rule. One problem with this solution is that reduplication has all of the properties of a regular word formation rule and regular word formation rules can be ordered to precede all phonological rules. Ordering reduplication after certain phonological rules implies that one can place a derivational or inflectional affixing rule somewhere in the middle of the phonology, an option that is, apparently, not otherwise needed.[18]

In addition to loosening constraints on the organization of grammar, the ordering solution to the overapplication of phonological rules to reduplicated forms cannot be extended to explain the *under*application of certain rules to these forms. To take another example from Dakota: certain word-final *a*s in Dakota change to *e* before a number of morphemes including the phrase-ending morpheme, /ʔ/.

(44) a. hą́ska[19] 'to be tall'
b. čʰą-kį iyúha hą́ske-ʔ 'all the trees are tall'

However, the final *a* of at least a certain class of reduplicated verbs does not change to *e* before these same morphemes even when the final *a* of their unreduplicated roots does change. Thus, despite the fact that the final *a* of *hą́ska* changes to *e* before *-ʔ*, as shown in (44b), the final *a* of its reduplicated form, *hą́ska-ska*, does not change to *e* before *-ʔ*, as shown in (45).

(45) cʰą́-kį hą́ska-ska-ʔ 'the trees are tall'

If reduplication were ordered after the rule changing *a* to *e*, we would expect **hą́ske-ske-ʔ* in (45); if before, we would expect **hą́ska-ske-ʔ*. Since rule ordering provides no explanation for the underapplication of rules to reduplicated forms, it is a questionable solution to their overapplication. One would expect the same analysis to cover both cases of irregular rule interaction.

Wilbur herself offers a reason for the fact that rules over- and underapply to reduplicated forms. She attributes this special behavior of reduplicated forms to the *Identity Constraint* (Wilbur (1973, 58)):

(46) *The Identity Constraint*

There is a tendency to preserve the identity of R_o [what is copied in reduplication] and R_r [the copy] in reduplicated forms.

Wilbur suggests that the Identity Constraint may be realized as a global condition on the rules which over- and underapply to reduplicated forms. A rule which overapplies would be written to apply both to a segment in R_o and to the corresponding segment in R_r if the rule's environment is met for the segment in R_o. A rule which underapplies would be written to apply to a segment in R_r only if the corresponding segment in R_o

[18] An anonymous *LI* reviewer has pointed out that, even setting aside reduplication, some morphological rules have been argued to "follow" phonological rules in some sense. I know of no convincing arguments to this effect consistent with the restrictive theories of phonology and morphology I am assuming here (but see Anderson (1975)).

[19] A vowel with a superimposed comma, e.g. *ą*, represents a nasalized vowel in this orthography.

also occurs in the appropriate environment. The rule would thus fail to apply when a segment X in R_r but not the corresponding segment X′ in R_o appears in the right environment.

The difficulty is that the Identity Constraint explains nothing. Wilbur observes that rules appear to over- and underapply to reduplicated forms and invents a constraint which merely encodes this fact. Many rules apply "normally" to reduplicated forms; that is, they apply wherever—and only where—their environments are met. For example, a rule of Devoicing in Dakota, which devoices fricatives before boundaries, is responsible for the *s* in example (43), repeated here as (47).

(47) kíčoščoza (from *koza* 'to wave')

Although they destroy the identity of R_o and R_r, rules like Dakota Devoicing (given as (62) below) do not violate the Identity Constraint, which does not insist that phonological rules preserve the identity of R_o and R_r but merely allows that they might. A real solution to the application problem will explain why only certain rules and not others over- and underapply in reduplicated forms. If we can make the behavior of rules with respect to reduplicated forms follow from an independently motivated theory of phonology without keying on the duplicative nature of reduplication, we will have explained the phenomenon instead of merely remarking upon it.

The Identity Constraint as formalized by Wilbur makes an empirical prediction regarding the possible application of phonological rules to reduplicated forms which data from Karok (Bright (1957)) actually disconfirm. Therefore, Wilbur's solution to the application problem can be rejected on empirical as well as explanatory grounds.[20] Karok forms a derived intensive verb indicating the repetition of a short action by suffixing a CVC reduplicating skeletal morpheme.

(48) parak 'to separate with a wedge' — parak-rak 'to split logs with wedges'
tasĩr 'to brush' — tasin-sĩr 'to brush (repeatedly)'

(In (48), *r̃* is a morphophoneme which nasalizes to *n* before a consonant.) The morphophoneme that Bright writes as *v* deletes between an *a* or *o* and a consonant-initial suffix. In the reduplicated forms of $\left\{\begin{matrix} a \\ o \end{matrix}\right\}$*v*-final stems, however, neither the *v* before the reduplicating suffix nor the final *v* of the suffix deletes, even when a consonant-initial suffix is added to the reduplicated form.

