When Features Are Not Deleted: Contextual Allomorphy in Sanskrit Noun Declension

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This paper is concerned with nominal inflection in Classical Sanskrit within the framework of Distributed Morphology. The complex nominal endings of Sanskrit are analysed into morphemes that are inserted into the functional heads n, Num, Gend and Case provided by the morphology. The Sanskrit data show that vocabulary insertion depends upon contextual features in such a way that a given morpheme is maximally sensitive both inwards and outwards. It is therefore argued that morphological features are not deleted completely once the vocabulary has been inserted. Furthermore, the analysis offers an account of grammatically driven phonological processes such as vowel lengthening and quantitative ablaut. These morpho-phonological phenomena are assumed to apply at vocabulary insertion and are dealt with by means of rules of exponence.

1. Introduction

This paper proposes an analysis of Classical Sanskrit noun inflection making use of a subanalysis of inflectional markers within the framework of Distributed Morphology (see Halle & Marantz, 1993, 1994; Harley & Noyer, 1999, among many others). One of the basic assumptions of this lexical-realisational approach is that vocabulary items, which are often underspecified, are inserted into functional morphemes post-syntactically. Vocabulary insertion, which applies cyclically from inward to outward, is regulated by two principles, the Subset Principle (Halle, 1997; Lumsden, 1992; Noyer, 1992; Wiese, 1999), and the Specificity Principle (e.g., Blevins, 1995; Wunderlich, 1997). The notion of specificity adopted here is based on the quantity of the features on vocabulary items.

Inter- and intraparadigmatic syncretisms in number, gender and case are accounted for by decomposing privative class, number, gender, and case features into more primitive, binary features that are cross-classified, yielding natural classes.

Further assumptions made in this analysis are that vocabulary insertion can apply iteratively (i.e., no fission is involved) in accordance with the Subset Principle, and that vocabulary insertion depends upon contextual features in such a way that a given morpheme is maximally sensitive both inwards and outwards. In other words, morphological features are not deleted completely at Vocabulary Insertion, and the complete set of morphological features is assumed to be accessible at each step of vocabulary insertion (partly against Bobaljik, 2000 and Carstairs, 1987). Finally, I assume that

morphologically driven phonological processes like vowel lengthening and quantitative ablaut apply in the form of rules of exponence at vocabulary insertion.

2. The Nominal System of Sanskrit

2.1. Nominal Inflection and Stem Classes

Nominal forms in Sanskrit are structured according to the pattern 'STEM - ENDING'. This paper is concerned with five major inflectional classes of Sanskrit: *a*-stems (thematic stems), *i*- and *u*-stems, *r̥*-stems[1], and *n*-stems. Traditionally a distinction is made between *i*-stems and *u*-stems; however, I subsume them under one single vocalic class as their paradigms are identical[2], and the stem-final vowels *-i* and *-u* by means of which these stems are identified are originally suffixes, thus not part of inflection proper, even though this is not always transparent in Classical Sanskrit (see e.g. Brugmann, 1889, §§92-93, 103,104, Euler, 1979; Kuiper, 1997). The paradigms of resulting four noun classes (thematic stems, vocalic stems, *r̥*-stems and consonant stems) are shown in table 1.

Following Harley & Noyer (1999); Bobaljik (2002) etc., I assume that paradigms do not exist as genuine entities. Merge of the stem with an inflectional marker is induced by a feature on the noun stem which acts as a probe (Alexiadou & Müller, 2005). As table 1 shows, gender features on the stem do not suffice to predict the inflection class (e.g., masculine nouns can be vowel or consonant stems). Likewise, semantic features are not relevant to the identification of the inflection class (e.g., animate nouns can occur in all inflection classes). *A*-stems are therefore assumed to be roots with an inherent class feature [+th], which triggers Merge of the root with a n^o specified as [+th +voc +cons]. The theme vowel is assimilated systematically with vowel-initial endings (see section 2.5).

