

## THE PROBLEM OF PSYCHOLOGICAL REALITY IN THE PHONOLOGY OF PAPAGO

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This paper amounts to a clarification, for my own benefit more than anything else, of a certain linguistic principle involved in the evaluation of grammars. The principle, termed recoverability, is due to Jonathan Kaye (1975), and my conclusion about its nature and role in choosing among competing analyses is strongly influenced by a recent paper of Morris Halle's (1978). In examining the recoverability principle, I draw a comparison between two cases of alternative analyses - namely, the familiar problem of the Polynesian passive morphology, and a superficially similar problem in the phonology of Papago. In the course of the discussion, I will attempt to correct an error of reasoning which I made in an earlier treatment of the Polynesian case (Hale, 1973).

I begin with the Polynesian passive, using Maori to exemplify the classic situation. Some passives appear simply to involve straightforward suffixation of a vowel /-a/ - e.g., /patua/ beside active /patu/, /kitea/ beside /kite/, and so on. The majority, however, show a consonant between the root and a vocalic termination /-ia/ - e.g., /awhitia/ beside /awhi/, /hopukia/ beside /hopu/, /werohia/ beside /wero/, /inumia/ beside /inu/, etc. The consonant in these passives cannot be predicted from the surface form of the uninflected, or active, verb. There are at least two ways to analyze the consonantal passives. The 'phonological' analysis assigns the consonant to the stem, and the passive is formed by suffixing /-ia/ thereto. In addition, there is a rule deleting word-final consonants, thereby accounting for the fact that uninflected verbs, like all words in Maori, end in vowels. Thus, underlying /inum/ appears as [inu] if uninflected, but the deletion does not apply before the passive suffix, hence [inumia]. The 'morphological' analysis, by contrast, assigns the consonant to the suffix, thereby proliferating suffixal alternants (/ -tia, -kia, -hia, -mia.../), and each verb is assigned to a 'conjugation' according to the passive allomorph it selects. The assignment of the final consonant to forms like /inum/ is historically correct, and the deletion of these consonants in word-final position is a fact of the linguistic tradition leading to Polynesian. Nevertheless, I have attempted to argue (Hale, 1973) that the ahistorical morphological analysis is correct synchronically. If so, then what linguistic principle

dictates it? What motivated the change from the (historical) phonological analysis to the (ahistorical) morphological analysis? I suggested that the motivating factor was the canonical disparity, present in the phonological analysis, between the underlying morpheme structure of lexical items (allowing final consonants) and the surface syllabic canon of Polynesian (forbidding final consonants). The change to the morphological analysis eliminated this disparity.

Kaye has suggested another explanation. He defines a principle of 'phonological recoverability': "Recoverability concerns the degree of ambiguity manifested by a given surface form. The fewer the number of potential sources for the form, the greater its recoverability" (Kaye, 1975, 244-45). Phonological recoverability is valued in grammar, while 'phonological ambiguity', its converse, is devalued. Notice that the change in Polynesian completely eliminates phonological ambiguity - under the morphological analysis, the underlying form of a verb root is entirely recoverable from its surface form. Kaye proposes that phonological recoverability is the deciding factor in the Polynesian case.

This is a very promising suggestion. However, there is somewhat more texture to the problem which should be brought out in order to characterize the linguistic nature of the recoverability principle. As Halle (1978) points out, the Polynesian change did not really eliminate ambiguity. Rather, it shifted the ambiguity entirely to the morphology. The relation between uninflected and inflected forms remains ambiguous, since the derived form (the passive) is not predictable from the surface form of the active. Let us refer to this relation as 'morphological ambiguity' and to the converse relation as 'morphological recoverability'.

While phonological recoverability is logically distinct from morphological recoverability, it is not at all clear that the two principles are linguistically distinct. At least, I know of no convincing case in which phonological recoverability can be said to function autonomously in the evaluation of grammars. If the Polynesian change had consisted solely in the restructuring (i.e., in the realignment of the historic stem-final consonants onto the suffix), it would be possible, in principle, to argue that the change was motivated by phonological, rather than morphological, recoverability - since the former, but not the latter, would have been achieved. But the facts are different. The bulk of the evi-

dence which I adduced in favor of the morphological analysis consisted in observations to the effect that the conjugation system, assumed to have arisen through the restructuring of passive forms, was being regularized - a process which is complete in some Polynesian languages (e.g., Hawaiian, Tahitian) and merely well advanced in others (e.g., Maori, Samoan). I reasoned incorrectly that regularization implied restructuring. Surely regularization - i.e., the reduction of morphological ambiguity - could take place without restructuring. The evidence, therefore, does not directly support restructuring. Rather, it supports the view that recoverability is a genuine principle in the evaluation of grammars - assuming, as is reasonable, that change toward greater recoverability is in fact progressive. We cannot, on the basis of this evidence, at least, isolate phonological recoverability as linguistically distinct from morphological recoverability.

What, then, is left of the argument that the morphological analysis is correct in the case of the Polynesian passive? Before attempting to answer this question, let me introduce the Papago case (simplified in nonessential ways for the sake of space).

