(i.e. into a feeding order) and a change from A'-B' to B'-A' (i.e. out of a bleeding order) would be possible and likely changes—the opposite changes would be unlikely, if not impossible. Kiparsky proposes further that, if the implications of his observations are correct, then 'the order toward which rules gravitate ... is linguistically simpler than its opposite', i.e. that rule reordering is a form of simplification.

An important aspect of Kiparsky's discovery is its demonstration that the function of rules must be taken into account in comparing grammars in terms of their relative complexity. In a particular instance, a change in the ordering of two rules might not affect the complexity of either rule, and it might not result in the elimination of some other rule from the grammar—i.e. it might possibly have no effect whatsoever on the total number of symbols which require mention in the grammar. Such a change is nonetheless a simplification, Kiparsky argues, because it increases the utilization of a rule — an ordering is less highly marked, i.e. simpler, than its opposite if it provides for greater utilization of the rules involved in the ordering.18 If this is correct, then it helps to define simplification in a rather meaningful way. A grammar can be simplified by elimination of rules or by generalization of rules, or both. The generalization of a rule is not defined in terms of a reduction in its formal complexity, but in terms of its applicability to linguistic forms — a rule has greater generality if it applies to a more general class of forms; and this may or may not be reflected in the formal complexity of the rule itself. In the Walbiri-Warramunga comparison examined earlier, the Warramunga rule is more general than the Walbiri one, because it applies to all forms which conform to the description

... V + C1V ..., 

while the Walbiri rule applies only to forms in which the vowels are high. In the case of rule reordering, the generality of forms to which a rule applies is defined in terms of derivations — thus, rule A in the ordering B-A applies to all forms which satisfy the description

... iCu ..., 

not only to those which exist prior to the application of rule B. Similarly, rule B' in the ordering B'-A' affects all forms satisfying the description

... iCu ..., 

not merely those to which A' would be inapplicable.

It is evident that a large and interesting class of linguistic changes can be understood in relation to the assumption that language acquisition is subject to principles of linguistic simplicity. I would like now to consider some rather different cases of gram-

18 Kiparsky extends the concept of markedness to cover cases of rule ordering (1968a:200). This usage is investigated further by Anderson 1969.
mational restructuring which are not so obviously explicable in these terms. I will consider first an example from Polynesia and then a somewhat more complicated example from Australia.

At some point in the history of Polynesian languages, at a time which we might refer to as ‘pre-Polynesian’, a phonological rule was added to the grammar whose effect was to delete word-final consonants:

\[ C \rightarrow \emptyset \]

Thus, words which now end in a vowel (e.g., Maori /inu/ ‘to drink’) once ended in a consonant (/m/, in this particular example — thus, evidently, *inum). The rule applied only to word-final consonants; before suffixes, a stem-final consonant remained (thus, in Maori, the original final /m/ of *inum remains in the modern passive /inuma/ and gerundive /inumanga/).

The effect of the consonant deletion rule on the modern Polynesian language is the circumstance that no words end in consonants; all morphemes end in vowels when they precede word boundaries. The pre-Polynesian stem-final consonants are, however, continued in modern suffixed forms. Thus, what one finds in a modern Polynesian language like Maori, for example, is data of the following sort:

<table>
<thead>
<tr>
<th>verb</th>
<th>passive</th>
</tr>
</thead>
<tbody>
<tr>
<td>awhi</td>
<td>awhitia</td>
</tr>
<tr>
<td>hopu</td>
<td>hopukia</td>
</tr>
<tr>
<td>aru</td>
<td>arumia</td>
</tr>
<tr>
<td>tohu</td>
<td>tohunia</td>
</tr>
<tr>
<td>mau</td>
<td>mauria</td>
</tr>
<tr>
<td>wero</td>
<td>werohia</td>
</tr>
<tr>
<td>patu</td>
<td>patua</td>
</tr>
<tr>
<td>kite</td>
<td>kitea</td>
</tr>
</tbody>
</table>

