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Metathesis in Kasem

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John Callow's article "Kasem Nominals - A Study in Analyses" included twenty-six examples of class C nominals and twenty-eight examples of class D nominals. His paper has served as the basis for several discussions of metathesis rules which have appeared in the literature in recent years. In The Sound Pattern of English (p. 358-364), Chomsky and Halle claim that a metathesis rule is needed in the analysis of class C nominals in Kasem. They need to include the metathesis rule because of problems which arise in a couple of derivations involving the application of a truncation rule. Chomsky and Halle then have to posit abstract underlying representations for some of the examples in order to have the derivations come out correctly. Irwin Howard published a paper "Kasem Nominals Revisited", in which he expands and reformulates Chomsky and Halle's analysis. He agrees with the way in which Chomsky and Halle analyzed the data, and basically just extends the analysis to include the class D nominals discussed in Callow's article. In Stephen Anderson's book, The Organization of Phonology (p. 152-160), he argues against the condition which Chomsky and Halle placed on their rule of metathesis, claiming that it is an ad-hoc solution to the rule ordering problem which arises. He proposes the notion of contingent ordering in order to handle the problems without having to include the condition on the metathesis rule. Most recently, Elaine Phelps published an article in Linguistic Analysis in which she claims to refute Chomsky and Halle's arguments for having a metathesis rule in Kasem. Curiously, she was forced to have a metathesis rule of a much more powerful form in order to account for some class D nominals. I do not agree with a number of her assumptions, so I will only briefly discuss her paper later. After discussing these different analyses of Kasem nominals, I will present an alternate analysis which does not include a rule of metathesis, and thus avoids all of the problems mentioned.

With such a small set of data to work from, it is impossible to make any conclusive argument. The exact formulation of the rules I will propose in this paper is tentative and they will undoubtedly need to be revised somewhat when additional data become available. After discussing the rules needed for the class C nominals, I will give a few additional

rules which are needed to account for the alternations which occur in the class D nominals. Obviously more rules will have to be added to the grammar as the amount of data increases, but I believe the set of rules I am going to propose will make the correct predictions. In this paper, I am only concerned with the rules which are relevant to the discussion of whether or not there are metathesis rules in Kasem, so I have not attempted to discuss all of the phonological rules needed in the grammar.

According to Callow, the phonetic vowel system in Kasem consists of two sets of five vowels each: an "upper" set (i, e, ə, o, u) and a "lower" set (ɪ, ɛ, a, ɔ, ɔ̃). It appears to be a [± tense] harmony system, where all the vowels of a word are drawn from one set or the other. The corresponding vowels of the two sets behave alike with respect to the phonological rules, so I will follow Chomsky and Halle in ignoring the variants. All of the examples in this paper will be written using the vowels of the "upper" set, except that a will be used in place of ə for convenience. Chomsky and Halle assume that (e, a, o) are all low vowels, but Callow's transcription indicates that there are two high vowels (i, u), two mid-vowels (e, o) and one low vowel (a). I believe that the mid-vowels are always derived, and that the only vowels in underlying representations are i, u, and a.

To form class C nominals in Kasem, the suffix -a is added to the stem in the singular and the suffix -i is added in the plural. So, for example:

- | | | | | |
|----|-----------------------|---------------------|-------------|----------|
| 1. | <u>bakada</u> (sing.) | <u>bakadi</u> (pl.) | "boy" | (bakad-) |
| 2. | <u>sada</u> | <u>sadi</u> | "grass mat" | (sad-) |
| 3. | <u>tula</u> | <u>tuli</u> | "granary" | (tul-) |

When a word ends in two identical vowels, there is a truncation rule which deletes the first one of them. The truncation rule proposed by Chomsky and Halle is given below in (4), and is followed by a couple examples. Throughout this paper I shall use the features [± syll] instead of [cons]
[voc] .

