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Morphology and the Rule Ordering Controversy

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The rule ordering controversy has been with us a long time. This is not at all surprising, since the notion of the "rule" is crucial to generative grammar, and consequently its behavior (and constraints on it) are of vital concern. The ordering of some rules with respect to each other is easily demonstrable with small sets of data, but more and more complex sets of data are needed to go beyond the immediately obvious orderings. This inevitably leads to controversy: how the ordering is established, or the constraints which are postulated for rules, depends critically on which complex sets of data are being explored, and how the linguist chooses to interpret the results. Each successive solution accounts for either a different or larger set of data than the last, no solution presumably ever the one final one. Working within such a framework, it becomes necessary to step back occasionally and examine the data base, the models, the claims, the adequacy and accuracy, the function, and the explanatory power of suggested proposals. The preferred solution is the one which can handle the greatest amount of data, capture the significant generalizations, make the correct claims about observable behavior and appropriate predictions with respect to new forms and future changes, account for speaker behavior so far as possible, all without violating the linguist's intuitive judgments as to how things ought to work. The controversy over rule ordering with the many approaches which have been suggested may be seen as steps in the evolution of a solution which works, explains, and satisfies.

Attempts to provide language-independent principles for guiding the possible behavior of rules with respect to each other have resulted in several proposals which have concentrated more on the function of the rule rather than its formal characteristics (Kiparsky, 1971; Kisseberth, 1973; Wilbur, 1973a; 1974). This in turn has led to a need for more explicit recognition of the fact that some rules which look like phonological rules are not phonological rules at all, but morphological rules which do not require phonological conditioning to trigger their application, but rather depend on syntactic and semantic factors to condition their application. Pre-generative grammarians considered morphology to be closely aligned with syntax. Except in those cases where a phonological alternation was restricted to a particular morphological

category, the phonological component and the morphological component were generally kept distinct. Until recently, generative phonologists have not explicitly dealt with morphology. The assumption was generally made that the morphological component was somehow responsible for the phonological representation to which phonological rules apply, and that, therefore the morphological component precedes the phonological component (Kiefer 1973).

Several models have evolved, some of which do not hold to the principle that the morphological component comes first. Chomsky (1965) does not have a separate morphological component at all.¹ In Sound Pattern of English, Chomsky and Halle (1968) divide grammar into semantics, syntax, and phonology. They have "two concepts of surface structure: input to the phonological component and output of the syntactic component." Where the two do not coincide, it is assumed that readjustment rules in the phonological component would make the necessary corrections, but some of the functions now attributed to the morphological component were still retained in the syntactic component. Models that have evolved with explicit recognition of morphological rules have differed on the representation of these rules. Kiefer (1973), Wilbur (1973a; 1974) and Cearley (1974) hold to a model where the morphological rules are contained in separate unified component which precedes the phonological rules. Kiefer outlines an internal structure for such a component, with the derivational rules operating before the inflectional rules.² On the other hand, Anderson (1974) argues that morphological, phonological, and phonetic rules may be freely intermixed, although the preferred ordering is morphological, phonological, phonetic. A compromise position is put forth in Aronoff (1974) where it is suggested that morphological rules may precede phonological rules, but that there are also "breaks" in the phonological component where morphological rules may intervene. Such "breaks" occur between phonological cycles, after all cycles, and possibly after all word-level rules. It is at these points, and these points only, that morphological rules may come after (or between) phonological rules.

Here then is the intersection of morphology and the rule ordering controversy.³ The question centers on the status to be afforded to morphological rules and the manner in which it is to be incorporated into the grammar. A direct comparison between the three positions is possible because all three attempt to deal with the same set

of data, namely the exceptional behavior of reduplicated forms. It will be argued in this paper that 1) the Anderson model fails to achieve descriptive adequacy with respect to the data from Luiseño, and 2) variable ordering approaches (Anderson and Aronoff) and rule rebuilding approaches (Aronoff)⁴ are missing a significant generalization about the behavior of reduplicated forms as well as denying the differences in function which exist between morphological and phonological rules. I will present the data first and then the suggested solutions with their relative problems and merits.

