Greek Variables and the Sanskrit ruki Class

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1. According to a well-known rule of Sanskrit internal sandhi, s is replaced by its retroflex counterpart, ṣ, when immediately preceded by r, u, k, or i (or one of their alternants, such as o or e or the syllabic liquid ṛ).[1] Thus, compare the following two sets of nominal forms containing the locative plural ending -su:

(1) jāsu (jā- 'progeny')
marutsu (marut- 'wind')
apsu (ap- 'water')

(2) svasṛṣu (svasṛ- 'sister')
śatruṣu (śatru- 'enemy')
vākṣu (vāc- 'voice')
agniṣu (agni- 'fire')

and compare the following two sets of verbal roots:

(3) vas- 'clothe'
bhās- 'shine'
tsar- 'creep up on'
psā- 'devour'
bharts- 'revile'

(4) dhṛṣ- 'dare'
bhūṣ- 'adorn'
akṣ- 'attain'

dviṣ- 'hate'

kṣudh- 'crush' .

Within the framework of generative phonology prior to Chomsky and Halle (1968) the class of segments conditioning the retroflexion is the class of $\begin{bmatrix}\alpha\text{consonantal}\\ \alpha\text{compact}\end{bmatrix}$ segments--that is, those which are $\begin{bmatrix}+\text{consonantal}\\ +\text{compact}\end{bmatrix}$ (the liquids r and l, of which only r occurs before s, plus all the palatal and velar consonants, all of which are realized as k before s) together with those which are $\begin{bmatrix}-\text{consonantal}\\ -\text{compact}\end{bmatrix}$ (the glides y and w, which appear before s as alternants of i and u, respectively, plus all vowels except a and ā).

This formulation, given slightly differently in Zwicky (1964), but as above in Zwicky (1965), was one of the earliest instances of the extension of the use of variables over feature values from their original domain of justification, rules of assimilation and dissimilation, to the specification of classes of segments mentioned in rules. In fact, such use of variables has been quite limited, the only common instances in the literature being the classes $\begin{bmatrix}\alpha\text{consonantal}\\ \alpha\text{vocalic}\end{bmatrix}$ (liquids and glides as opposed to true consonants and vowels) and $\begin{bmatrix}\alpha\text{back}\\ \alpha\text{round}\end{bmatrix}$ (rounded back vowels and unrounded front vowels), and their complements $\begin{bmatrix}\alpha\text{consonantal}\\ -\alpha\text{vocalic}\end{bmatrix}$ and $\begin{bmatrix}\alpha\text{back}\\ -\alpha\text{round}\end{bmatrix}$. An extensive, although not exhaustive, survey of published generative phonological descriptions (containing many hundreds of rules) revealed only six additional cases of variables employed to specify classes: two instances in which variables class some consonants together with one liquid, three in which variables distinguish a subclass of vowels, and one

in which they delimit a group of consonants.[2]

The first example is a Turkish gravity harmony rule, discussed by Lees (1967), which creates the "palatal-velar" alternations k-g, g-ɣ, and l-ʎ. As Lees formulates this rule, it assimilates the

gravity of a $\begin{bmatrix} +\text{consonantal} \\ +\text{compact} \\ \alpha\text{vocalic} \\ \alpha\text{continuant} \end{bmatrix}$ segment to the gravity of a preceding

segment of the same type. The intent of the specification is to group together the back stops k g with the liquid l while excluding the liquid r from the alternation (note that Lees treats l as continuant in contrast to r).