4. Truncation Rule (Chomsky and Halle page 359):

$$\left[\begin{array}{l} +\text{syll} \\ \wedge \text{high} \\ \wedge \text{back} \end{array} \right] \rightarrow \emptyset / _ \left[\begin{array}{l} +\text{syll} \\ \wedge \text{high} \\ \wedge \text{back} \end{array} \right]$$

- | | | | |
|----|---------------------------|--------------------------|---------------|
| 5. | /kambi+a/ > <u>kambia</u> | /kambi+i/ > <u>kambi</u> | "cooking pot" |
| 6. | /pi+a/ > <u>pia</u> | /pi+i/ > <u>pi</u> | "yam" |

Stems ending in velar consonants, lose the velar before the plural suffix -i.

7. Velar Elision (Chomsky and Halle page 359):

$$\begin{bmatrix} -\text{syll} \\ -\text{ant} \\ -\text{cor} \end{bmatrix} \rightarrow \emptyset / \text{---} \begin{bmatrix} +\text{syll} \\ +\text{high} \\ -\text{back} \end{bmatrix}$$

8. /dig+a/ > diga /dig+i/ > di "room"9. /bug+a/ > buga /bug+i/ > bui "river"

In order to derive the plural form di in (8), it is necessary to apply velar elision before truncation. There is also a glide formation rule which applies to examples like the plural form in (9), changing the round vowel u into a glide. Chomsky and Halle state this rule as in (10), but in fact w is the only glide formed by this rule and there are restrictions on what the following vowel may be. Chomsky and Halle acknowledge these problems (p. 363) but they do not revise the rule so that it will apply correctly.

10. Glide Formation Rule (Chomsky and Halle page 359):

$$\begin{bmatrix} +\text{syll} \\ +\text{high} \end{bmatrix} \rightarrow [-\text{syll}] / \text{---} \begin{bmatrix} +\text{syll} \\ -\text{back} \end{bmatrix}$$

The glide formation rule is ordered last in their analysis, and as stated in (10), it will incorrectly give *kwa instead of kua "bone". A revised version of the glide formation rule is given in (11). The rule should be restricted so that it will apply only when there is a front vowel following.

11. Glide Formation Rule - Revision I:

$$\begin{bmatrix} +\text{syll} \\ +\text{high} \\ +\text{round} \end{bmatrix} \rightarrow [-\text{syll}] / \text{---} \begin{bmatrix} +\text{syll} \\ -\text{back} \end{bmatrix}$$

12. /ku+a/ > kua /ku+i/ > kui "bone"13. /nu+a/ > nua /nu+i/ > nui "finger"

In the plural forms of examples (15) and (16), the mid-vowels are derived by a rule of vowel contraction. This rule applies to the vowel sequences ai and au, contracting them to the mid-vowels e and o respectively. This vowel contraction rule must be ordered after velar elision, as illustrated in the derivation given in (17).

14. Vowel Contraction (Chomsky and Halle page 363):

SD:	$\begin{bmatrix} +\text{syll} \\ -\text{high} \\ +\text{back} \\ -\text{round} \end{bmatrix}$	$\begin{bmatrix} +\text{syll} \\ +\text{high} \\ \alpha\text{back} \end{bmatrix}$
	1	2
SC:	$\begin{bmatrix} 1 \\ \alpha\text{back} \\ \alpha\text{round} \end{bmatrix}$	$\begin{bmatrix} 2 \\ \emptyset \end{bmatrix}$

- | | | | |
|-------------------------|-----------------|--------|-------------------|
| 15. <u>laŋa</u> (sing.) | <u>le</u> (pl.) | "song" | (laŋ-) |
| 16. <u>naga</u> | <u>ne</u> | "leg" | (nag-) |
| 17. /laŋ+a/ | /laŋ+i/ | | |
| --- | la+i | | Velar Elision (7) |
| --- | le | | Contraction (14) |

Howard points out in his article (p. 92) that it is possible to simplify the vowel contraction rule considerably if the second vowel assimilates to the first and then the first one is dropped. The second segment would only have to change its value for highness.

18. Vowel Contraction (Howard page 92)

SD:	[+low]	$\begin{bmatrix} +\text{syll} \\ +\text{high} \end{bmatrix}$
	1	2
SC:	$\begin{bmatrix} 1 \\ \emptyset \end{bmatrix}$	$\begin{bmatrix} 2 \\ -\text{high} \end{bmatrix}$

The following two examples, (19) and (20), cause problems for Chomsky and Halle's analysis as described so far, and lead them to propose the metathesis rule given in (21).