In Tagalog, the future tenses are formed by copying the C_1V_1 of the base of the verb stem. The present is distinguished from the future by the infix -um- as well as reduplication. The form without reduplication but with the infix is referred to as the modal form.

<u>Modal</u>	<u>Future</u>	<u>Present</u>	<u>Gloss</u>
s-um-úlat	su-súlat	s-um-u-súlat	write
um-íbig	i-ibig	um-i-íbig	wish ⁵

Some verbs appear instead with prefixes which end in /ŋ/. This final nasal then undergoes a Prefix Assimilation rule, in which initial /b/, /p/, /t/, /d/, and /s/ of the verb stem are often assimilated to the corresponding homorganic nasal, while /k/ is always changed.

/p/	pamálo?	(paŋ-pálo?)	but	paŋ-parikìt
/b/	pamilmít	(paŋ-bilmít)	but	paŋ-bambò
/t/	panáli?	(paŋ-táli?)	but	paŋ-takíp
/d/	panaláŋin	(paŋ-daláŋin)	but	paŋ-dilìg
/s/	nanaríwa?	(naŋ-saríwa?)	but	paŋ-sakàŷ
/k/	naŋapà?	(naŋ-kapà?)		

Those forms which do not undergo the complete Prefix Assimilation process do still undergo the regressive nasal assimilation, suggesting two rules, one for homorganic nasal assimilation and the other for subsequent consonant deletion. However, regressive nasal assimilation is not required for the forms on the right above, except that it usually occurs before dentals. The final nasal of the prefix is lost before nasal initial stems.

/d/	mandurúkit ~	mandudúkit	(d → r / V _____ V)
/m/	namahála?	(naŋ-mahála?)	

In reduplicated forms, the assimilated nasal appears on

both the copy and the original, giving the appearance that Prefix Assimilation has applied where its environment has not been met.

/bigáy/	mamigáy (maŋ-bigáy)	mamimigáy (maŋ-bi-bigáy)	namimigáy give (naŋ-bi-bigáy)
/sumpâ/	manumpâ (maŋ-sumpâ)	manunumpâ (maŋ-su-sumpâ)	nanunumpâ curse (naŋ-su-sumpâ)
/kúha/	maŋúha (maŋ-kúha)	maŋuŋúha (maŋ-ku-kúha)	naŋuŋúha take (naŋ-ku-kúha)
/isdâ/	maŋisdâ (maŋ-isdâ)	maŋiŋisdâ (maŋ-i-isdâ)	naŋiŋisdâ fish (naŋ-i-isdâ)
/libák/	manlibák (maŋ-libák)	manlilibák (maŋ-li-libák)	nanlilibák scoff (naŋ-li-libák)

In Luiseño, adjectives derived from verbs by reduplication are exceptions to a general rule which changes /č/ to [š] before a consonant or word boundary. The output of the Reduplication rule is $C_1V_1C_2V_2+C_1V_1C_2V_2+i+č$, where $C_1V_1C_2V_2$ is a verb root, i is a nominalizer, and $č$ is an absolutive ending. There are several rules which are relevant.

1. Stress Placement -- under normal conditions, stress is root-initial, except if the root contains a long vowel, in which case, the long vowel gets the stress
2. Stress Retraction -- shifts the stress to the last vowel of the root when a particular class of verb augments is added to the stem. The ad hoc feature [+R] is used to mark this class.
3. Vowel Deletion -- when a two vowel sequence arises (only across morpheme boundaries) the second of the two vowels regularly deletes.
4. Vowel Syncope -- $V \rightarrow \emptyset$ / $\bar{V}C \quad \underline{\quad} CV$
5. č to š -- /č/ → [š] / $\underline{\quad} \left\{ \begin{array}{l} C \\ \# \end{array} \right.$
6. Vowel Raising -- /e/ and /o/ are raised to [i] and [u] respectively in unstressed position.

