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Author(s): James E. Hoard

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On Incorporating Grassmann's Law Into Sanskrit Phonology

James E. Hoard

University of Oregon

1. Within the generative phonological framework a number of proposals have been advanced to incorporate Grassmann's Law into Sanskrit phonology in a natural way. The proposals of Kiparsky (1965) and Zwicky (1965) have been criticized by Anderson (1970) for, among other things, a failure to characterize exceptions in a straightforward manner. Anderson's solution to the problem, which involves a scheme for local reordering of rules, has recently been criticized by Phelps and Brame (1973) who themselves reject local reordering and offer two additional solutions preserving linear rule order. However, neither of their solutions seems to me to be acceptable since both involve theoretical claims that are very questionable.

At the meeting of the Western Conference on Linguistics held at Victoria, B.C. in October, 1973, I presented a new solution to the problem which, like that of Phelps and Brame (and of Zwicky), preserved linear ordering but which used rather simple rules along the lines of Anderson and Kiparsky and took into account some of the sandhi phenomena in Sanskrit. Since the proposal given in this paper differs only in minor ways from the earlier one of 1973, I have retained the same title.

In response to the analysis that I gave at the WECOL meeting, Phelps (to appear) has abandoned the proposals given in Phelps and Brame (1973), adopts the suggestion that Sanskrit sandhi phenomena play a crucial role in the solution, and advances a new proposal which accounts for a range of data well beyond that previously considered in the recent literature. Sag (1974) has also offered a solution to this problem. I take up both of these proposals below in §7.

2. Anderson (1970) claims that local reordering of Grassmann's Law (GL) must be invoked to derive correctly Sanskrit forms which involve also Bartholomae's Law (BL) and the rule for deaspiration of consonants (DaC). Anderson follows Kiparsky in formulating GL; except for changes in feature names the rule formulations are identical. Anderson formulates GL as follows:

$$[+cons] \rightarrow [-asp] / __ [+seg]_0 \begin{bmatrix} +cons \\ +asp \\ +Root \end{bmatrix}$$

The application of GL in reduplicated forms may be seen in (first and third person singular) perfect forms of such roots as phal 'burst' and dhāv 'run/wash'. The (third person singular) present forms show the underlying aspirate initial of these roots.

root
phal
dhāv

present
phalati
dhāvati

perfect
paphala
dadhāva

Anderson formulates his rule for the deaspiration of consonants (DaC) as:

$$[+cons] \rightarrow [-asp] / \text{---} \left\{ \begin{array}{c} [+obstr] \\ \# \end{array} \right\}$$

This formulation is equivalent to both Zwicky and Kiparsky's rules for deaspiration. The application of DaC may be seen in the nominative singular and instrumental plural forms of such roots as -stubbh 'praising' and -bhudh 'waking'. The accusative singular forms show the underlying aspirate finals of these roots. The final t of bhut is due to a rule of obstruent devoicing; this devoicing rule is left out of account here as the rule does not bear on any of the arguments presented.

<u>root</u>	<u>nom. sg.</u>	<u>acc. sg.</u>	<u>instr. pl.</u>
/stubbh/	-stup	-stubbham	-stubbhis
/bhudh/	-bhut	-budham	-bhudbhis

That DaC precedes GL may be seen in various of the forms involving diaspirate roots (those roots whose underlying forms begin and end with an aspirate). The roots and endings are here separated by a hyphen. The o of bhodh is the guṇa-grade of the root.