(49) ʔu·mxávxam (< ʔu·mxav) 'to pull up by the roots'; -tih 'durative'
ʔu·mxavxá·vtih 'to be pulling up by the roots'
When *v* (but not *ṽ*) comes to stand between *a(·)* or *o* and a consonant, in that order, it is replaced by lengthening of the preceding vowel (if not already long) . . . The only exception occurs in reduplicated forms, where *v* is always retained. (Bright (1957, 34))

Thus, *v* Deletion appears to underapply in reduplicated forms. However, Wilbur's Iden-

[20] Tagalog presents another empirical problem for Wilbur's proposals; see section 2.2.2.2.

tity Constraint cannot account for the underapplication of *v* Deletion in Karok. The Identity Constraint blocks the application of a rule to a segment or segments in the copy portion of a reduplicated form when the corresponding segment or segments in the original are not in the proper environment for the rule. In *ʔu·mxavxa·vtih*, both the stem and copy *v* stand between an *a* and a consonant and thus should delete under the Identity Constraint to yield **ʔu·mxa·xa·tih*.[21]

I will demonstrate that the behavior of phonological processes with respect to reduplication is predicted by current theories about the organization of phonology and the lexicon. To account for the data, all we need to assume is our conclusion from section 1—that reduplication is simply derivational or inflectional affixation. To switch perspective, given that my data are correct, the behavior of reduplicated forms will provide considerable support for the current theories of phonology and the lexicon which predict this behavior. The strategy of this section, then, is to show that the apparent problems and paradoxes associated with the interaction of reduplication with phonological processes are in fact pseudoproblems and paraparadoxes. Once the grammars of reduplicating languages are examined with care, difficulties surrounding the interaction of reduplication rules with phonological processes disappear.

The cases of apparent over- and underapplication of phonological rules to reduplicated forms fall into two classes. In the first, we find phonological processes that do not apply within the reduplicating affix (the "copy") although their environments are met there. It will be shown (section 2.1) that in Luiseño, the rule in question is a cyclic rule, which, according to current interpretations of the cycle (see e.g. Mascaró (1976), Halle (1979)), should not apply within morphemes in nonderived environments. Therefore, we should not expect it to apply within the reduplicating morpheme.

The second class of cases exhausts the remaining types of examples of over- and underapplication of phonological processes to reduplicated forms. For Dakota and Tagalog, I will suggest that these processes meet the criteria to be considered *morpholexical rules* in the sense of Lieber (1980). That is, they are not phonological rules at all, but rather rules which express the relationships between allomorphs of morphemes, both of which are listed in the lexicon. If the phonological processes in question are morpholexical rules and reduplication is considered an affixing word formation rule like any other affixing rule, then we can explain the interaction of these processes with reduplication without any extra machinery. In fact, Lieber's theory predicts the appearance of under- and overapplication of morpholexical rules in reduplicated forms; it prohibits what would look like the "normal" application of these rules to such forms. Since both the "input" and "output" of a morpholexical rule are listed in the lexicon, reduplication, an affixing process, must build on one of these listed allomorphs. If it builds on the

[21] In an earlier version of this article, I included an analysis of Karok reduplication in section 2.2. There I provided evidence that *v* Deletion between {*a*, *o*} and a consonant is "morpholexical" in the sense to be defined below and that, therefore, apparent underapplication of *v* Deletion to reduplicated forms is expected (see section 2.2 for a discussion of the relationship between the morpholexical character of a rule and its apparent over- or underapplication to reduplicated forms).

pseudoinput to the morpholexical rule, the illusion of underapplication results; if it builds on the pseudooutput, the result is the illusion of overapplication. We take up this second class of cases in section 2.2.[22]

2.1. Reduplication and Cyclic Rules: Luiseño[23]

Munro and Benson (1973, 16) note that "the surface phones *č* and *š* of Luiseño are in complementary distribution such that [(50) holds of them]":

(50) $\check{c} \rightarrow \check{s} \,/\, \_\_\_ \left\{ \begin{matrix} \# \\ [-\text{cont}] \end{matrix} \right\}$

The grammar of Luiseño includes a regular derivation process, schematized in (51), which forms moderative adjectives from verbs by reduplication.