The order of the relevant rules as established by Munro and Benson (1973) is:

Reduplication
Stress Assignment
Stress Retraction

Vowel Deletion
Syncope
č to š

As a result of these rules, the deverbal adjectives derived by reduplication usually have the shape $C_1V_1C_2V_2C_1C_2V_2\check{s}$. However, when C_1 is /č/ and the derivation brings it into contact with C_2 , the /č/ to [š] rule fails to apply.

čara -- "to tear"	čaráčraš "torn"	*čarašraš
čoka -- "to be limp"	čukáčkaš "limping"	*čukaškaš

Munro and Benson (1973) demonstrate that it is not the stem itself which is exceptional, that the ad hoc feature [+R] which triggers Stress Retraction cannot be used to characterize this class as exceptions, that the regular notion of exception feature does not suffice either, and that within a traditional framework of sequential ordering, rule ordering cannot be used.

Both Anderson and Aronoff attempt to deal explicitly with the data from these two languages. They do so however without considering these forms in context with data from other languages. In fact, languages which contain reduplicated forms which are exceptional in some respect to a phonological process can be grouped into two groups, those in which a particular phonological rule fails to apply where it should (like in Luiseño) and those in which a rule appears to apply where it should not ("overapplication" as in Tagalog).⁶

1. Rule Failure

Madurese (regressive nasal assimilation)
 Akan (palatalization)
 Luiseño
 Japanese (Intervocalic consonant nasalization)
 Palauan (consonant deletion)
 Dakota (Vowel combination)

2. Rule Overapplication

Tagalog, Javanese, Sundanese, Madurese, Agta, Malay, Palauan (regressive nasal assimilation or replacement)
 Chumash (aspiration, glottalization)
 Dakota (palatalization)

From the list, it can be seen that the particular type of exceptional behavior is not a feature of certain phonological processes (i.e. palatalization fails in Akan but overapplies in Dakota), nor is it a feature of the language itself (Dakota, Madurese, Palauan

appear in both lists). In Squamish, from the same underlying representation, two alternating surface forms are derived, one which involves failure, the other overapplication.

I have argued elsewhere (Wilbur 1973a,b,c) that when reduplicated forms are exceptions to phonological rules (both failure and overapplication), the end result is always to keep the original and the copy as identical as possible. Presumably this is to keep phonological processes from obscuring morphological processes, although clearly some opacity is tolerated, as evidenced by reduplicated forms which undergo any phonological process which can apply to them. In comparing the three models, it is of interest to note how, if at all, this generalization can be incorporated into the grammar.

Anderson's proposal to handle the Tagalog data is simply to order Prefix Assimilation before Reduplication. This will combine the final nasal of the prefix with the initial consonant of the stem of the verb root into one nasal consonant which will then be copied by Reduplication.

	/paŋ + bilmit/ +Redup
Prefix Assim.	pa m ilmit
Redup	pa mi mi lmit

In Anderson's framework, a phonological rule may precede a morphological rule. Anderson does not attempt to account for those forms where Prefix Assimilation does not occur, but notes that "other languages of the family show the operation of the same rules in the opposite order" (Anderson 1974:4).

Aronoff starts by treating Prefix Assimilation as two rules, nasal assimilation and consonant deletion. He then gives the following as the regular order for Tagalog.

1. Prefixing (Morphological) /paŋ/, /maŋ/, /naŋ/
2. Nasal Assimilation /ŋ/ → $\left[\begin{array}{l} \text{coronal} \\ \text{anterior} \end{array} \right]$ / _____^c $\left[\begin{array}{l} \text{coronal} \\ \text{anterior} \end{array} \right]$
3. Consonant Deletion $\left[\begin{array}{l} +\text{cons} \\ -\text{voc} \\ -\text{syll} \end{array} \right]$ → \emptyset / [+nasal] + _____
4. Flap rule /d/ → [r] / $\left[\begin{array}{l} \text{V} \\ \text{_____} \\ \text{V} \end{array} \right]$
5. Reduplication (Morphological)

The sequence 234 defines a phonological cycle in the sense that if 2 is the first phonological rule of the grammar, and 5 is the only morphological rule which occurs in this particular break, then the next phonological rule to apply after 5 must be 2. No morphological rule may intervene between 2 and 3, or 3 and 4. The forms which do not undergo Prefix Assimilation (paɲbambɔ) are "assigned" the ordering 23415 so that Prefixing does not create the environment to which rules 2 and 3 must apply. Forms like mandurúkit require Reduplication to feed the Flap rule, so therefore they must have the ordering 15234. Aronoff notes that forms with the ordering 15234 also have alternate forms with the ordering 23415.

