ → [tʃabwinɔ]
NOUN CL-POSS-good 'a good one'
d. /zi-a-gɔna/ → [zagɔna]
NOUN CL-PERF-sleep 'they have slept'

In these examples, the second prefix consists of a single segment. Deletion of $V_2$ would therefore violate MAXMS, and also MAXMI. Eliding the vowel of the first (CV) prefix in contrast violates only MAX. Thus, the analysis necessarily predicts $V_1$ elision in this context. (Note that although this result does not crucially depend on the ranking MAXLEX ≫ MAXMI that has already been established for the demonstrative suffix cases, it is fully consistent with it.)

At lexical word boundaries, elision also targets $V_1$, as in the examples in 53 (Watkins 1937:11, Mtenje 1980:33).

(53) a. /fùrú á-tʃɛ̀:mà/ → [fùrá:tʃɛ̀:mà] 'tortoise is calling'
tortoise CNCRD-call
b. /gālù á-yɛ̄ndà/ → [gāláyɛ̄ndà] 'a dog walks'
dog CNCRD-walk

Once again, this result follows (universally) from the fact that $V_2$ elision in this context would violate both MAXLEX and MAXWI, while $V_1$ elision violates only the former.[33]

Finally, in addition to elision, glide formation also occurs in Chichewa, as seen in the following examples (Mtenje 1980:46, 59).[34]

[33] Mtenje's data also contains instances of $V_1$ elision involving verbal suffixes. In Watkins's analysis, these examples (which are discussed in Casali 1996a) do not actually involve elision, but rather the absence of epenthesis and/or morphological suffixation.

[34] In addition to vowel elision and glide formation, Chichewa also displays some instances of

(54) a. /mú-á-mwānɔ̀/ → [mwámwānɔ̀] 'rudely'
LOC-ADJ-rudeness
b. /mú-á-tɛ́ŋgà/ → [mwátɛ́ŋgà] 'you will take them'
2SG-3PL-take

Glide formation is only possible however when $V_1$ is /u/. When /i/ occurs in $V_1$ position, it undergoes elision instead, as illustrated in 52 above.[35] This indicates that the single constraint *CG thus far used to rule out glide formation is inadequate; we must distinguish between gliding of /u/ and gliding of /i/, using more specific constraints *Cw and *Cy. We can then account for the fact that Chichewa glides /u/ but not /i/ by ranking *Cw below MAX but *Cy above MAX. This gives rise to results like those shown in 55 and 56.[36]

(55)

| /Ci+$V_2$/ | *Cy | MAX | *Cw |
|---|---|---|---|
| ☞ C<i>$V_2$ | | * | |
| C$yV_2$ | *! | | |

(56)

| /Cu+$V_2$/ | *Cy | MAX | *Cw |
|---|---|---|---|
| C<u>$V_2$ | | *! | |
| ☞ C$wV_2$ | | | * |

The claim that languages may distinguish between the acceptability of [Cy] sequences and [Cw] sequences is of course hardly surprising, and is supported for example by the existence of a large number of West African languages which permit only the latter.[37]

The rankings established for Chichewa are summarized in Table 6.

coalescence and epenthesis. Although the general treatment of these processes within the present model is straightforward in principle, constructing a detailed treatment of epenthesis in Chichewa is made difficult by the fact that the conditions which determine when epenthesis will take place in preference to elision or glide formation are far from clear. (For proposals on the general mechanisms responsible for coalescence, see Casali 1996a.)

[35] No examples are given of underlying mid vowels occurring in $V_1$ position.

[36] Remaining to be explained is why glide formation does not apply to the word-final /u/'s in 53. I speculate that glide formation fails to apply to these examples because the consonant preceding the word-final /u/ in both cases is a coronal. This is plausible in view of the fact that it is not uncommon for languages to permit only [Cw] clusters in which the consonant is noncoronal. If this hunch is right, it would argue for adopting a constraint (ranked above MAX) dispreferring coronal + [w] sequences. Alternatively, we might take the failure of glide formation to apply in the two examples above as indicating a different constraint ranking postlexically from the one that obtains within single words. (All of the glide formation examples I could find occur within single words after noncoronal consonants.) Clearly, this issue can be decided only on the basis of further data.