(51) $C_1V_1C_2V_2 \rightarrow C_1V_1C_2\acute{V}_2 + C_1C_2V_2 + \check{s}$

ʔáva 'be red'	ʔaváʔvaš 'pink'
máha 'to stop'	mahámhaš 'slow'

Under the analysis of reduplication presented in section 1, we would say that Luiseño forms moderative adjectives from verbs by suffixing the C–V skeletal morpheme CCV (or CCV C). The apparent problem concerning the interaction of phonological rules and
|
č
reduplication in Luiseño is this: when the initial consonant of a verb is *č*, it does not become *š* in the adjective-forming reduplicating suffix even though it immediately precedes a consonant. That is, *č* → *š* appears to underapply in reduplicated forms.

(52)

čára 'to tear'	čaráčraš 'torn'
čóka 'to limp'	čukáčkaš 'limping'

What prevents *č* → *š* from applying in the reduplicated forms of (52)? Wilbur (1973) claims that *č* → *š* is subject to the Identity Constraint, (46). This constraint blocks the

[22] I will not discuss here all of Wilbur's (1973) examples of the over- and underapplication of phonological processes to reduplicated forms, but will instead restrict attention to those languages for which sufficient data exist to answer crucial questions about the phonological processes involved. As will become clear in the pages to follow, an explanation of the apparent over- and underapplication of phonological processes depends on determining properties of these processes which often cannot be extracted from even a fairly careful grammar of a language. Wilbur, for the most part, simply accepts the analyses of her sources, writing that a phonological process is a rule, for example, if her sources claim that it is. To understand more clearly why not all of Wilbur's (1973) examples are treated here, consider the case of the underapplication of Palatalization in Akan reduplicated forms. In an earlier version of this article, I claimed that Palatalization underapplied within a reduplicating prefix in Akan because it was a cyclic rule. Reviewing Wilbur's source on Akan (Schachter and Fromkin (1968)) more carefully in preparation for rewriting the article, I realized that there was no evidence for the rule of Palatalization at all; it was simply a device used to reduce the underlying inventory of phonemes. The state of the art was such in 1968 that one freely exploited rule ordering and lexical exceptions to replace phonemes with rules.

[23] Aronoff (1976) and McCarthy (1979), among others, have argued from the Luiseño data to different conclusions. [illegible] they were not aware of the crucial data exemplified in (53) and (54), or at least they do not [illegible]

rule in the copy (R_r) of the reduplicated form because the *č* in the original (R_o) does not meet the environment of the rule, that is, it does not immediately precede a consonant. The failure of *č* → *š* to apply in the reduplicated forms thus preserves the identity of R_r and R_o.

On the analysis of reduplication given in section 1, we need not say anything about the interaction of *č* → *š* and reduplication in Luiseño. Since, as we shall see, the *č* → *š* rule is "cyclic", in a technical sense, and since the *č*–C combinations in the reduplicated forms in (52) are entirely internal to the suffixal adjective-forming morpheme, CCV, current theories of the application of cyclic rules (see e.g. Mascaró (1976), Halle (1979)) predict that *č* → *š* will not apply within the copy portions of these reduplicated forms.

Contrary to the claims of Munro and Benson (1973), *č* and *š* are not in complementary distribution in Luiseño. In fact, *č* → *š* is a neutralizing rule with a restricted range of application. Davis (1976) indicates that there is one Luiseño word in which *š* precedes a vowel, the exclamatory *šóx* 'oh!' (cf. *čára* 'to tear', *čóka* 'to limp'), but discounts this as a counterexample to complementary distribution because "exclamations in many languages frequently display exceptional phonological characteristics" (p. 197). Kroeber and Grace (1960) include an example of *š* before a [+cont] consonant, *x*, but their transcription of *mašxai* 'isn't it?' might be a result of their failure to distinguish *š* from *ś*, a retroflex (see Davis (1976)).

(53) quawíčxal 'Bloomeria aurea' mašxai 'isn't it?'
páčxam- 'to launder'

If *šóx* and *mašxai* constituted the only examples of the breakdown in complementary distribution between *č* and *š* outside of reduplication, it would be difficult to argue that *č* → *š* is a neutralizing rule, that is, that *š* is an underlying phoneme in Luiseño. Although *šóx* and *mašxai* do suggest that *š* and *č* are not in complementary distribution, what is important for the present analysis is that *č* occurs in underived morpheme-internal environments before the very consonants in front of which *č* → *š* applies when the context, ____ [−cont], is derived,

(54) a. po-xečla 'its point, of an arrow'[24]
but pu·šla 'eye, nom.', pu·čil 'eye, obj.'
moš-la-t 'belt' < moči 'to weave'
b. čačmis 'a stone tool'
but pa·-ŋawišmi 'them of the water', pa·-ŋawiči 'him of the water'
neš-ma-l 'old woman' < ne·ču- 'to become an old woman'

Although *po-xečla* appears among my sources only in Kroeber and Grace (1960), Bright (1968) confirms their *čačmis*.