	/bhudh/	/bhudh-am/	/bhodh-syati/	/bhudh-bhis/
DaC	bhud	_____	bhod-syati	bhud-bhis
GL		budh-am	_____	_____
phonetic	bhut	budham	bhotsyati	bhudbhis

Anderson formulates Bartholomae's Law (BL) as:

$$[-cont] \rightarrow \left[\begin{array}{c} +voi \\ +asp \end{array} \right] / \left[\begin{array}{c} +voi \\ +asp \end{array} \right] \left[\begin{array}{c} \text{---} \\ -voi \end{array} \right]$$

Except for changes in feature names, Anderson's formulation of BL is the same as Kiparsky's. For roots like ru(n)dh 'obstruct' and labh 'catch', the application of BL before suffixes like -tha (second plural active) and -ta (past participle) gives forms such as:

<u>root</u>	<u>2nd pl. active</u>	<u>past participle</u>
ru(n)dh	runddha	ruddha
labh	labdha	labdha

It is easy to see that (as Anderson has stated them) BL precedes DaC in forms such as the following:

	/rundh-tha/	/rudh-ta/	/labh-tha/	/labh-ta/
BL	rundh-dha	rudh-dha	labh-dha	labh-dha
DaC	rund-dha	rud-dha	lab-dha	lab-dha

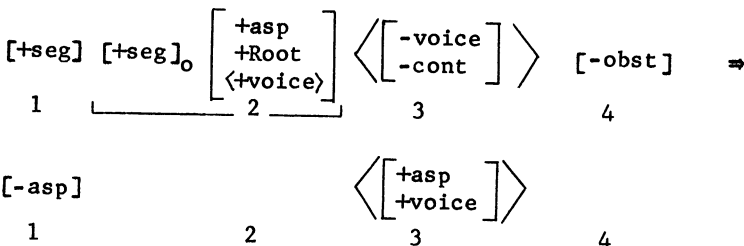
However, for those forms for which BL and GL both apply, Anderson must have GL precede DaC. Only forms which contain diaspirate roots (such as bhudh) enter into such derivations:

	/bhudh-ta/
GL	budh-ta
BL	budh-dha
DaC	bud-dha

Anderson argues that the order BL-DaC is the 'unmarked' order for the application of these rules (it is counter-bleeding) and that the order GL-BL is extrinsic. This establishes the order GL-BL-DaC when all three rules apply. When BL does not apply, however, Anderson argues that DaC-GL, despite the fact that it is a bleeding order, is the 'unmarked' order of these two rules. His reasoning is that the class of diaspirate roots would disappear altogether with the order GL-DaC, an order which would otherwise be the 'unmarked' one. According to Anderson, GL would also be lost as a phonological rule and would become merely a fact about reduplication.

3. Phelps and Brame (1973) consider Anderson's local ordering principles in some detail and conclude that Anderson's procedures for determining the order in which n rules apply to any given form result in n! possible rule sequences to examine. Moreover, each of these n! orders must be compared with the n! possible orders for every other form in the given language to see that rule loss will not be the result of particular orders. Phelps and Brame conclude that "the inclusion of rule loss in the scale of rule order markedness has questionable implications for language acquisition and language change, and ... dramatically alters the theory of local ordering in such a way as to render the theory virtually unconstrained (399)."

Phelps and Brame propose two solutions to the problem of incorporating GL into Sanskrit phonology. One of them involves combining GL with BL. GL and BL can be combined in a transformational rule GL-BL:



This gives derivations for diaspirate roots as follows:

	/bhudh-ta/	/bhudh-am/	/bhudh/	/bhudh-bhis/
GL-BL	budh+dha	budh-am	<u>bhud</u>	<u>bhud</u> -bhis.
DaC	bud+dha	—		

As Phelps and Brame admit, the putative rule 'GL and BL' makes a very questionable use of angle brackets and also raises questions about exceptions to only one expansion of a rule, since some forms undergo GL but not BL.