[37] It may be that there is a universal or near-universal implicational generalization to the effect that languages glide front vowels if and only if they also glide round vowels (Casali 1995c).

| RANKING | REASON(S) |
|---|---|
| {NoDiph, Onset, Dep, Uniformity, Ident} ≫ {MaxLex, MaxMI, Max} | The constraints that militate against diphthong formation, heterosyllabification, epenthesis, and coalescence must be ranked above the Max constraints that are violated in Chichewa in order to yield elision in preference to one of these other hiatus outcomes. |
| MaxLex ≫ MaxMI | MaxLex must be ranked above MaxMI to yield $V_2$ elision at a root-plus-suffix boundary. |
| MaxWI, MaxMI, MaxMS, MaxLex ≫ Max | (universal) |
| *Cy ≫ Max ≫ *Cw | Permits glide formation when $V_1$ is /u/ but not when $V_1$ is /i/. |

TABLE 6. Constraint rankings for Chichewa.

7. PREVIOUS APPROACHES. Most previous treatments of vowel elision (for example, Aoki 1974, Casali 1988, Clements 1986, Donwa-Ifode 1985, Masagbor 1989, Pulleyblank 1988, Snider 1985, 1989c) have been carried out within the framework of linear or nonlinear generative phonology.[38] Within these approaches, the choice of which of two adjacent vowels is elided is determined, trivially, by the form of the rule that carries out the deletion. Thus the literature contains examples of rules deleting $V_1$, as in 57, as well as rules deleting $V_2$, as in 58.

(57) $V_1$ elision:
$V \rightarrow \emptyset / \_\_\_\_ V$

(58) $V_2$ elision:
$V \rightarrow \emptyset / V \_\_\_\_$

Implicit in this approach is the claim that which vowel is deleted is not predetermined by contextual factors, but is simply a matter of which of two equally available options is selected by the language. In fact, the possibility that the choice of vowel targeted might be to some extent predictable seems never to have been seriously explored. As we have seen, however, the choice of vowel targeted by elision is highly dependent on the type of context in which hiatus arises. While rules along the lines of 57 and 58 have generally proved adequate in accounting for elision facts within individual languages, it is not at all clear

[38] There have so far been few treatments of hiatus resolution via elision within the framework of optimality theory. Since completing this article, I have seen a copy (kindly furnished by Sam Rosenthall) of a recent paper, Lamontagne & Rosenthall 1996, which presents an optimality-theoretic analysis of elision, glide formation, and coalescence in hiatus contexts. This analysis, which relies on an extension of the contiguity constraint proposed in McCarthy & Prince 1995, makes several interesting predictions; it does not, however, predict any correlation between the vowel targeted by elision and the morphological position in which hiatus occurs. An earlier optimality-theoretic treatment of elision, superseded to some extent by Lamontagne & Rosenthall 1996, is found in Rosenthall 1994. A further possibility (suggested by a referee) that exists within optimality theory, accounting for the direction of elision in terms of Align constraints (Prince & Smolensky 1993, McCarthy & Prince 1993), is discussed by Rosenthall (1994:61) and convincingly shown to be unworkable.

how an approach based on rules of this type can account for the cross-linguistic restrictions on elision in particular hiatus contexts. There is nothing, for example, to rule out a language (apparently unattested) that systematically elides $V_2$ in ALL environments, including the boundary between two lexical words; such a language would simply be one that has only the general elision rule 58. Under my approach, in contrast, there is simply no way to generate a language that regularly elides $V_2$ at lexical word boundaries, for reasons discussed above.

**8.** FURTHER ISSUES. The goal of this article was to show how an approach based on position-sensitive faithfulness can account for certain major cross-linguistic generalizations about the vowel targeted by elision. No attempt has been made to provide a comprehensive account of hiatus phenomena. A number of important issues remain to be addressed. I briefly mention a few of these:

1. A number of hiatus contexts remain to be systematically investigated, for example hiatus arising morpheme-internally due to the loss of an intervening consonant (this occurs for example in many Bantu languages).

2. The interaction of elision with prosodic phenomena requires treatment. In addition to well-known cases of tonal stability under elision, there are more unusual cases in which elision may be blocked in certain tonal configurations. This occurs for example in Izi (Meier et al. 1975), Nupe (Smith 1967) and Pero (Frajzyngier 1980). Similarly, elision may also be blocked in some languages when stress clash would result; this occurs in Ancient Greek (Kaisse 1977).