Athematic stems display an almost identical set of endings; however, there are a number of differences in case marking between vowel and consonant stems which justify the distinction into these classes (e.g., *-u* vs. *-i* in loc sg masc). In athematic stems phonological features on the stem (stem-

[1]Throughout this paper I will retain the transcriptions common in Indo-European Linguistics. Thus, /r̥/ = IPA /ɾ̩/, /l̥/ = /l̩/, /y/ = /j/, /ś/ = /ʃ/, /ṣ/ = /ʂ/, /ṇ/ = /ɳ/, /ḥ/ = /h/.

[2]In cases where alternative forms are documented, as in masculine *i*-stems, and feminine *u*-stems, I chose the more frequent form for analysis (e.g. *-ām* instead of *-au* in loc sg masc V-stems).

final ±voc, ±cons) predict the inflection class (unlike thematic stems, where the phonological features of the root-final segment do not play a role in the choice of noun class).[3] R̥-stems are classified as [+voc +cons], as they display a number of case syncretisms with vowel stems (e.g., acc pl masc) as well as with consonant stems (e.g., nom/acc/voc dual masc). The decomposition of class features is shown in table 2.

[3]Noun class systems depending on phonology are extremely rare in the world's languages. Such systems have been reported for Arapesh, Yimas, Pashto and Latin (Aronoff, 1994). As was pointed out to me by Jochen Trommer, there are two alternatives to this phonology-based analysis, both working with only two noun classes, [+th] and [–th]. The first alternative would be to assume that the marking variations in the athematic class are due to vocabulary insertion being sensitive to phonological features of the stem. The second alternative is to explain the variations in the case markers by phonological optimisation.

Table 1 *Sanskrit: Inflectional classes*

		a (+th +voc +cons)			V (–th +voc –cons)			r̥ (–th +voc +cons)		K (–th –voc +cons)	
		M	F	N	M	F	N	M	N	M	N
SG	NOM	aḥ	ā	am	ḥ	ḥ	ø	ø	ø	ø	ø
	VOC	a	e	am	ø	ø	ø	ø	ø	ø	ø
	ACC	am	ām	am	m	m	ø	am	ø	am	ø
	INS	ena	ayā	ena	nā	ā	nā	ā	nā	ā	ā
	DAT	āya	āyai	āya	e	ai	ne	e	ne	e	e
	ABL	āt	āyāḥ	āt	āḥ	āḥ	naḥ	aḥ	naḥ	aḥ	aḥ
	GEN	asya	āyāḥ	asya	āḥ	āḥ	naḥ	aḥ	naḥ	aḥ	aḥ
	LOC	e	āyām	e	ām	ām	ni	i	ni	i	i
DU	NOM	au	e	e	ø	ø	nī	au	nī	au	i
	VOC	au	e	e	ø	ø	nī	au	nī	au	i
	ACC	au	e	e	ø	ø	nī	au	nī	au	i
	INS	ābhyām	ābhyām	ābhyām	bhyām	bhyām	bhyām	bhyām	bhyām	bhyām	bhyām
	DAT	ābhyām	ābhyām	ābhyām	bhyām	bhyām	bhyām	bhyām	bhyām	bhyām	bhyām
	ABL	ābhyām	ābhyām	ābhyām	bhyām	bhyām	bhyām	bhyām	bhyām	bhyām	bhyām
	GEN	ayoḥ	ayoḥ	ayoḥ	oḥ	oḥ	oḥ	oḥ	oḥ	oḥ	oḥ
	LOC	ayoḥ	ayoḥ	ayoḥ	oḥ	oḥ	oḥ	oḥ	oḥ	oḥ	oḥ
PL	NOM	āḥ	āḥ	āni	aḥ	aḥ	ni	aḥ	ni	aḥ	i
	VOC	āḥ	āḥ	āni	aḥ	aḥ	ni	aḥ	ni	aḥ	i
	ACC	ān	āḥ	āni	n	ḥ	ni	n	ni	aḥ	i
	INS	aiḥ	ābhiḥ	aiḥ	bhiḥ	bhiḥ	bhiḥ	bhiḥ	bhiḥ	bhiḥ	bhiḥ
	DAT	ebhyaḥ	ābhyaḥ	ebhyaḥ	bhyaḥ	bhyaḥ	bhyaḥ	bhyaḥ	bhyaḥ	bhyaḥ	bhyaḥ
	ABL	ebhyaḥ	ābhyaḥ	ebhyaḥ	bhyaḥ	bhyaḥ	bhyaḥ	bhyaḥ	bhyaḥ	bhyaḥ	bhyaḥ
	GEN	ānām	ānām	ānām	nām	nām	nām	nām	nām	ām	ām
	LOC	eṣu	āṣu	eṣu	ṣu	ṣu	ṣu	ṣu	ṣu	ṣu	ṣu