‘to embrace’
‘to catch’
‘to follow’
‘to point out’
‘to carry’
‘to stab’
‘to strike, kill’
‘to see, find’

In the last two examples, the passive suffix is simply /-a/, evidently. In all of the preceding examples, however, the ending has associated with it a consonant which does not appear in the bare stem. If these data were extended, it would become clear that there are basically two classes of alternants for the passive, one class which involves a consonant, and another which does not — and all Maori consonants, with the exception of /p/ and /w/, are attested in the consonantal class of alternants. Given just the bare form of the stem, there is no way of predicting, in a given case, what the passive form will be.

From the point of view of a linguist confronted with data like these, the natural account is a purely phonological one along roughly the following lines. All of the verbs whose passive forms involve a consonantal increment have themselves a final consonant in their underlying representations:
/awhit/
/hopuk/
/arum/
/tohun/
/maur/
/weroh/

The passive ending itself has only two alternants whose distribution can be described in purely phonological terms:

\[
\text{Pass} \rightarrow -\text{ia} / C + \ldots .
\]

\[
\text{Pass} \rightarrow -\text{a} / V + \ldots .
\]

That is, the passive ending (Pass) is represented phonologically by /-ia/ when it follows a consonant, and by /-a/ when it follows a vowel.\(^1\) When a consonant-final stem is not followed by a suffix — i.e. when it is followed immediately by a word boundary — its final consonant is deleted by the rule

\[
C \rightarrow \emptyset / \ldots \# .
\]

According to this analysis, Maori would have derivations like the following:

\[
\text{awhit} + \text{Pass} \rightarrow \text{awhit} + \text{ia}
\]

\[
\text{awhit} \neq \rightarrow \text{awhi} \#
\]

\[
\text{hopuk} + \text{Pass} \rightarrow \text{hopuk} + \text{ia}
\]

\[
\text{hopuk} \neq \rightarrow \text{hopu} \#
\]

\[
\text{patu} + \text{Pass} \rightarrow \text{patu} + \text{a}.
\]

The analysis is further supported by the observation that another ending, the gerundive, also involves retention of the postulated stem-final consonants. The gerundive ending, like the passive, has two alternants under this analysis — namely, /-aŋa/ after consonants, /-ŋa/ after vowels (hence: /awhit + aŋa/, /hopuk + aŋa/, /patu + ŋa/).

What this analysis claims, in effect, is that the postulated pre-Polynesian rule

\[
C \rightarrow \emptyset / \ldots \#
\]

is still a part of the synchronic grammar of Maori. By making this assumption, it is possible to describe the Maori passive and gerundive verb forms in purely phonological terms with a small set of completely natural rules. Let us refer to this analysis of Maori passives and gerundives as the 'phonological alternative'.

Another conceivable analysis of the Maori data (in fact, the null-hypothesis) is one according to which the endings are identified with the material to the right of the subsequence which matches the stem in its uninflected form. According to this alternative, the passive ending is /-tia/ in /awhitia/, /-kia/ in /hopukia/, /-a/ in /patua/, and so forth; all verb stems are consistently vowel final, since the ancestral stem-final

\(^1\) For a more exact formulation, see Hale 1968b:85–8.
consonant is now assigned to the suffix. And because of this reassignment of the consonant, the passive and gerundive suffixes each have a dozen or so alternants. In order to associate the suffixial alternants with the proper stems (i.e. /hopu + kia/, not */hopu + a/ or */hopu + ŋia/, and so on), it is necessary to attribute to each stem a diacritic feature which can serve as conditioning environment for the rules which specify the phonological shapes of the passive and gerundive suffixes.