The second example is a German ablaut rule, formulated by Ross (1967: 59f., 70, 90f.), which says that an irregular verb stem with vowel a or ä has the vowel ɪ in the past tense if the segment following the vowel is $\begin{bmatrix} +\text{consonantal} \\ -\text{grave} \\ -\text{compact} \\ \alpha\text{continuant} \\ \alpha\text{strident} \end{bmatrix}$; if any other segment follows the

vowel, the past tense vowel is ʊ. The notation is designed to contrast the dental obstruents t, d, n, s, and z, together with l, to the remaining obstruents plus r (note that Ross treats l as a noncontinuant). The class in question could equally well be specified as

$\begin{bmatrix} +\text{consonantal} \\ -\text{grave} \\ -\text{compact} \\ \begin{Bmatrix} -\text{continuant} \\ +\text{strident} \end{Bmatrix} \end{bmatrix}$, using a disjunction instead of variables. Moreover, the ablaut rule is a minor one affecting only 18 verbs, two of which (laden and schlafen) constitute exceptions in Ross' treatment.

The first vowel case is a Nez Perce vowel harmony rule according to which all the vowels in a word are chosen from the ("dominant") set i a o if any morpheme in the word has vowels from this set; otherwise, the vowels are chosen from the ("recessive") set i æ u. In the formulation of Aoki (1966: 765) the rule affects the recessive vowels æ u, which are specified as $\begin{bmatrix} \alpha\text{diffuse} \\ \alpha\text{grave} \end{bmatrix}$ --high back u and nonhigh front æ. The second vowel example appears in Harms' reformulation of Sapir's Southern Paiute rules. The rule in question is one in which š occurring between i æ and i o is realized as s. The environment class i o is specified as $\begin{bmatrix} -\text{consonantal} \\ +\text{vocalic} \\ \alpha\text{grave} \\ \alpha\text{compact} \end{bmatrix}$ so that its members can be distinguished from the $\begin{bmatrix} +\text{grave} \\ -\text{compact} \end{bmatrix}$ vowels i and u and the $\begin{bmatrix} -\text{grave} \\ +\text{compact} \end{bmatrix}$ vowel æ. The final vowel example concerns the class of $\begin{bmatrix} \alpha\text{round} \\ -\alpha\text{low} \end{bmatrix}$ vowels in Finnish, which figure in a vowel harmony rule formulated by Rardin (1969: 230). The vowels under discussion are "harmonic" a o u ä ö ü, as opposed to "neutral" i and e, and can be specified as easily with the disjunction $\left[\begin{Bmatrix} +\text{round} \\ +\text{low} \end{Bmatrix} \right]$ as with variables.

The remaining case is a rule deleting certain instances of intervocalic g and d (but not b) in Spanish (Harris 1969:140, 145). According to Harris, the rule affects segments marked $\begin{bmatrix} +\text{obstruent} \\ -\text{tense} \\ \alpha\text{coronal} \\ \alpha\text{anterior} \end{bmatrix}$. But inasmuch as the rule is merely intended to exclude b, the disjunction $\left[\begin{Bmatrix} +\text{coronal} \\ -\text{anterior} \end{Bmatrix} \right]$ would serve as well as

the version with variables. As in the German and Finnish cases already mentioned, if only three of the four possible combinations of values for two independent features happen to occur, then the use of variables is dispensable in favor of a disjunction. Thus, the class of underlying vowels that can occur before final n in English--specified as $\left[\begin{Bmatrix} +\text{diffuse} \\ +\text{compact} \end{Bmatrix} \right]$ by Chomsky and Halle (1965: 124)--could have been formulated, with variables, as $\begin{bmatrix} \alpha\text{diffuse} \\ -\alpha\text{compact} \end{bmatrix}$, thanks to the absence of vowels having the specifications $\begin{bmatrix} +\text{diffuse} \\ +\text{compact} \end{bmatrix}$.

Quite aside from the question of whether or not any one of the descriptions cited is correct, it is remarkable that they, and the more typical occurrences of variables in specifications, utilize only a few sorts of feature combinations. Briefly, it appears that variables used to specify classes must relate features of the same type--either two cavity features (back and round, grave and compact, round and low, diffuse and grave, coronal and anterior, or diffuse and compact) or two manner features (vocalic and consonantal, vocalic and continuant, or continuant and strident). The Sanskrit ruki class, however, is specified by variables relating a cavity feature, compact, and a manner feature, consonantal. In general, such uses of variables yield classes that are highly unnatural, for example, the $\begin{bmatrix} \alpha\text{consonantal} \\ \alpha\text{round} \end{bmatrix}$ segments, i.e. the class consisting of labialized consonants and unrounded vowels.