Table 2

Sanskrit Class features

STEM	TH	VOC	CONS
A	+	+	+
I, U	−	+	−
R̥	−	+	+
N	−	−	+

2.2. Case, Number and Gender Decomposition in Sanskrit

Sanskrit has eight cases: nominative, vocative, accusative, instrumental, dative, ablative, genitive, and locative. Nominative, accusative and vocative typically mark the agent, the patient and the addressee. The instrumental is used for adverbials of instrument, but also for agents in past contexts:[4]

(1) a. jal-ena aśv-ān siūca-ti
water-INSTR.SG horse-ACC.PL sprinkle-PRES.SG
'he sprinkles the horses with water'

b. Rām-ena api nagar-aṃ praviṣṭ-am
Rāma-INS and town-ACC.SG entered-ACC.SG
'and Rāma entered the town ("the town was entered by Rāma")'

c. t-ena gat-aṃ
DEM-INS.SG.M gone-NOM.SG
'he went ("it was gone by him")'

The dative encodes the indirect object, and adverbials of purpose and result:

(2) a. datt-am m-ayā bhrāmaṇ-ebhyaḥ draviṇ-am
given-ACC.SG me-INSTR brahmin-DAT.PL wealth-ACC.SG
'I have given the brahmins wealth'

b. aṅga-ānām bhaṅg-āya ārūḍh-aḥ bāl-aiḥ
limb-GEN.PL break-DAT.SG climbed-NOM.SG child-INS.PL
prākār-aḥ
wall-NOM.SG
'the children climbed the wall only to break ("for the breaking of") their limbs'

[4] All data are taken from Schuhmann (2002), which is partly based on Coulson (1976)

The ablative is typically used to mark a point of origin or a source:

(3) a. nagar-āt kṣetr-āṇi gaccha-ti
town-ABL.SG fields-ACC.PL go-3SG.PRES
'he goes from the city to the fields'

b. krodh-āt
anger-ABL.SG
'because of/ out of anger'

The genitive is used to encode subjective (possessive) and objective nominal attributes, and can be used to mark the indirect object (in competition with the dative):

(4) a. nr̥p-asya krodh-aḥ
king-GEN.SG anger-NOM.SG
'the king's anger'

b. nr̥p-asya darśan-aṃ
king-GEN.SG sight-NOM.SG
'the sight of the king'

c. datt-am m-ayā bhrāmaṇ-ānām draviṇ-am
given-ACC.SG me-INSTR brahmin-GEN.PL wealth-ACC.SG
'I have given the brahmins wealth'

The locative marks adverbials of place and circumstance, and can be used as an attributive marker:

(5) a. phalak-e bāl-āḥ upaviṣṭ-āḥ
wooden.bench-LOC.SG children-NOM.PL sit-NOM.PL
'The children are sitting on the wooden bench'

b. apāp-aḥ aham Parvateśvar-e
guiltless-NOM.SG I.NOM.SG Parvateśvaraḥ-LOC.SG
'I am guiltless towards ("in the matter of") Parvateśvaraḥ'

c. avagacchā-mi t-e t-asmin sauhārd-am
understand-1SG you-GEN.SG DEM.3SG.LOC.SG fondness-ACC.SG
'I understand your fondness for him'

Following Bierwisch (1967), Wiese (1999) and Alexiadou & Müller (2005), among others, I decompose the privative case features [nom], [voc], [acc],

[ins], [dat], [abl], [gen] and [loc] into more primitive, syntax-based binary case features [±subjective], [±objective], [±oblique] and [±attributive].[5] I propose the decomposition of cases given in table 3.