Phelps and Brame offer a second solution with a revised BL which not only aspirates and voices the t and th endings but assigns them to the category 'Root'. The revised rule is BL':

$$\begin{bmatrix} -\text{voice} \\ -\text{cont} \end{bmatrix} \rightarrow \begin{bmatrix} +\text{voice} \\ +\text{asp} \\ +\text{Root} \end{bmatrix} / \begin{bmatrix} +\text{voice} \\ +\text{asp} \\ +\text{Root} \end{bmatrix} \text{ — } .$$

If DaC and GL follow BL' (Phelps and Brame 'combine' DaC and GL with braces), then we have derivations such as the following:

	/bhudh-ta/	/bhudh-am/	/bhudh/	/bhudh-bhis/
BL'	bhud h d h -a	—	<u>bhud</u>	<u>bhud</u> -bhis
DaC	bhudd h -a			
GL	budd h -a	bud h -am	—	—

While BL' 'works' in the limited sense that correct forms are derived, it seems to me that BL' is totally unacceptable from a theoretical standpoint. The theoretical principle I have in mind can be stated simply: Categories are inviolable. To be able to claim that an ending or a part of one is a 'root' is an innovation that leaves phonological theory utterly incoherent since derivations and P-rules are no longer constrained by the morphological facts of a given language. If categories are inviolable, then one cannot move boundaries about and/or change morphological labels in mid-derivation. Categories and boundaries simply have to be 'natural' or there is no way whatever to relate morphology to surface phonetics in an explanatory fashion.

Incidentally, the inviolability-of-categories principle also includes the notion that distinctive feature definitions assign values to segments naturally and automatically. It follows, for example, that [p] cannot (arbitrarily) be assigned to the category [+cont]. We can, of course, change [p] to [f] by a P-rule. If so, then the feature [+cont] will be automatically assigned to the new segment [f]. Assigning [p] to the category [+cont] is no more unnatural than assigning the first segment of a suffix to the category [+Root]. In brief, the categories (however defined) of morphology and phonetics are constants so far as the phonology is concerned. The only items affected by P-rules are segments and classes of segments. Morphology and phonetics are then the bases

for the phonological theory.

4. At this point, it is perhaps well to consider how Whitney (1889) formulates equivalents to DaC, BL, and GL. On permitted final consonants, Whitney states: "141. Of the non-nasal mutes, only the first in each series, the non-aspirate surd, is allowed; the others---surd aspirate, and both sonants---whenever they would etymologically occur, are converted into this." On deaspiration, he states: "153. As aspirate mute is changed to a non-aspirate before another mute or before a sibilant..." Whitney gives Bartholomae's Law clearly: "160. If, however, a final sonant aspiration of a root is followed by...t or...th of an ending, the assimilation is in the other direction, or progressive: the combination is made sonant, and the aspiration of the final (lost according to 153, above) is transferred to the initial of the ending." Whitney recognizes Grassmann's Law as a part of reduplication: "590a. A non-aspirate is substituted in reduplication for an aspirate..."

At several places in his grammar, Whitney comments on the diaspirate roots: "155. In a few roots, when a final sonant aspirate...loses its aspiration, the initial sonant consonant becomes aspirate... 141a. In a few roots, when their final (sonant aspirate) thus loses its aspiration [by 141, JEH], the original sonant aspiration of the initial reappears... 160b. In this combination [where BL applies, JEH], as the sonant aspiration is not lost but transferred, the restoration of the initial aspiration (155) does not take place..."¹

Whitney's section 141 is a statement of external sandhi; in current terminology, we would say that only voiceless unaspirate stops occur before #. On the matter of internal versus external sandhi Whitney says: "109. The rules of combination (sandhi putting together) are in some respects different, according as they apply--- a. to the internal make-up of a word, by the addition of derivative and inflectional endings to roots and stems; b. to the more external putting together of stems to make compound stems, and yet looser and more accidental collocation of words in the sentence... 111a. Moreover, before case-endings beginning with bh and s (namely, bhyām, bhis, bhyas, su), the treatment of the finals of stems is in general the same as in the combinations of words (pada) with one another---whence those endings are sometimes called pada-endings, and the cases they form are known as pada-cases."