- | | | |
|---|-----------------|---------|
| 19. <u>pia</u> (sing.) | <u>pe</u> (pl.) | "sheep" |
| 20. <u>babia</u> | <u>babe</u> | "brave" |
| 21. Metathesis Rule (Chomsky and Halle page 361): | | |

SD:	$\begin{bmatrix} +\text{syll} \\ 1 \end{bmatrix}$	$\begin{bmatrix} +\text{syll} \\ 2 \end{bmatrix}$	$\begin{bmatrix} +\text{syll} \\ 3 \end{bmatrix}$
SC:	123 → 213	except where 2 = 3 = <u>a</u>	

Since a vowel truncation rule is independently needed in the grammar, they say that pia could be derived from pia+a and that pe could be derived from pai+i. They claim that the difference in the form of the stem at the time the truncation rule is applied is due to the rule of metathesis. Thus, under their analysis, the derivations of the examples in (19) and (20) would be:

22.	/pia+a/	/pia+i/	
	---	pai+i	Metathesis (21)
	pi+a	pa+i	Truncation (4)
	---	pe	Contraction (14)
23.	/babia+a/	/babia+i/	
	---	babai+i	Metathesis (21)
	babi+a	baba+i	Truncation (4)
	---	babe	Contraction (14)

As Anderson points out on page 155, Chomsky and Halle's metathesis rule is blocked from applying by an ad-hoc condition where the three vowel sequence is one that truncation could reduce to two vowels - a reduction that would destroy the environment for the application of metathesis. The condition which they placed on the metathesis rule ("except where 2=3=a") blocks the rule from applying in the singular forms, and thus allows them to avoid an ordering problem. Truncation should apply before metathesis to /pia+a/ but only after metathesis in the plural form /pia+i/.

In Anderson's discussion of Kasem, he assumes that there is a metathesis rule like Chomsky and Halle's which inverts the first two vowels of a three vowel sequence. He is mainly concerned with arguing against the condition which they placed on their rule ("except where 2=3=a"). Anderson claims that within the theory of local ordering (extended slightly), you can get the correct results without having the condition on the metathesis rule. In the derivation of /pia+i/ > pia, both orders of applying truncation and metathesis are bleeding. In order for the derivation to come out correctly, the order has to be truncation - metathesis. In the derivation of /pia+i/ > pe, however, the order has to be metathesis - truncation (the "natural" order). For these derivations, there cannot be an absolute ordering restriction, so Anderson extends his theory of local ordering to include the notion of contingent ordering. Within his theory, contingent ordering defines the relative ordering in derivations where principles of natural ordering do not provide a basis for choice between two possible orderings. Contingent ordering restrictions are ignored when a natural order is defined. So for Kasem, Anderson claims that the grammar contains the restriction that the rules are ordered: truncation precedes metathesis (contingently).

This extension of the theory of local ordering to include contingent rule ordering seems like a very undesirable solution to the problem. Within this extended theory, there will be language specific specified orderings (contingent orderings), as well as possibly different natural orderings. In the remaining part of this paper, I propose an analysis for Kasem nominals which does not include a metathesis rule. Within my analysis, none of the problems which are associated with the application of the metathesis rule arise. I believe that it is in fact the optimum analysis because of the simplicity and naturalness of the rules. The essential difference is that I have generalized the truncation rule and I have reversed the order in which the truncation and contraction rules are applied.

Notice that by having the metathesis rule stated in (21), Chomsky and Halle are forced to have abstract underlying forms for yua and ywe "hair". Under their analysis, both the singular and plural forms have to undergo metathesis, as shown in the following derivations:

24. /yau+a/	/yau+i/	
yua+a	yua+i	Metathesis (21)
yu+a	---	Truncation (4)
---	yue	Contraction (14)
---	ywe	Glide Formation (11)

To allow metathesis to apply to the plural form /pia+i/ but to block its application in /yua+i/ would require a very complex rule. It is an added complication in Chomsky and Halle's analysis that they have to posit the abstract underlying forms of (24), rather than having the more straightforward underlying forms:

25. /yua+a/	/yua+i/	"hair"
-------------	---------	--------

In Callow's data, the only instances of truncation are with the vowels a and i. Round vowels are never truncated. I have generalized the truncation rule so that an i will be deleted before either of the front vowels (i or e).