3. The languages discussed in §6 have provided only a partial picture of the variation displayed by languages in combining different forms of hiatus resolution outcomes. At the same time, there is some indication of interesting restrictions on the cooccurrence of different possibilities; for example, the presence of a particular type of 'height' coalescence (Casali 1996a) in a language normally implies the presence of elision as well, while the presence of this same type of coalescence seems to exclude a particular pattern of glide formation (Casali 1995c).

**9.** CONCLUSION. I have outlined an analysis in which the vowel targeted for elision in hiatus contexts is determined by the interaction of constraints that refer not to linear order but to morphological or prosodic positions. In this approach, regularities that emerge about the linear position of the targeted vowel in a language are epiphenomenal. The analysis I propose is explanatory, both in suggesting reasons for the tendency of elision to target a particular vowel and by virtue of the interesting empirical predictions it makes. To the extent that these predictions are in general agreement with the observed facts, the current framework represents a clear advance over previous analyses.

## APPENDIX: LANGUAGES SURVEYED

The languages in my survey are grouped according to the type(s) of elision ($V_1$ and/or $V_2$) they display. Following each language I list the family to which the language belongs and the source(s) consulted.

Languages where source shows $V_1$ elision only:
**Au** (Toricelli), Scorza 1985; **Babole** (Niger-Congo), Leitch 1994, Myles Leitch, personal communi-

cation; **Bemba** (Niger-Congo), Sims 1959, Sambeek 1955, Givón 1970a, Kashoki 1968; **Bobangi** (Niger-Congo), Whitehead 1899; **Bolia** (Niger-Congo), Mamet 1960; **Central Kambari** (Niger-Congo), Hoffman 1972; **Chagga** (Niger-Congo), Nurse & Philippson 1977, Saloné 1980; **Chicano Spanish** (Indo-European), Schane 1987; **Chumburung** (Niger-Congo), Hansford 1988, Snider 1985, 1989c; **Chiyao** (Niger-Congo), Ngunga 1995; **Dyula** (Niger-Congo), Long & Diomandé n.d.; **Eggon** (Niger-Congo), Maddieson 1972; **Engenni** (Niger-Congo), Elugbe 1989, Thomas 1978; **Ghotuo** (Niger-Congo), Elugbe 1972; **Gichode** (Niger-Congo), Keith Snider, field notes; **Gonja** (Niger-Congo), Painter 1970; **Igede** (Niger-Congo), Bergman 1968, 1971; **Ila** (Niger-Congo), Smith 1907; **Iraqw** (Afro-Asiatic), Rosenthall & Mous 1995; **Izi** (Niger-Congo), Meier et al. 1975; **Kamba** (Niger-Congo), Whitely & Muli 1962, Roberts-Kohno 1995a, b; **KiYaka** (Niger-Congo), Van den Eynde 1968, Kidima 1991; **Kikuyu** (Niger-Congo), Armstrong 1940; **Kinande** (Niger-Congo), Mutaka & Hyman 1990, Schlindwein 1987; **Kisar** (Austronesian), Christensen & Christensen 1992; **Kongo** (Niger-Congo), Meinhoff 1932; **Krachi** (Niger-Congo), Keith Snider, field notes; **Lango** (Nilo-Saharan), Noonan 1992; **Lokəə** (Niger-Congo), Iwara 1982; **Logo** (Nilo-Saharan), Goyvaerts 1983; **Lugisu** (Niger-Congo), Brown 1969; **Malakmalak** (Australian), Birk 1976; **Moba** (Niger-Congo), Russell 1985; **Nawuri** (Niger-Congo), Casali 1988, 1995b; **Nuni** (Niger-Congo), Kurrle 1988; **Nupe** (Niger-Congo), Smith 1967, 1969; **Ogbia** (Niger-Congo), Williamson 1972; **Ogori** (Niger-Congo), Chumbow 1982a, b; **Owon Afa** (Niger-Congo), Awobuluyi 1972, Stahlke 1976; **Pero** (Afro-Asiatic), Frajzyngier 1980; **Santee Dakota** (Siouan), Shaw 1980; **Shilluk** (Nilo-Saharan), Gilley 1992; **Si-Luyana** (Niger-Congo), Givón 1970b; **SiSwati** (Niger-Congo), Cahill 1994, Herman 1995; **Southern Sotho** (Niger-Congo), Doke & Mofokeng 1957; **Swahili** (Niger-Congo), Keach 1987; **Tabla** (Trans-New Guinea), Collier & Gregerson 1985; **Teton Dakota** (Siouan), Carter 1974; **Tsonga** (Niger-Congo), Baumbach 1987; **Uma Juman** (Austronesian), Blust 1977; **Urhobo** (Niger-Congo), Elugbe 1972; **West Tarangan** (Austronesian), Nivens 1992; **Xhosa** (Niger-Congo), Aoki 1974, McLaren 1955; **Yakata** (Niger-Congo), Motingéa 1993); **Zulu** (Niger-Congo), Doke 1926, 1931, 1954