5. While Whitney does state the facts of the matter, we can note first that the deaspiration process he gives in section 153 is unnecessary since all cases of deaspiration are actually already accounted for in section 141. Section 141 accounts for deaspiration before external suffixes like bhis (and it is external according to Whitney, 111a). Similarly, deaspiration before external suffixes beginning with s are also accounted for by 141. In fact the only deaspiration rule that we need is the following:

Deaspiration of Consonants (DC)

[+asp] → [-asp]/___#

At first glance it seems that one cannot posit external sandhi before s suffixes because of the sandhi rule, usually considered to be internal, that retroflexes s after vowels other than a (and after k, r, l). But this sandhi rule also applies over # (as in agni#su ⇒ agnisu 'fire', loc. pl. This retroflexion rule applies, then, over either a+ or a# formative juncture (see Whitney, §§180-185) and cannot bear in any way on the formulation of a deaspiration rule.

To prevent misunderstanding about the application of rules across morphological boundaries, it should be pointed out that there are actually three different situations which obtain when two formatives are concatenated. 1) An internal + boundary separates the formatives; 2) an external # boundary separates the formatives; 3) two external sharp boundaries separate the formatives. Both 1) and 2) are intraword environments and the symbols + and # are merely a formal way of showing that formatives may be 'tightly' (+) or 'loosely' (#) concatenated. Case 3) is the interword environment and the ## notation indicates formally that an external juncture is associated with each of two concatenated formatives.

The rule that retroflexes s, as in agnisu, applies over either + or #, but not over ##. That is to say, retroflexion of s occurs over an internal or an external juncture, but not between words.

The terminology involving +, #, and ## (now fairly widespread in phonology) must be distinguished from the terminology used by Whitney and others for Sanskrit. For Whitney, both the # and the ## environments are 'external sandhi' (§109b) and he apparently does not recognize a distinction between the interword ## and the intraword # environments so far as sandhi rules are concerned.

GL can be formulated in an even more general way than that of Kiparsky and Anderson.

$$\text{Grassmann's Law (GL): } \begin{bmatrix} -\text{syll} \\ +\text{cons} \\ +\text{obst} \end{bmatrix} \rightarrow [-\text{asp}]/___\text{X} \begin{bmatrix} -\text{syll} \\ +\text{cons} \\ +\text{obst} \\ +\text{asp} \end{bmatrix}$$

The formulation given here differs from Anderson's and Kiparsky's in that [+Root] is not specified in the environment. GL is stated as in Jensen (1974:682) and the X in the environment indicates that only 'irrelevant' segments may intervene between the two aspirate obstruents. The 'irrelevant' segments according to Jensen's 'relevancy condition', are the non-obstruents. We should also note that, by convention, # is not included in X, but that + is.

Since GL is right-handed (i.e. the crucial environment is to the right of the environment bar) and GL is self-bleeding, it applies iteratively from left to right. For example, GL applies to the reduplicated perfect form /bhabhandh+a/ as follows:

GL - 1st application
GL - 2nd application

/bhabbandh+ta/
babbandh+ta
babandh+ta

The root specification given in earlier formulations of GL has been dropped because, in fact, the imperative suffix /dhi/ can be an environment for GL. A relevant example is bindhi 'cleave' (2nd sing. imp.), cited in Monier-Williams (1899:756), apparently from underlying /bhi+t+d+dhi/. The d of the root must be deleted before GL applies. If the d of the root were not deleted we would expect bhinddhi since the d of the root is excluded from X and GL would not apply. The form bhinddhi is given by Sag (1974: 599). I have, however, been unable to find a citation in any of the dictionaries at my disposal.

Another example of GL application involving this suffix is jahi, the imp. form of /ghan/ 'kill, slay' from /ghn+dhi/. The derivation apparently involves vocalization of n before a consonantal affix as well as palatalization and deaspiration (cf. ghnanti, 3rd pl. pres. indic.). The dh of dhi usually becomes h before vowels. Here the dh must not become h before GL has applied.

The form bodhi, 2nd sing. imp. of /bhudh/ is somewhat more problematical. We cannot tell by inspection whether the surface dh is the dh of the root or the dh of the imperative marker. The underlying form, with guṇa of the root, should be /bhodh+dhi/. Now it simply does not matter for present purposes whether the dh of the root or the dh of the suffix is deleted. In either event, GL will apply to deaspirate the initial consonant.