We can refer to this second analysis as the 'conjugation alternative'. It denies that the pre-Polynesian consonant deletion rule is still present in Maori — the rule has no conceivable role to play under this analysis, since there are no morpheme final consonants at all. Assuming that the rule did exist in a language ancestral to Maori, the conjugation alternative makes sense synchronically only if, at some later point in the ancestry of Maori, the passives and gerundives underwent a reanalysis in which the erstwhile stem-final consonants were assigned to the suffix rather than to the stem.

Of the two alternatives, the phonological one is, without question, the more elegant. Moreover, on the basis of its relatively greater elegance, the phonological alternative is certainly the one which would be favored by a linguist studying the Maori data. It is important, however, to hesitate somewhat and ask whether this is the correct decision. What exactly is the basis on which the phonological alternative is preferred? It is tempting to say that the basis of choice is simplicity, that the phonological alternative is simpler than the conjugation alternative. In other words, the relative elegance of one alternative over the other is a function of their relative simplicity. If this were in fact so, then the choice would be justified. It is questionable, however, whether these alternatives can be compared in terms of simplicity — one analysis posits abstract phonological markers (final consonants), at the expense of the generalization that all Maori morphemes end in vowels; the other analysis posits abstract diacritic features (conjugations), at the expense of the simple and purely phonological rules which spell suffixal alternants. I know of no a priori principle which will evaluate these alternative hypotheses. In order to pick the phonological alternative in cases like this one, we are, in the end, forced to entertain the claim that a purely phonological solution is always superior to one which uses diacritic features. And this is precisely the claim that requires examination.

It is appropriate to look at the phonological alternative in terms of the effect which its rule — i.e. consonant deletion — has on forms in the language. Let us assume that it is correct to say that the deletion rule was in fact added to the grammar of a language ancestral to Maori. Prior to that, certain words ended in consonants and, presumably, the passive and gerundive suffixes were attached to consonant-final verbs in much the way we suggest in the phonological alternative. But consider the surface forms of sentences subsequent to the time at which the rule deleting word-final consonants was added to the grammar. In these, no words end in consonants. Further-

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20 Kiparsky (1968b) has questioned this claim in connection with a somewhat different type of data, i.e. cases in which a purely phonological solution is maintained by positing totally abstract phonological distinctions which never appear in the phonetic representations of linguistic forms.
more, stems which do not combine with the passive and gerundive suffixes never appear in environments which would lead one to suspect that they have an underlying consonant-final form. These are the sentences which constitute the data on the basis of which the learning generations subsequent to the addition of the rule must construct a grammar of their language. The overwhelming fact about surface canonical forms confronting the learner is that there are no word-final consonants. In fact, this surface fact is even more general for modern Polynesian languages like Maori — there are no syllable-final consonants; all syllables end in a vowel. This is so even in passive and gerundive forms — the consonants which appear in them are associated syllabically with the ending rather than with the preceding stem. It does not seem at all unreasonable to suppose that this fact of surface phonology could play a role in determining the theory of Maori passives and gerundives developed by members of the learning generations. A reinterpretation of the passives and gerundives according to which the morpheme boundary precedes rather than follows the erstwhile stem-final consonant yields an analysis which is consistent with the prevailing fact of Maori phonotactics. Under such a reanalysis, all Maori stems conform to the prevailing pattern, in their most abstract phonological representations as well as on the surface.