Languages where source shows $V_2$ elision only:[39]
**Basque** (language isolate), Hualde & Elordieta 1992; **Kagate** (Sino-Tibetan), Walker 1989

Languages with both $V_1$ elision and $V_2$ elision:
**Afar** (Afro-Asiatic), Bliese 1981; **Aghem** (Niger-Congo), Hyman 1979; **Avatime** (Niger-Congo), Schuh 1995; **Chichewa** (Niger-Congo), Mtenje 1980, 1992; **Daga** (Trans-New Guinea), Murane 1974; **Dangme** (Niger-Congo), Dakubu 1987; **Diola-Fogny** (Niger-Congo), Sapir 1965; **Ebira** (Niger-Congo), Adive 1984; **Edo** (Niger-Congo), Agheyisi 1987, Folarin-Schleicher 1992, Omozuwa 1992, Wescott 1962; **Efik** (Niger-Congo), Ward 1933, Welmers 1973; **Emai** (Niger-Congo), Egbokhare 1990, Folarin-Schleicher 1992, Schaefer 1987; **Etsako** (Niger-Congo), Elimelech 1976; **Ewe** (Niger-Congo), Westermann 1930; **Igbo** (Niger-Congo), Emenanjo 1972; **Ijo** (Niger-Congo), Williamson 1965; **Isekiri** (Niger-Congo), Dunstan 1969, Omamor 1979; **Isoko** (Niger-Congo), Donwa-Ifode 1985; **Ivie** (Niger-Congo), Masagbor 1989; **Lamba** (Niger-Congo), Doke 1922, 1931, 1938; **LuGanda**

[39] An issue of interpretation must be noted here, involving two common situations that superficially appear to involve $V_2$ elision but which I have not treated as such. One of these, which occurs for example in Bemba and some other Bantu languages, involves the failure of the initial vowel of a noun to surface in certain syntactic contexts. Although some of these contexts follow a preceding word-final vowel and might thus appear to be cases of hiatus resolution through $V_2$ elision, closer examination of the facts indicates that the absence of these vowels is determined by syntactic factors that have nothing to do with hiatus resolution. The second case involves a number of languages that have a coalescence process that realizes /a + i/ and /a + u/ as [e] and [o] respectively. It is common for such languages to realize the sequences /e + i/, /e + u/, /o + i/, and /o + u/ as the first vowel in each sequence, e.g. /e + i/ > [e]. In languages which clearly have coalescence (e.g. with /a + i/ > [e]) in some contexts, I have regarded all such cases as instances of coalescence rather than $V_2$ elision, that is, these languages have a general coalescence process that converts a nonhigh $V_1$ plus a high $V_2$ to a vowel that combines the [ − high] value of $V_1$ with all other features of $V_2$. That this is correct is shown by the fact that the resolution of precisely these sequences via superficial $V_2$ elision is extremely rare in languages without coalescence, but very common in languages with coalescence.

(Niger-Congo), Ashton et al. 1954, Clements 1986, Katamba 1985, Tucker 1962; **Lulobo** (Nilo-Saharan), Andersen 1987; **Mundani** (Niger-Congo), Parker n.d., Elizabeth Parker, personal communication; **Niaboua** (Niger-Congo), Bentinck 1978, 1979; **Obolo** (Niger-Congo), Faraclas 1982, 1985; **Ogoja Yala** (Niger-Congo), Bunkowske 1972; **Okpe** (Niger-Congo), Hoffman 1973, Omamor 1988, Pulleyblank 1986; **Sango** (Niger-Congo), Samarin 1967; **Shona** (Niger-Congo), Doke 1931, Fortune 1955; **Vata** (Niger-Congo), Kaye 1982; **Yoruba** (Niger-Congo), Pulleyblank 1988

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