The points of interest can be illustrated by the third person singular possessed forms. These involve mere suffixation of [-j] to roots whose surface forms end in vowels - e.g., [mo'o<sup>j</sup>] from [mo'o], [bahi<sup>j</sup>] from [bahi], [gooki<sup>j</sup>] from [gooki]. But when the root ends in a consonant in surface form, the suffix brings a vowel into view - e.g., [ñimaj] from [ñim], [hikaj] from [hik], [toonaj] from [toon], [ciñij] from [ciñ], [huuci<sup>j</sup>] from [huuc], etc. Relevant historical events in the Piman tradition leading to Papago are the introduction of a palatalization rule, raising \*/t, d, n/ to [c, j, ñ] before high vowels, and the development of processes effecting the reduction or deletion of unstressed short vowels in certain environments - e.g., word-finally. Final short back vowels were deleted following any true consonant (i.e., nonlaryngeal), and final short \*i was deleted following coronals. While there is evidence that deletion was chronologically prior to palatalization, modern forms show the more natural nonbleeding order to have developed at some stage (e.g., [huuñ] from \*huunu). Since any of the five vowels of Piman (\*i, i, u, o, a/) could occur finally, deletion gave rise to ambiguity. This ambiguity is still present in the closely related Pima of Ónavas (in Sonora), where deletion

(but not palatalization) also exists - thus, for example, in Ónavas Pima, [hik] (from \*hiku) has the third singular possessed form [hikud], while [naak] (from \*naaka) has [naakad]. In Papago, however, the ambiguity has been entirely eliminated (in nouns, at least) through vocalic mergers. The deleting vowels merged as follows: (1) high vowels merged to /i/ following coronals; (2) back vowels not effected by (1) above merged to /a/. These mergers result in the circumstance that the vowel appearing in the suffixed form is recoverable from the quality of the surface final consonant in the uninflected base - if the consonant is a high coronal, the vowel is [i]; otherwise, the vowel is [a]. Thus, [hik] and [naak], ambiguous in Ónavas Pima, are recoverable in Papago.

Clearly, the elimination of ambiguity here is independent of any reanalysis of inflected forms which would associate the vowel with the suffix, rather than the stem, in forms like [hikaj] and [huuci<sup>j</sup>] - the vocalic mergers in no way imply such a restructuring. It is entirely consistent with the facts to assume that modern Papago simply continues synchronically the historic deletion and palatalization rules (in nonbleeding order) and that the only restructuring consists in the vocalic mergers. While a restructuring to the morphological analysis would have achieved instantaneous phonological recoverability (in this area of Papago phonology, at least), there is no evidence suggesting that the change actually happened. Morphological ambiguity is the same under either analysis - namely, zero ambiguity.

Now let us consider the Polynesian and Papago cases together. What arguments can be constructed to choose an analysis in each instance? I think that the outcome will differ in the two cases, and, moreover, that the issue will turn on 'internal' arguments (cf. Kenstowicz, 1978) of a rather traditional sort.

I will assume, since I have no evidence to the contrary, that phonological recoverability is not distinct from morphological recoverability. Instead, there is a unitary principle of (morpho-phonological) recoverability according to which the value of a grammar increases as the amount of ambiguity (in relating base and derived forms) decreases.

In the Polynesian case, the phonological and morphological analyses are equal in terms of recoverability. This equality might be formalized, for example, by designing an evaluation metric

according to which the diacritic use of a phonological segment has the same cost as does an allomorph whose distribution is not predictable from surface phonology. Clearly, then, recoverability cannot be used to decide the issue here. From this fresh starting point, we see that there is no additional cost whatsoever associated with the morphological analysis. But there is an additional cost associated with the phonological analysis - namely, the deletion rule and, assuming it to be an extra cost, the canonical disparity between underlying morpheme structure and the Polynesian syllabic canon. Given these considerations, it seems to me that the rational choice here is the morphological analysis.

In the Papago case, likewise, recoverability fails to decide the issue. Here, however, there is nothing to recommend the morphological analysis. Its choice would not eliminate the necessity for the deletion and palatalization rules, since these are independently motivated - the morphological process of perfective truncation, among other processes, exposes medial vowels to the effect of the deletion rule, and a well motivated prevocalic vowel deletion rule exposes coronals to the palatalizing effect of suffix-initial /i/. Moreover, under the morphological analysis, we must distinguish at least two types of suffixes - one having a single alternant, continuing original Piman vowel-initial (e.g., the causative-benefactive formative [-id], from \*-ida), and another, continuing original consonant-initials and exhibiting synchronically three underlying forms distributed in accordance with an allomorphy rule (e.g., the modern forms deriving from Piman \*-di, [-j] after vowels, [-ij] after high coronals, [-aj] elsewhere). This second type of suffix, and the allomorphy rule associated with it, are entirely a product of the morphological analysis. There is no comparable cost associated with the phonological analysis. It does not, as it would in the Polynesian case, involve a canonical disparity, since underlying morpheme structure in the phonological analysis of Papago simply corresponds to the least marked of the rich variety of syllabic patterns admitted by the Papago canon. All things considered, the phonological solution here costs no more than what is necessary in a descriptive adequate account - it is, therefore, the rational choice in this instance.

I conclude from this discussion that recoverability is a genuine principle in the evaluation of grammars. Properly construed,

however, it enters into linguistic argumentation in much the same way as do traditional cost-accounting arguments which evaluate competing analyses in terms of relative parsimony. If this is correct, then it is not surprising that recoverability may fail to decide between alternative solutions - the alternatives may, as in the two cases examined here, be equal in terms of recoverability. Beyond recoverability, there are other principles which are relevant to the evaluation of grammars, including parsimony. I very much doubt that any of these principles can be said to carry greater psychological weight than others, i.e., to be more 'real' psychologically. Our task as students of language, it seems to me, is to determine which principles are justifiable linguistically - those principles will also be justifiable psychologically, given the subject matter of linguistic science. Of course, it is legitimate in making this determination to use evidence of all sorts, and some may prove to be more helpful than others.

#### References

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