26. Truncation Rule - Revision I:

$$\left[\begin{array}{l} +\text{syll} \\ -\text{round} \\ \swarrow \text{low} \end{array} \right] \rightarrow \emptyset / \text{---} \left[\begin{array}{l} +\text{syll} \\ -\text{round} \\ \swarrow \text{low} \end{array} \right]$$

With this rule and Howard's version of the vowel contraction rule (18), it is possible to derive pia and pe "sheep". These are two of the examples for which Chomsky and Halle needed their metathesis rule. Chomsky and Halle's derivation was illustrated in (22), and the derivation by my analysis is:

27.	/pia+a/	/pia+i/	"sheep"
	---	pie	Contraction (18)
	pi+a	pe	Truncation (26)

It is now also possible to derive yua and ywe "hair" from the underlying stem /yua-/. These are the examples for which Chomsky and Halle had to posit abstract underlying forms which underwent metathesis in both the singular and plural. Derivations within Chomsky and Halle's analysis were given earlier in (24).

28.	/yua+a/	/yua+i/	
	---	yue	Contraction (18)
	yu+a	---	Truncation (26)
	---	ywe	Glide Formation (11)

At this point it is necessary to consider some examples of class D nominals in order to motivate some additional revisions in the rules I have discussed. First of all, there is one other source for mid-vowels besides the vowel contraction rule stated in (18). There is a rule which assimilates the class D singular suffix -u to the height of the preceding vowel as shown in the examples below. I will give a full derivation of these examples later, when some additional rules have been discussed.

29.	<u>godo</u> < god+u	"cloth"
30.	<u>bolo</u> < bol+u	"valley"

This lowering rule should be generalized so that it will also lower the class C plural suffix -i to agree in height with a preceding mid-vowel. Naturally, this lowering rule should be ordered after contraction since there are no mid-vowels in underlying representations.

31. Lowering Rule:

$$\begin{bmatrix} +\text{syll} \\ +\text{high} \end{bmatrix} \rightarrow [-\text{high}] / \begin{bmatrix} +\text{syll} \\ -\text{high} \\ -\text{low} \end{bmatrix} \quad (\text{C}) + \underline{\quad}$$

Before giving any derivations, it is necessary to revise one more rule. In the earlier statement of the glide formation rule (11), only the high vowel could change into a glide. I believe this rule should be revised so that it would apply to either of the round vowels (o or u). As in Chomsky and Halle's analysis, this rule should apply last. The only difference is that it may also apply to contracted vowels.

32. Glide Formation Rule - Final Version

$$\begin{bmatrix} +\text{syll} \\ +\text{round} \end{bmatrix} \rightarrow \begin{bmatrix} -\text{syll} \\ +\text{high} \end{bmatrix} / \underline{\quad} \begin{bmatrix} +\text{syll} \\ -\text{back} \end{bmatrix}$$

Having generalized both the lowering rule and the glide formation rule, it is now possible to derive an additional group of examples without using Chomsky and Halle's metathesis rule. For comparison, I will give my derivation of the plural form of the example in (33) and Chomsky and Halle's.

33.	<u>koga</u> (sing.)	<u>kwe</u> (pl.)	"back"	(kaug-)
34.	Chomsky and Halle's derivation:		My derivation:	
	/kaug+i/		/kaug+i/	
	kau+i	Velar Elision (7)	kau+i	Velar Elision (7)
	kua+i	Metathesis (21)	ko+i	Contraction (18)
	kue	Contraction (14)	ko+e	Lowering (31)
	kwe	Glide Formation (10)	kwe	Glide Formation (32)

I would now like to consider some of the class D nominals in detail. First of all, it is necessary to describe a number of rules which will be important in later derivations. There is a nasal assimilation rule by which a nasal assimilates in place of articulation to the following obstruent. There is also a rule by which the initial consonant of the plural suffix -du assimilates to a preceding l or n (l+d > l+l, n+d > n+n). So, for example:

35.	<u>yitunu</u> (sing.)	<u>yitunnu</u> (pl.)	"chair, stool"
36.	/yitun+u/	/yitun+du/	
	---	yitun+du	Nasal Assimilation
	---	yitun+nu	d-Assimilation

To account for examples like those in (37-39), three additional rules are needed. First, there is a degemination rule which will delete the first of two identical consonants if they follow a low vowel. Then there is a stem-final vowel lengthening rule and finally a second contraction rule by which wa > o if followed by a consonant.