BL can be formulated in approximately the way suggested by Whitney, section 160. The second segment need not be restricted to voiceless stops. BL is an internal sandhi rule.

Bartholomae's Law (BL)

$$\begin{bmatrix} +\text{voice} \\ +\text{asp} \\ +\text{obst} \end{bmatrix} + \begin{bmatrix} -\text{cont} \\ +\text{obst} \end{bmatrix} \rightarrow \begin{bmatrix} +\text{voice} \\ -\text{asp} \end{bmatrix} + \begin{bmatrix} +\text{voice} \\ +\text{asp} \end{bmatrix}$$

For a diaspirate root like /bhudh/, we now have derivations which preserve linear ordering and which do not require rules utilize questionable theoretical devices. DC must apply before GL in a bleeding order. The order GL-BL is a counter-bleeding order.

	/bhudh+ta/	/bhudh+am/	/bhudh/	/bhodh#syati/	/bhudh#bhis/
DC			bhud	bhod#syati	bhud#bhis
GL	<u>budh+ta</u>	<u>budh+am</u>	_____	_____	_____
BL	<u>bud+dha</u>	<u>budham</u>	<u>bhut</u>	<u>bhotsyati</u>	<u>bhubhis</u>
	buddha	budham	bhut	bhotsyati	bhubhis

The rule order DC-GL-BL is the same as Kiparsky's. However, his solution differs from the one proposed here in several ways:

1) Kiparsky formulates BL (as does Anderson) so that only the progressive aspiration and voicing is accounted for; a separate rule of regressive deaspiration must somehow apply to give the final result. 2) To achieve regressive deaspiration, Kiparsky invokes a cycle. His version of DC, which deaspirates consonants before s, dh, and #, can then apply on a second pass through the rules to produce correct outputs.² He will derive buddha as follows:

		/bhudh+ta/
1st cycle	DaC	_____
	GL	budh+ta
	BL	budh+dha
2nd cycle	DaC	bud+dha

There is, however, no reason to believe that deaspiration applies anywhere except in the external # environment, at least so far as these forms are concerned. Hence, there is no reason to suppose that BL should be effected piecemeal rather than as a single unified process. There is, then, no reason to cycle the rules and, in fact, since deaspiration is apparently restricted to #, it would not in any event reapply to BL forms (which all have internal sandhi).

There are a few cases of exceptional external sandhi. Whitney comments: "667. ...In combination with a final t or th, the final dh of dadh does not follow the special rule of combination of a final sonant aspirate (becoming ddh with a t or th: 160) but-- as also before s and dhv-- the more general rules of aspirate and of surd and sonant combination..." The "more general rules" are those of external sandhi. Sample derivations are as follows:

	/dhadh#tha/	/dhadh#ta/	/dhadh+ā+mi/
DC	dhad#tha	dhad#ta	_____
GL	_____	_____	dadh+ā+mi
BL	_____	_____	_____
	dhattha	dhatta	dadhāmi

Although not mentioned by Whitney in his section 111a and barely touched on in 667, the endings dhve and dhvam (second plural middle suffixes) are external. With the root duh 'to milk' (underlying /dhugh/) and dhā 'put, do' (reduplicated stem /dhadh/) sample derivations are as follows:

	/dhugh#dhve/	/dhugh#dhvam/	/dhugh+thām/	/dhadh#dhvam/
DC	dhug#dhve	dhug#dhvam	_____	dhad#dhvam
GL	_____	_____	dugh+thām	_____
BL	_____	_____	dug+dhām	_____

For reduplicated forms with bhr 'bear' and bhudh we have such derivations as:

	bhibhr̥#tha	bhubhodh+ta	bhibhr̥#dhve
DC			
GL	bibhr̥#tha	bubodh+ta	bibhr̥#dhve
BL			