There are some technical problems with the Aronoff solution. One is that forms which do not undergo Prefix Assimilation as a whole may be seen to be exceptions to Consonant Deletion (rule 3) but may nonetheless undergo Nasal Assimilation (rule 2). No ordering of the morphological rules 1 and 5 with respect to the phonological rules 2, 3, and 4 can account for what is clearly an internal phonological matter. The forms must be allowed to undergo rule 2 but not rule 3. In connection with this, the ordering assigned to forms like mandurúkit 15234 also fails, since mandurúkit undergoes 1, 5, 2, and 4 but not 3. Again, no ordering of the morphological rules with respect to the phonological rules as a group can handle these forms.

For the Luiseño data, Anderson suggests that the /ç/ to [ʃ] rule be ordered before Adjective Reduplication. In this way, /ç/ to [ʃ] would apply to the other forms before Reduplication creates the adjectives to which it does not apply. Anderson notes "there are important problems with the ordering relations among the rules discussed here in Luiseño, as Munro and Benson note. They can be resolved easily within the framework of local ordering (see Anderson 1969; 1974b)" (Anderson 1974a:11). One of the important problems is that Stress Assignment, Stress Retraction, and Syncope, which all apply regularly to the adjective forms derived by Adjective Reduplication, need Reduplication to apply first so that they can apply properly. The ordering

↓ c to ↓ s
 Reduplication
 Stress Assignment
 Stress Retraction
 Syncope

or a possible alternative

Reduplication
 Stress Assignment
 Stress Retraction
 č to š
 Syncope

can be demonstrated as inadequate by derivations in which the adjectives in question have several more suffixes. Syncope also applies when the stress on the preceding vowel is only secondary stress, so in some forms Syncope may apply twice. For example,

	čukačkašmi	from	čoka	i	č	um	i	
		/	čoka	i	č	um	i/	+Redup
Reduplication		čoka	čoka	i	č	um	i	
Stress Assignment		čoka	čoka	i	č	um	i	
Stress Retraction		čoká	čoka	i	č	um	i	
Vowel Deletion		čoká	čoka		č	um	i	
Syncope		čoká	č ka		č	m	i	
č to š		čoká	š ka		š	m	i	
Raising		čuká	č ka		š	m	i	*čukáškašmi

Aronoff attempts to avoid the ordering problem by building Syncope into the Reduplication rule. Aronoff's (1974:163) revised rule is:

C V C V X#
 1 2 3 4 5 \Rightarrow 1 2 3 4 1 3 4 5

There is however already a productive rule of Syncope in Luiseño which the revised Adjective Reduplication rule will duplicate. Aronoff recognizes this, but says only that sometimes generalizations have to be given up. In Wilbur (1974), I argued that when a generalization must be given up, there must be good reason for it. If giving up a language-specific generalization allows us to maintain a more universal language-independent generalization, that might be considered a good reason. By giving up the generalization in Luiseño provided for by a single Syncope rule and a general Reduplication rule, we have not gained anything except a workable solution for one set of forms. And in fact it can be demonstrated that the solution is not all that workable. Only those adjectives which are derived from verb roots marked with the feature [+R] actually undergo Stress Retraction and Syncope. Other adjectives derived from verbs by the same Reduplication process and having similar meaning do not

undergo Syncope because the verb roots are not marked [+R] and do not trigger Stress Retraction which is necessary for Syncope to apply. So we find forms like pelavela from the verb pela- "dance" which may surface as either pélavela or pelavéla, but not with Syncope. Thus Syncope is not itself an inherent part of the Adjective Reduplication rule as Aronoff suggests. The only argument for a separate Reduplication rule for the adjectives is that this particular group has a meaning of de-intensification, rather than intensification as other reduplicated forms do, but a separate reduplication rule could still not incorporate Syncope, so there would be no actual advantage to writing such a rule, as the problems inherent in Anderson's solution would still remain.