37.	<u>godo</u>	<u>gwa:du</u>	"cloth"	(gwad-)
38.	<u>bolo</u>	<u>bwa:lu</u>	"valley"	(bwal-)
39.	<u>yolo</u>	<u>ywa:lu</u>	"basket for seiving"	(ywal-)
40.	Degemination Rule:			

$$\begin{array}{c} C \\ [\neq F] \end{array} \rightarrow \emptyset / \left[\begin{array}{c} +\text{syll} \\ +\text{low} \end{array} \right] \text{ --- } + \begin{array}{c} C \\ [\neq F] \end{array}$$

41. Stem-Final Vowel Lengthening:

[+syll] → [+long] / ___ + [-syll]

42. Contraction Rule II:

wa → o / ___ C

So, for example:

43.	/gwad+u/	/gwad+du/	
	---	gwa+du	Degemination (40)
	---	gwa:+du	Stem-Final Vowel Lengthening (41)
	god+u	---	Contraction II (42)
	god+o	---	Lowering (31)
44.	/bwal+u/	/bwal+du/	
	---	bwal+lu	d-Assimilation
	---	bwa+lu	Degemination (40)
	---	bwa:+lu	Stem-Final Vowel Lengthening (41)
	bol+u	---	Contraction II (42)
	bol+o	---	Lowering (31)

Elaine Phelps argues in her paper that the class D nominals require a metathesis rule which is different from the one proposed by Chomsky and Halle.

"Well motivated metathesis rules are relatively rare in synchronic generative grammars, compared to rules like nasalization, deletion, assimilation, or even vowel harmony. How strange it is then, that the very language Chomsky and Halle used in order to demonstrate that metathesis rules are needed in generative phonology, which they in fact failed to show, should turn out to require a metathesis rule in the class of nouns that they had neglected to analyze because 'the facts...hold little additional interest.'" (Phelps page 327)

To account for the class D nominals like those in examples (37-39), she proposes the following metathesis rule:

45. Metathesis Rule (Phelps page 325)

[+syll] [+syll] [-syll] + [+syll]
 1 2 3 4 5 ⇒ 1 3 2 4 5

Phelps' analysis assumes that there are both mid-vowels and long vowels in underlying representations. So, for example, in the derivation of bolo "valley", the underlying form /boa:l+u/ would be changed to bola:+u by her metathesis rule (45). The final mid-vowel would then be derived by her contraction rule which is not sensitive to vowel length.

If it turns out to be necessary to include metathesis rules within the grammar at all, there should certainly be very tight restrictions on the environments in which such a rule could apply in order to limit the possible grammars. Including a rule such as (45) above which switches vowel and consonant at the end of a stem would greatly weaken the theory and thus would have to be very well motivated.

In Howard's paper, he considers the class D nominals and points out that a stem final velar consonant is deleted before the class D plural suffix -du as well as before the class C plural suffix -i. The revised version of the velar elision rule is stated in (46); using the notation + [plural] to collapse the two environments, as suggested by Anderson (page 153). Examples from both classes of nominals are given below to illustrate how the rule applies:

46. Velar Elision - Final Revision:

$$\left[\begin{array}{l} -\text{syll} \\ +\text{high} \\ -\text{cor} \end{array} \right] \rightarrow \emptyset / \text{---} + [\text{plural}]$$

- | | | | |
|-----|---------------------|----------------------------|---------------------------|
| 47. | <u>diga</u> (sing.) | /dig+i/ > <u>di</u> (pl.) | "room" |
| 48. | <u>lanja</u> | /lan+i/ > <u>le</u> | "song" |
| 49. | <u>tasugu</u> | /tasug+du/ > <u>tasudu</u> | "granary cover" |
| 50. | <u>kasugu</u> | /kasug+du/ > <u>kasudu</u> | "bundle of millet stalks" |

The stem-final vowel lengthening rule discussed earlier is critically ordered before the velar elision rule. Notice that in the following class D nominals (51-52), the underlying form of the stem has a final velar consonant which blocks the application of the stem-final vowel lengthening rule if that rule is ordered before velar elision.