The innovations I have suggested with regard to the sandhi of certain Sanskrit affixes are modest. The declensional endings bhyām, bhis, bhyas, and su have traditionally been considered to be preceded by #. I have suggested that sya, dhve, and dhvam from the conjugational system are also preceded by #, that dhi is normally preceded by + (as in Phelps, to appear), and that the conjugational markers tha and ta are normally preceded by + but are exceptionally preceded by # (for dhā and bhr̥, for example). None of the sandhi rules stated in the literature appear to go against this analysis.³

It is perhaps necessary to point out that sandhi phenomena are widespread. Not only does Sanskrit show a difference between internal and external sandhi, so do such diverse languages as English, the Salish languages, and Quileute. It seems to me not unlikely that every language with a well developed morphology has two ways of joining affixes and roots. Moreover, it is clear why there are two ways of joining formatives: external sandhi tends to preserve the discreteness of the items being joined; internal sandhi leads to words which, although morphologically complex, have more nearly the phonological structure of unit morphemes. It is not at all surprising to find the contrary needs of communicability and pronouncability reflected in the way formatives are joined.

On the other hand, it would be very surprising if local ordering and the cycle, two recently suggested theoretical innovations that come immediately to mind, had any basis in fact. Neither enhances communicability or pronouncability (except by accident) and both place severe burdens on language learners unless they are very much predisposed toward communication systems with strange and apparently useless properties.

However, we must examine the solution given above in light of some recent proposals for eliminating extrinsic ordering (Kisseberth (1972), Koutsoudas, Sanders, and Noll (1971)). Given that DC, GL, and BL are formulated as I have stated them above, then the rules must be extrinsically ordered, in the order DC-GL-BL, or else we must find some very subtle principle which selects DC-GL, a bleeding order, but also GL-BL, a counter-bleeding order. It is not obvious that there is any such principle. As I understand Kisseberth's proposal, it will select the order DC-GL, but not GL-BL.⁴ Simultaneous application of DC and GL, as advocated by Koutsoudas, Sanders, and Noll, will give wrong outputs. This can be remedied by building in the converse of the environment of DC into GL so that [+asp]→[asp]/__X[+asp]~#. DC and GL are now unordered, but at the price of complicating GL (and, in fact, repeating in GL information already in DC).

Historically, extrinsic ordering is well supported by the

fact that rules arise sequentially at particular times and places. There is no reason to assume that only certain rule relations (feeding, counter-bleeding, etc.) are permitted to occur as sequential historical events or that re-ordering must occur if certain rule relationships arise as a result of rule addition. In the Sanskrit case there is every reason to think that DC was introduced before GL and that the introduction of BL followed GL; that is, there is every reason to think that the synchronic and historical orders are the same; namely, DC-GL-BL (see Kiparsky 1965:66ff. for discussion). I am not arguing that the synchronic order of rules must always be in agreement with the historical order of rule addition. I am merely noting that this seems to be true in the present instance and that one would expect the historical order of rule addition to be maintained for the most part.

In the question of rule ordering, observations and conclusions concerning rule markedness are not at issue. It is perfectly possible to understand that some rule orders are more natural than others without being able to predict whether a particular order (marked or unmarked) will occur. Inabilities to predict the order of rule application leaves us with no alternative but to invoke extrinsic ordering or some equivalent device to establish proper priority statements. Since there seems to me to be no well motivated way to eliminate extrinsic ordering or its equivalent in the present instance, I prefer to maintain the simple rules I have formulated together with extrinsic order than to complicate the rules and/or to advance ad hoc ordering principles.