The evidence for a reanalysis of this type for Maori, and for other Polynesian languages as well, is rather convincing. An effect of the reanalysis is the proliferation of suffixal alternants — i.e. since the consonants are now assigned to the suffix, there is an alternant for each of them (thus, the passive has alternants /-tia/, /-kia/, /-nia/, and so on). It is expected, as a consequence of this circumstance, that there would be a tendency to regularize the alternations, to identify one of the alternants as, so to speak, the regular one. This expectation is fulfilled in Maori, evidently — the alternant /-tia/ is now regarded as the regular passive ending, for example, as evidenced by a number of observations: (1) Stems which are basically nominal are often used verbally in spontaneous discourse; when they are so used, in the passive, they regularly take the ending /-tia/. (2) Derived causatives (formed with the prefix /whaka-/) take /-tia/ in the passive even if the basic verb stem takes another alternant when not in the causative. (3) There is a rule whereby certain adverbials are made to agree in voice with the verbs they modify; these adverbials take /-tia/ in the passive regardless of the shape of the passive ending which the verb itself takes. (4) Borrowings from English, including unassimilated consonant-final ones, take the ending /-tia/ in the passive. (5) Compound verbs derived by incorporating a noun from an adverbial phrase regularly form their passives in /-tia/. (6) In general, /-tia/ can be used when the conventional passive termination for a given verb is not remembered. These facts are entirely consistent with the suggested reanalysis. Only with difficulty can they be made consistent with the phonological alternative in the synchronic description of Maori. The situation is similar in other Polynesian languages — the extreme case of regularization.

21 Maori grammars have normally assumed it, including grammars written by native speakers of Maori — cf. Hohepa 1967. And for further discussion, see Hale 1968b and Caplan 1970.
is exemplified by Hawaiian, which now has a single passive ending /-ia/ (from *-kia, presumably).

If Maori has undergone a reanalysis of its passive and gerundive forms, as the evidence seems to suggest, then the phonological alternative is in doubt as an appropriate linguistic description of the Maori facts. This raises an interesting problem for the grammarian. Suppose there were no evidence whatsoever for reanalysis — i.e. suppose there were no evidence suggesting that any passive or gerundive form is analyzed in such a way that the consonant in question here is assigned to the suffix rather than to the stem. Other things being equal, would it then be correct to pick the phonological alternative over the conjugation alternative? This is a rather serious question, since it bears directly on the problem of abstractness in phonological representations. Certainly, our practice in the linguistic study of phonology has been to choose a phonological alternative where possible, and we have been, to some extent at least, careful to distinguish circumstances in which a phonological alternative is possible from circumstances in which a phonological alternative is not possible. In general, tacitly if not always explicitly, we have disallowed the postulation of totally abstract phonological segments. The special interest of the Maori case resides precisely in the fact that the phonological alternative is possible under this convention. The stem-final consonants which it postulates are abstract only in the sense that they never appear stem-finally if the stem is followed by word boundary; as phonological segments they are not abstract at all; the postulated final consonants are exactly the ones which actually appear on the surface in passive and gerundive verb forms.

Suppose we state an explicit convention of the following type for the choice among alternative phonological analyses:

Where there is no evidence to the contrary, if a phonological alternative is possible (i.e. does not require the use of totally abstract phonological segments), it is to be preferred over an alternative which requires the use of diacritic features.

In Maori, the phonological alternative requires an underlying representation of certain stems which is in conflict with the prevailing surface phonotactic structure. The fact that, independent of this, Maori does provide evidence which conflicts with the phonological alternative suggests that some special influence has been at work in determining the form of Maori grammar in this particular area. If this is so, it is almost certain in this case that the influencing factor has been the surface phonotactic

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31 Kiparsky has attempted to make this explicit by requiring that non-alternating forms be entered in the lexicon in 'roughly their autonomous phonemic representation' (Kiparsky 1968b:13). For an opposing view, see Brame 1969.

32 An exception to this is the postulation of a stem final /p/ (or perhaps /w/), which is deleted in all forms, to account for passives like /nohoaia/ (\(<\)/nohop + /ia/). A final consonant is postulated for /nohoaia/ in order to account for the fact that the passive appears as /ia/ rather than /a/ — the latter would be expected if the stem /noho/ ended in a vowel in its underlying representation.
structure of linguistic forms. It is tempting to try to relate this to linguistic theory by imposing a constraint on grammars to the effect that

an underlying phonological representation of stems is disallowed if it violates a universal (i.e. exceptionless within the language) surface canonical pattern.