The solution suggested in Wilbur (1973a) for all languages which contain exceptional reduplicated forms argued as follows:

Reduplication is not a phonological rule, but rather a morphological rule. It seems appropriate for morphological rules to precede phonological rules, since they create the environment to which phonological rules apply. The following solution does not require morphological rules to precede all phonological rules, but it does provide a framework in which such an ordering can be easily accommodated. Separating morphological rules from phonological rules is one way in which the difference in function can be acknowledged. (Cearley (1974) lists some putative distinctions between morphological and phonological rules. Cearley claims that by definition morphological rules precede phonological rules.)

To the extent that it can be argued that a notion such as the preservation of underlying semantic, syntactic, or morphological information should be incorporated into the phonological component, it can also be argued that the appropriate way to accomplish this incorporation would be if all the cases in all the languages were handled similarly, by a single notational device. In Wilbur (1973a,b) it was argued that no one single device currently available is strong enough to handle all the data and also capture the generalizations about the behavior of reduplicated forms, with the exception of global rules. It was argued that global rules would 1) allow all morphological rules to precede all phonological rules and 2) handle all languages the same, and presumably thereby capture the generalizations that the end result of the exceptional behavior in all the languages is to preserve as much of

the identity of the original and its copy as possible, or in other words, to maintain the transparency of the reduplication process. At the same time, the derivational information required for a global rule is exactly that two units (segments, syllables, morphemes, whatever) are related by a copying rule, without having to build the copying rule into the phonological rule. It is, after all, crucial to all of the examples given, and others in Wilbur (1973a), that the unit (in these cases, segment) which is exceptionally affected is related to another such unit by a copying rule. Other units which are identical (i.e. the suffix c in Luiseno) but which lack a correspondence with some other identical unit by a copying rule are not adversely affected. Such phonological coreference is as difficult to build into the phonological component as specifying certain types of pronominal coreference in the syntactic component.

The formulation of the global rules needed can be made independently of any particular language. For rules which overapply, a global rule would look something like

$$X \text{ (and } X') \rightarrow Y \text{ if } AXB$$

where X' is defined as the "mate" of X by a copying rule (Reduplication, Vowel Copy, etc.) and interpreted as

X and its mate (if there is one) become Y if X (but not necessarily X') is in the environment $A \underline{\quad} B$.

Thus both parts undergo the rule although only one is actually in the proper environment. For rule failure, a global rule would be formulated as

$$X \text{ (and } X') \rightarrow Y \text{ if } X \text{ (and } X') / A \underline{\quad} B$$

which is interpreted as 1) X becomes Y if AXB and 2) X and X' become Y if both of them are in the environment $A \underline{\quad} B$, otherwise neither of them become Y .

This solution essentially claims that it is a property of a particular rule in a particular language that it will behave exceptionally with respect to reduplicated forms, and that the exceptional behavior (failure or overapplication) is also a rule/language-specific feature, but that languages and rules which

have this feature have only two options in terms of behavior, and that the relevant function in each language is to treat the copy and the original in the same way. It may be seen as a drawback of both Anderson's and Aronoff's proposals that they require different analyses for each language and fail to incorporate any portion of the universality of this behavior.

Further Remarks on Global Rules

Global rules have been shunned by many phonologists as being entirely too powerful and essentially unconstrained. Part of the problem has been that global rules have not actually been formalized when they have been proposed. In this case, however, I think the use of global rules is well-justified -- they capture exactly and only the behavior which is observed, they formalize in a reasonably satisfying notation, they eliminate the barbarous abuses of other notational devices -- exception features, special reduplication boundaries, etc. (see Wilbur 1973a) -- to handle reduplicated forms, and they do not require overhauling the phonological analysis of a particular language at all. They also eliminate the need to make arbitrary decisions between two alternate possible analyses of the same data. For example, the failure of Regressive Nasal Assimilation in Madurese (/baŋ/baŋbaŋ * bambaŋ) may be treated by either 1) ordering Reduplication after Regressive Nasal Assimilation or 2) having the output of the Reduplication rule marked by a special reduplication boundary across which Regressive Nasal Assimilation cannot apply. Both solutions capture the fact that only reduplicated forms do not undergo Regressive Nasal Assimilation. The difference in traditional terms is a matter of esthetics, especially if there is no evidence to indicate that the rule ordering solution will not work. The function of the rules and the similarity across languages are ignored by language-specific solutions of the type proposed by Anderson and Aronoff.