7. Phelps' new solution to the diaspirate problem (Phelps, to appear) produces correct outputs, and does so without appeal to fantastical theoretical devices like cycles and local recording, but it is not without difficulties. Her solution depends on five important rules, which apply in the following order:

- 1) BL, stated as in Anderson (1970)
- 2) Regressive Voicing Assimilation (RVA)

$$[+obst] \rightarrow [\alpha voice] / __ (\#) \begin{bmatrix} +obst \\ \alpha voice \end{bmatrix}$$

- 3) External deaspiration (ED) [=DC]

- 4) GL

$$\begin{bmatrix} +asp \\ \alpha voice \end{bmatrix} \rightarrow [-asp] / __ [+seg]_1 \begin{bmatrix} +asp \\ +Root \\ \alpha voice \end{bmatrix}$$

- 5) Internal Deaspiration
- $$[+asp] \rightarrow [-asp] / __ [+obst]$$

Rule 2), RVA, is required in anyone's analysis of Sanskrit. In the analysis given above, RVA does not figure in the diaspirate problem. For Phelps, however, it is crucial that RVA apply before GL, for RVA bleeds her version of GL, now restricted to apply only in an $[\alpha voice]$ environment. To derive dhatta, Phelps requires

that dhadh+ta be an exception to BL. Thus, BL is skipped; but RVA applies and gives dhath+ta. GL cannot now apply since RVA has bled GL and the [αvoice] requirement is not met. Finally, Internal Deaspiration gives dhat+ta.

The formulation of GL with [αvoice] is not well motivated. There are no diaspirate forms in Sanskrit which differ in voicing. Such forms are prohibited by morpheme structure constraints and are not produced by any morphological reduplication process. Independent evidence for including [αvoice] in the statement of GL is lacking because there are no roots like *bhath which would simply go through the rules unaltered (say before an internal suffix beginning with a vowel) nor any reduplicated forms like *tha+ghan, which would also emerge unscathed. While ED (=DC) is independently well motivated and bleeds the independently well motivated version of GL that contains no α-variables, one is led to conclude that adding [αvoice] to GL is merely a device which allows the independently well motivated rule RVA to bleed a now parasitic version of GL.

Complicating GL so that RVA bleeds it may seem an innocuous strategy. But it is not. On the contrary, it must be a basic tenet of (natural) phonology that each phonological rule of a language be independently motivated in its entirety; that is, each rule must be stated in the most general way. Only if each rule is independently motivated in its entirety can questions concerning how rules interact in a phonology have empirical significance. And only if empirically significant answers to these questions are possible can we hope ever to ascertain the organization of a phonology. But this completes the argument, since a fundamental goal of linguistics is to ascertain how phonologies are organized. In brief, if we wish in principle ever to say how a phonology is organized, we must have the basic tenet that rules are independently motivated in their entirety. Moreover, the whole enterprise of determining what constitutes a natural process or rule is also ultimately pointless in the absence of this tenet.

It seems to me, then, that, because GL has been 'degeneralized' to allow RVA to bleed it, Phelps' solution does not meet this very basic criterion of phonologies.

Incidentally, the argument applies with equal force against the Unordered Rule Hypothesis. As I mentioned above, complicating GL with the unnecessary specification ~# only appears to save the Unordered Rule Hypothesis. The cost of such a strategy is to deprive the hypothesis of any possible empirical significance.

In my analysis, unlike that of Phelps, I posit a lexical exception feature associated with dhadh. The exception feature is (informally): + → #/___ [t, th]. All of the t and th initial suffixes normally have internal sandhi. I am claiming, then, that dhadh is an exception to this generalization. This stem has perfectly regular sandhi elsewhere. The expected # occurs before se, dhve, etc. and the expected + occurs before sonorant-initial suffixes and before dhi.

Phelps' apparently disagrees with the claim that an exception feature can have an environment which is partly phonological and wishes to "disallow the insertion of # before t and th, a phonological context." However, exception features are not phonological readjustment rules of the type I argued against in Hoard (1972:134). For exception features the environment is always morphological (in part or entirely) since exception features apply only to specific formatives.