This would preclude the phonological alternative for Maori, since stem-final consonants conflict with the universal surface fact of Maori sentences that no syllable ends in a consonant. This constraint would doubtless operate correctly in a large number of cases. I feel, however, that it would be incorrect at this time to attempt to state such a constraint. A host of counter-examples come to mind immediately. Furthermore, the notion 'surface canonical pattern' is hopelessly imprecise. It cannot be equated with 'systematic phonetic representation', for example, since late phonetic rules quite typically modify sequences to an extent which removes them a great distance from their underlying representations — in fact, one would presumably want the constraint to apply in the Maori case even if Maori had a late phonetic rule, which deleted vowels and thereby gave rise to syllable-final consonants. The surface canonical pattern must, therefore, appear in phonological derivations at some point prior to the late phonetic rules — but where that point is, if it exists at all, is not known. Even if it were possible to formulate the principle in a precise manner, it is questionable whether it could really be a constraint on grammars. As a constraint on grammars, it would imply, for example, that the phonological alternative is impossible in cases like the Maori one.

I frankly do not think that such a claim is testable in any meaningful sense. We are reasonably certain that some Maori passives are analyzed as having a suffix /-tia/, with /t/ assigned to the suffix rather than to the stem — i.e. we are relatively certain that some reanalysis has taken place. This does not, however, eliminate the possibility that the phonological treatment is still in force to some extent in Maori grammar. It is conceivable, for example, that Maori verbs fall in two classes, strong and weak; under this proposal, the weak verbs (all of which end in vowels, with the exception of certain unassimilated borrowings) form their passives in what is now the 'regular' manner (i.e. by adding the suffix /-tia/), while the strong verbs form their passives according to the phonological analysis outlined earlier (i.e. those ending in consonants take /-ia/, while those ending in vowels take /-a/). 24

If the prohibition against underlying phonological representations which violate surface canonical patterns is inappropriate as a constraint on grammars, it nonetheless contains an element of reality in it. I would like to suggest that it is, in fact, the principle which is responsible for the predominant tendency observed in the development of passives and gerundives in Maori. The principle might be stated in relation to the process of language acquisition, in very roughly the following way:

24 This alternative was suggested to me by Hu Matthews.
There is a tendency in the acquisition of a language for linguistic forms to be analyzed in a way which minimizes the necessity to postulate underlying phonological representations of morphemes which violate the universal surface canonical patterns of the language.

The imprecision of the notion 'surface canonical pattern' is continued in this statement, but I see no way of avoiding it altogether. The notion is at least intuitively clear in the example at hand — I am referring to the phonological representation of Maori in which it is universally the case that all syllables are open syllables; this is almost certainly a level of phonological representation to which late rules, effecting minor phonetic adjustments, apply. And I intend to imply that the prevailing canonical structure at that representation is of some systematic importance in Maori grammar.