[24] Kroeber and Grace (1960, 22) suggest that *po-xečla* 'its point, of an arrow' is derived from *xeči-* 'strike' and *-la* 'place of'. However, this is undoubtedly an historical derivation, not a synchronic analysis. First, note that the meaning of *po-xečla* is not a predictable combination of the meaning of its constituent parts; rather, it has developed a specialized usage. Moreover, as Kroeber and Grace point out, *-la* is not a "truncating suffix"; that is, the final vowel of *xeči-* would not delete before *-la* if the proposed derivation were synchronically valid.

Drawing on the work of Kiparsky (1973), Mascaró (1976) and Halle (1979) identify as "cyclic" the class of rules which appear to apply only in derived environments. That *č* → *š* fails to apply before certain consonants (e.g. before *m* in *čačmis*) when *č* appears before these consonants in the underlying form of a morpheme but applies before the same consonants when the environment is derived indicates that *č* → *š* is "cyclic" in the technical sense. Halle (1979, 18) formulates the condition on cyclic rules which prevents them from applying in nonderived environments in a manner which blocks application of a cyclic rule when the environment for the application of the rule is entirely contained within the underlying representation of a morpheme, be it root or affix. Since the *č*–[−cont] combinations in the reduplicated forms in (52) are entirely contained within the reduplicating suffix, CCV, Halle's formulation of the condition on cyclic rule application correctly predicts that *č* → *š* will fail to apply within such forms.

One might argue that the environment internal to the reduplication affix in Luiseño is a "derived" environment since the copying and linking of a phonemic melody in reduplication "derives" the phonemic shape of the affix. However, as long as the copying and linking processes in reduplication are not phonological rules, the technical definition of the cycle in Halle (1979, 18) yields the correct results for Luiseño. The juxtaposition of the *č* and the [−cont] within the reduplicating affixes in (52) is not the result of some phonological rule, nor would the application of *č* → *š* within those affixes make "specific use of information" outside the reduplication affix. Therefore, according to Halle's definition of the cycle, *č* → *š* should not apply in (52), if it is a cyclic rule.

To summarize, *č* → *š* fails to apply within the Luiseño reduplicated forms discussed above because *č* → *š* is a cyclic rule, the interior of the reduplicating prefix is not a derived environment, and cyclic rules apply only in derived environments. Note that, for our purposes, showing that *č* → *š* applies regularly in derived environments but fails to apply in nonderived environments was sufficient to demonstrate that the rule is "cyclic". That *č* → *š* is "cyclic" in the sense of applying once in each phonological cycle is of no importance here. We do not even need a theory of the phonological cycle to predict that *č* → *š* will not apply within the derived adjectives of (52). The forms in (54) demonstrate that *č* → *š* does not apply within nonderived environments, and the interior of the reduplicating suffixes in the adjectives of (52) is not a derived environment. Therefore, *č* → *š* should not apply in (52). The theory of the cycle found in Halle (1979) and the other sources cited above simply leads us to expect to find rules like the Luiseño *č* → *š*, i.e. rules which apply only in derived environments; such rules need not be considered problematic.

Knowledge of more of the phonology of Luiseño than I have presented here might lead one to raise two objections against the analysis of Luiseño outlined above. First, Luiseño contains a rule of Vowel Syncope which might be used to derive the surface form of reduplicated adjectives shown in (51) from the underlying structure schematized in (55), as suggested by Munro and Benson (1973).

(55) $C_1V_1C_2\acute{V}_2 + C_1V_1C_2V_2 + š$

If a rule of Syncope produces (51) from (55), we would expect the cyclic rule of *č* → *š*

rule in the copy (R_r) of the reduplicated form because the *č* in the original (R_o) does not meet the environment of the rule, that is, it does not immediately precede a consonant. The failure of *č* → *š* to apply in the reduplicated forms thus preserves the identity of R_r and R_o.

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(55) $C_1V_1C_2V_2 + \check{s}$

If a rule [illegible] (51) from (55), we would expect the cyclic rule of *č* → *š*