2. Is, then, the Sanskrit ruki class a natural one? In fact, is the Sanskrit s-retroflexion a single process, or is it two (or more) processes unified only by virtue of their effects?

The general problem of determining the unity of phonological

processes has been approached by a few recent investigators. As Kiparsky (1968) has noted, the fact that two rules can be ordered adjacent to each other and share some formal features cannot be taken as evidence that they should be combined by existing abbreviatory conventions and treated as subrules of a single rule: this cannot be so because virtually any two phonological rules, however unrelated their nature or effect, have sufficient formal similarity to be consolidated by the notational conventions of Chomsky and Halle (1968). Kiparsky suggests that some evidence as to the unity of rules can be obtained from diachronic changes in them.

Chomsky and Halle approach the problem of rule unity tangentially in a discussion of subrules and exceptions (1968: 175f.). They consider the possibility of requiring that any item which is an exception to one subrule of a rule be an exception to every relevant subrule of that rule, but conclude, with reservations, that the exceptionality of a lexical item must be marked with respect to each subrule. The facts are by no means clear, but it does seem that normally one can expect a lexical item to be exceptional with respect to all applicable subrules of a rule, or to none, so that the exceptionality of an item to several processes can be taken (ceteris paribus) as supporting evidence for the unity of these processes in a single rule.

Analogously, one expects (again ceteris paribus) that exceptions to a rule will be distributed essentially evenly among (mutually exclusive) subrules of that rule, so that if one putative subrule is nearly or entirely exceptionless while other subrules have the usual assortment of exceptions (or vice versa), the unity of the former with

the latter is suspect. Exactly this situation obtains in the case of the Sanskrit s-retroflexion rule, which has no exceptions when the conditioning segment is k, but has numerous exceptions when the conditioning segment is r, u, or i.

Some of the exceptions fall under various subregularities in the retroflexion rule--for instance, retroflexion does not occur when the s is followed by an r (thus, us-ra- 'daybreak', from vas- 'burn', instead of the expected *usra-). Other exceptions are entirely idiosyncratic;[3] for example:

(5) bṛsT- 'seat of an ascetic'
busa- 'vapor'
kusuma- 'flower'
bisa- 'lotus root'

The fact that there are no exceptions, partially regular or idiosyncratic, to the retroflexion after k, although there are many after r, u, and i, lends some support to the hypothesis that the two processes are different rules, not subrules of the same rule (even though no facts are known which would prevent them from being ordered adjacent to each other).[4]

A final remark: in the revised feature system of Chomsky and Halle (1968), the ruki class can be specified, without the use of variables, as $\begin{bmatrix} -\text{anterior} \\ -\text{low} \end{bmatrix}$. If, however, the ruki class is not a natural one, then the ability to specify it so simply (with two features, the same number required to specify the class of all vowels) must count as a defect, not an advantage, of this system of notation.[5]

Footnotes

[1]See the standard discussions in Whitney (1960: 61-64) and Renou (1961: 12-16).

[2]Two additional cases were uncovered by this survey--one (Wang 1968:703f.) which is eliminated by the writer's own reanalysis, and another (Smith 1969: 441) which appears to be an error.

[3]Macdonell (1916: 45) observes that "words in which s otherwise follows r or any vowel but ā must be of foreign origin."

[4]I am aware of the fact that rules very similar to the Sanskrit s-retroflexion rule applied historically in Slavic and Iranian. But as I am not familiar with the details of these processes I shall do no more than mention them in connection with the Sanskrit phenomena.

[5]I am indebted to David M. Perlmutter and David L. Stampe for their comments about the content and organization of this note.

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