For example, in English the past and past participle marker d is normally #d. But keep, hear, deal, leave and a number of other verbs have +d. The lexical notes are: keep: # → +/_d; hear: # → +/_d; deal: # → +/_d; leave: # → +/_d. With internal sandhi, keep, hear, deal, and leave are subject to Cluster Shortening of their vowels. Deal and leave are also subject to the rule of Cluster Naturalization. These two rules result in the surface forms: kept, heard, dealt, and left. Both of these rules are needed independently of internal sandhi verb forms to derive such words as stealth, width, and fifth. Positing irregular internal sandhi for keep, hear, deal, leave results in a straightforward analysis. (For details, see Sloat and Hoard (1973).) If we do not utilize lexical notes specifying exceptional sandhi, then we will be forced to postulate that there are two different and quite unrelated English past and past participle suffixes for weak verbs: #d and +d. Hence, given what is known about exceptional sandhi in English, positing an irregular # in Sanskrit before t and th endings as a lexical note of dhadh is quite acceptable.

The treatment of the entire problem advanced by Sag (1974) does not involve incorporating Grassmann's Law into Sanskrit as do all the others. His approach is to reject GL as a synchronic rule and simply to cast Pāṇini's rules for the Sanskrit data in question into a generative phonological framework. There is, however, a fundamental objection to Sag's analysis: The rules he gives as Regressive Aspiration Assimilation and Deaspiration (p.604) are almost totally unnatural and use the braces notation to include dissimilar items in what are actually discrete and incommensurate environments. Thus, the rules he gives force us to give up any generalizations about the lack of diaspirates within a root in the surface phonetics of Sanskrit. Moreover, after following Pāṇini in assuming that there are no underlying diaspirate roots, it is curious that Sag's rule of Regressive Aspiration Assimilation has only the effect of creating diaspirate roots in three separate environments as intermediate forms. This is a 'false step' in the sense of Zwicky (1974), but hardly a very good one. Since later rules simply conspire to undo all the diaspirates created by the unnatural rule of Regressive Aspiration Assimilation, Sag's proposal serves, then, to reinforce the proposition that Grassmann's Law is a synchronic rule of Sanskrit and that there are underlying diaspirates.

8. I have tried to show in this paper that very general and in-

independently motivated formulations of Grassmann's Law, Bartholomae's Law, and the rule for Deaspiration of Consonants are the correct synchronic rules of Sanskrit. If Sanskrit sandhi phenomena are taken into account, then the linear rule order DC-GL-BL accounts for the data with no theoretical innovations.

Footnotes

¹This statement is perhaps the source of Phelps and Brame's formulation of BL'. They 'transfer' the feature [+Root], however, as well as aspiration.

²Kiparsky (1965:64) inadvertently omits bh from the environment of his rule.

³There are, however, certain consonant alternations in Sanskrit which need to be mentioned just because it might be supposed that they have some bearing on the determination of + or # before these suffixes. For instance, root final ś is usually changed to ṣ before dh conjugation markers and before declensional bhṛām, bhṛis, bhṛas, su, and nominative s; but ś becomes k before the s of conjugation markers. From viś 'settler' we have, then, viṣ nom., viṣu loc. pl., viṣṭa 'entered', and vekṣyami 'I shall enter'; and from dviś 'hate' we have dveṣṭi 'he hates', dvekṣi 'thou hatest', dviddḥve 'you hate', dviddhi 'hate' imp., and adveṣ 'he hated' imperf. Sometimes, however, k appears instead of ṣ. So we find dik as the nom. sing. of dis 'cardinal point'. The appearance of k in final position in dik guarantees that there is no substance to the claim that ṣ occurs before # and certain consonants while k occurs before + and certain (other) consonants. It appears that these consonant alternations have nothing whatever to do with the sandhi of the affixes in question but are conditioned solely by the presence of a given affix (or by the initial consonant of an affix).

⁴The non-opaque order BL-GL which is selected requires a global rule to the effect that GL applies (not only in its stated environment) but just in case BL has applied. The global rule cannot be formulated in such a way that GL applies to any string whose ancestor had an aspirate stop since, in that case, GL will apply erroneously also to bhūt and bhotsyati.

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