If there is a tendency, such as the one I have described, for the surface canonical pattern of a language to limit the ways in which linguistic forms are analyzed in the course of acquisition, then there are associated with this tendency certain rather clear implications for the study of language change. The addition of a rule to the grammar of a language may result in a change which is far more extensive than the mere rule-addition itself. In other words, the rule may have an effect on the sentences of the language which influences the learning generation to construct a grammar which is quite different from that of the speakers responsible for the innovation. In the Maori case, the assumed addition of the rule deleting word-final consonants had an effect on the canonical pattern of all Maori sentences. If we could conceive of the addition of the rule as taking place at some particular point in time, presumably in the speech of mature users of the language, then the grammar of the speakers who added the rule would be one for which the phonological alternative is the correct one. The sentences which they spoke, however, would exhibit a canonical pattern suggesting a rather different state of affairs — a grammar which recognized no final consonants and, therefore, no rule deleting them. It is unlikely, of course, that the change occurred in exactly this manner — it is more likely that the rule was optional at first, its application becoming more and more favored until, ultimately, the learning generations simply ignored the cases where the rule failed to apply and thereby revealed an underlying morpheme structure in conflict with the canonical pattern which prevailed on the surface. Nonetheless, the artificial conception of the change is not particularly devoid of usefulness. The point is, at different times in the historical development of the Polynesian languages, the surface phonotactic structures differed — at some early point, final consonants were possible; at a later time they were not. In any event, what is ultimately of importance to us is an understanding of the modern question — what kind of phonology does the Maori speaker acquire when he learns his language? There is some evidence that, with respect to the passive and gerundive verb forms, he acquires a grammar which is more consistent with the conjugation alternative than with the phonological alternative. If this is a fact, then it is of considerable importance for phonological theory that the fact be explained. I have attempted an explanation in terms of a tendency in language acquisition.
Whatever the outcome of the Maori problem, it is clear that there are two alternatives — and if the evidence goes against the otherwise highly suggestive phonological analysis, there is a conceivable explanation. I will turn now to a somewhat more complicated, though similar, problem in the Australian language Lardil, spoken on Mornington Island in the Gulf of Carpentaria. Here, what corresponds to the conjugation alternative for Maori is virtually ruled out by a wealth of evidence supporting a grammar in which a purely phonological analysis is in full force. Despite this fact, there is some evidence indicating that a surface canonical pattern has influenced a reanalysis of certain endings. The forms which will concern us in this example are inflected nouns (and adjectives, which, so far as this problem is concerned, behave identically).

In Lardil, the object of a non-imperative verb is inflected for accusative case and, simultaneously, for tense (in agreement with the tense of the verb). The subject of a sentence, and the object of an imperative, are uninflected (as is the citation form). Thus, for example, the noun which appears in its uninflected form as /mela/ ‘sea’ has accusative forms /mela-n/ ‘nonfuture’ and /mela-ŋ/ ‘future’. Lardil nouns are capable of taking other endings besides these, but the nonfuture and future inflections will suffice for the purposes of the present discussion. Other nouns which inflect like /mela/ ‘sea’ are given in the following chart:

<table>
<thead>
<tr>
<th>uninflected</th>
<th>nonfuture</th>
<th>future</th>
</tr>
</thead>
<tbody>
<tr>
<td>parŋa</td>
<td>parŋa-ŋ</td>
<td>parŋa-ŋ ‘stone’</td>
</tr>
<tr>
<td>kela</td>
<td>kela-n</td>
<td>kela-ŋ ‘beach’</td>
</tr>
<tr>
<td>wanka</td>
<td>wanka-n</td>
<td>wanka-ŋ ‘arm’</td>
</tr>
<tr>
<td>kuŋka</td>
<td>kuŋka-n</td>
<td>kuŋka-ŋ ‘groin’</td>
</tr>
<tr>
<td>ūŋka</td>
<td>ūŋka-n</td>
<td>ūŋka-ŋ ‘barracuda’</td>
</tr>
</tbody>
</table>

The nonfuture and future endings in these forms are, quite obviously, /-ŋ/ and /-ŋ/, respectively; and they are suffixed directly to a form of the stem which exactly matches the uninflected noun. A slightly different circumstance is seen in the following:

Lardil consonants are as in Walbiri, except (1) lamino-dental obstruent [t ~ ʈ] and nasal [ŋ] are distinguished — I represent these as /th/ and /nh/, respectively, in the orthography used in the text; and (2) there is a single lateral phoneme /l/, though the retroflexed (apico-dental) glide /r/ has a lateral allophone [ɾ] which, for some speakers, predominates over the glide allophone — in fact, for most speakers, /r/ is consistently [ɾ] in initial position, as in /ɾtil/ /ɾtii/ ‘Lardil’. The Lardil vowel system has four vowels:

<table>
<thead>
<tr>
<th>high</th>
<th>front</th>
<th>back</th>
</tr>
</thead>
<tbody>
<tr>
<td>e</td>
<td>i</td>
<td>u</td>
</tr>
<tr>
<td>low</td>
<td></td>
<td>a</td>
</tr>
</tbody>
</table>