- | | | | | |
|-----|-------------|--------------|---------------|-----------------------------|
| 51. | <u>fogo</u> | <u>fwadu</u> | "die, dice" | (fwag-) |
| 52. | <u>ʃogo</u> | <u>ʃwadu</u> | "breechcloth" | (ʃwag-) |
| 53. | /fwag+u/ | /fwag+du/ | | |
| | ---- | ---- | | Stem-Final Lengthening (41) |
| | ---- | fwa+du | | Velar Elision (46) |
| | fog+u | ---- | | Contraction II (42) |
| | fog+o | ---- | | Lowering (31) |

- | | | | |
|-----|--------------|-------------|-------------|
| 60. | <u>gaa</u> | <u>ge</u> | "different" |
| 61. | <u>kabaa</u> | <u>kabe</u> | "slave" |
| 62. | <u>kapaa</u> | <u>kape</u> | "cobra" |

It is not possible to simply restrict the truncation rule so that it will not apply if the vowels are [+low], because the rule has to be able to apply in the derivation of the singular form of the following example.

- | | | | |
|-----|------------|-----------|------------------|
| 63. | <u>pia</u> | <u>pe</u> | "sheep" |
| 64. | /pia+a/ | /pia+i/ | |
| | --- | pie | Contraction (56) |
| | pi+a | pe | Truncation (26) |

The problem which arises in these examples can be solved by revising the truncation rule. The only time that truncation applies to a sequence of low vowels is when there is another vowel preceding.

65. Truncation Rule - Final Version:

$$\left[\begin{array}{l} +\text{syll} \\ -\text{round} \\ \neq \text{low} \end{array} \right] \rightarrow \emptyset / [\alpha \text{syll}] _ \left[\begin{array}{l} +\text{syll} \\ -\text{round} \\ \neq \text{low} \end{array} \right]$$

In examples like daa, the a will not be deleted because the preceding segment is not [+syll]. This rule is supported by all the available data. It should be noted that as the rule is stated, if the vowel to be deleted is [-low], then the preceding segment must be [-syll]. This is in fact true of all the examples available. For example:

- | | | | | |
|-----|-------------|--------------|---------------|---------|
| 66. | /kambi+i/ > | <u>kambi</u> | "cooking pot" | |
| 67. | /dig+i/ > | di+i > | <u>di</u> | "room" |
| 68. | /pi+i/ > | <u>pi</u> | "yam" | |
| 69. | /pia+i/ > | pie > | <u>pe</u> | "sheep" |

To conclude, then, it is possible to derive all of the surface forms of the Kasem nominals without having to include a metathesis rule in the phonological analysis. The analysis is based on a very limited set of data and the rules will undoubtedly need to be revised slightly in a broader analysis, but I am confident they will turn out to be generally correct. Below, I will give an ordered list of the rules which are needed to account for the alternations within my analysis. There aren't any ordering problems among these rules, so it is not necessary to complicate the theory by including the notion of contingent ordering as Anderson claimed. The rules I have proposed will account for the class D nominals without having to extend the phonological theory to include rules like Phelps' metathesis rule. The resulting analysis is simpler and more natural than any of the

others which have been discussed in the literature. There may be languages which require some restricted form of metathesis rule, but I don't believe that the data available from Kasem provides motivation for such an extension of phonological theory.

Ordered List of Rules:

1. Nasal Assimilation
2. d-Assimilation
3. Degemination (40)
4. Stem-Final Vowel Lengthening (41)
5. Velar Elision (46)
6. Contraction (56)
7. Contraction II (42)
8. Lowering (31)
9. Truncation (65)
10. Glide Formation (32)

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