Remarks on Variable Ordering

So far I have constrained my comments on Anderson's and Aronoff's approach to the data at hand. There are some theoretical complaints which can be lodged against a theory which incorporates local or variable ordering. When the order in which rules apply is not fixed within a particular language, a derivation has no fixed beginning, middle, and end. In order to know how a parti-

cular word is derived, the surface form must be looked at to determine what the end result will be, from which the ordering of the relevant rules can be deduced. At first glance, this might not seem to be a serious problem -- the surface form, after all, is only actual occurring form that we have, it is the observable data. Within such a framework, however, there is no predictive power whatsoever. It is not possible to predict what new forms will look like, unless there is some morphological semantic conditioning for the different orderings. In addition, the traditional notion of a derivation is destroyed, since rules do not generate forms when they have to look ahead to figure out what order to apply in. That is, if the surface form must be used to determine the order of two rules, then it can no longer be said that the rules produce the form. The rules then become a means of capturing generalizations about the relationships between the surface and underlying forms, in which case there is no need to order them, since they do not apply, they only describe. It is not at all clear that this is a totally undesirable situation, however, in that attempts to derive all the forms of a language that can possibly be squeezed into derivational form seem to be misguided, and serious reconsideration of the purpose and function of rules seems to point to a need to overhaul much of the work currently being done within the generative framework at all (Wilbur and Menn, 1974).

Remarks on Functionalism and Formalism

Part of the overhaul has already begun in the form of an increasing number of functional solutions which have been proposed as explanations for several different phenomena (Kisseberth and Abasheikh 1974a,b,c,; O'Bryan 1974; Flora 1974). These solutions deal with transderivational processes (Nessly 1974) but no attempt at formalizing them is made. In the case of the data discussed here, the notion of a global rule captures derivational information; the fact that only two kinds of global rules are involved captures some cross-language information. The problem is that the global rule solution does not seem to be sufficient. It is not an appropriate characterization of transderivational information in the sense that it does not capture the idea that languages have strategies for preserving underlying information, for regularizing paradigms. In other words, explanations are being proposed for different phenomena which are not currently formalizable.

These explanations seem to require a place not just in the grammar, but also in the theory -- the difference being that global rules puts the identity tendency into the grammar, into the phonological component specifically. But the overall tendency, the so-called guiding principle behind why there should be global rules in the phonological component, is statable but not formalizable (yet). Functional solutions can be seen as extremely important since they provide explanations that are not apparent when simply working within the present set of notational devices like rule ordering, but if they are not formalized then I am afraid that the end result will be a descriptive set of statements which will have no significant impact on the way phonology is done. We are cycling back to statements of the kind that resembled the X becomes Y by analogy statements of pre-generative grammarians. The real advance comes when it is possible to formalize (or even define) analogy in such a way that it becomes useful in terms of analyzing language. Heading in this direction will, I believe, eliminate the rule ordering controversy.

Footnotes

1. See Wilbur (1973a) for a more detailed discussion of morphology in pregenerative and generative linguistics.
2. It is not necessary to hold to a sharp distinction between derivational and inflectional morphology in order to accept a separate morphological component.
3. This discussion will be confined to theories with sequential rule ordering. Clearly a theory with simultaneous rule ordering (Koutsoudas, Sanders, Noll) makes no distinction between morphological and phonological rules and, although interesting in terms of the rule ordering controversy itself, is basically irrelevant to the present question.
4. cf fn. 3
5. Vowel-initial stems are actually glottal-initial. So: ?-um-íbig, ?i?íbig.
6. Wilbur, R. (1973 a, b, c).

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