Table 3

Sanskrit
Case features

	SUBJ	OBJ	OBL	ATTR
NOM	+	−	−	−
VOC	−	−	−	−
ACC	−	+	−	−
DAT	−	+	+	−
GEN	−	+	+	+
INS	+	−	+	−
LOC	−	−	+	+
ABL	−	−	+	−

As table 3 shows, acc, dat and gen form a natural class of object cases characterised by [+obj], as do the oblique cases dat, gen, ins, loc and abl ([+obl]), and the agent-marking cases nom and ins ([+subj]). The feature [+attr] defines a class of attributive cases (gen and loc).

Number and gender categories are decomposed into combinations of the binary features [± sg], [± pl], and [± m], [± f], respectively (Noyer, 1998). The cross-classifications of these features are shown in tables 4 and 5.

Table 4

Sanskrit
Number features

	[sg]	[pl]
SINGULAR	+	−
DUAL	−	−
PLURAL	−	+

Table 5

Sanskrit
Gender features

	[m]	[f]
MASCULINE	+	−
NEUTER	−	−
FEMININE	−	+

2.3. Accent and Vowel Length

Sanskrit accent is phonologically determined: in words consisting of two or more syllables, the penultimate is accentuated if it is long. If the penulti-

[5] For an approach to Sanskrit noun inflexion in a lexical-incremental framework, see Lühr (2002b,a)

mate is short, the accent lies on the ante-penultimate. The fourth last syllable is accentuated if it is the root syllable, and if both the penultimate and the ante-penultimate are short (Bopp, 1857, 183-193). However, this accent pattern does not correspond to the pattern of vowel lengthening reflected by segmental phonology, which reflects the accent patterns of Proto-Indo-European (see e.g. Meier-Brügger, 2002; Kiparsky & Halle, 1977; Frazier, 2006). Accent in PIE is a grammatically determined phenomenon. For example, in the PIE amphidynamic accent class, the accent shift between root and ending marks nom vs. gen singular:

(6) a. pént-oh$_2$-s (Lühr, 2004)
tread-NOMINAL-NOM.SG
'way'

b. pn̥t-h$_2$-és
tread-NOMINAL-GEN.SG
'of the way'

I assume that the system of morphology-driven vowel lengthening is transparent in Sanskrit, and that lengthening is accomplished by inserting a mora into a given environment γ under condition X. The general lengthening rule (in the form of a rule of exponence) is given in (7):

(7) **Lengthening rule**
[M-] ↔ [γ] / __ X

2.4. Ablaut

Sanskrit has a two ablaut systems, qualitative ablaut and quantitative ablaut, which are purely grammatical phenomena that are not determined by accent or vowel length. Qualitative ablaut is marginal in Sanskrit; however, from a synchronic perspective, it can explain the grammatically driven vowel alternation /a/ - /i/ of the theme vowel in the nominal inflection system. These two phonological representations are treated as separate vocabulary items that are introduced into the structure by distinct rules of exponence.

Quantitative ablaut, on the other hand, affects /a/, /i/, /u/, /r̥/ and /l̥/, which occur in three ablaut grades for which I keep the terms assigned by Indian grammarians: the zero grade, the *guṇa* grade and the *vr̥ddhi* grade. The quantitative ablaut system of Sanskrit is shown in table 6.

Table 6
Sanskrit Quantitative ablaut grades

ZERO	a/ ā	i/ ī	u/ ū	r̥/ r̥̄	l̥/ l̥̄
GUṆA	a/ā	e/ ay	o/ av	ar	al
VṚDDHI	ā	ai/ āy	au/ āv	ār	āl

In Indo-European linguistics, the guṇa grade is taken to be the underlying quantitative grade from which a sound is graded "upwards" and "downwards" for reasons of grammar design (Mayrhofer, 1978, 33f.). However, I depart from this view by assuming the zero grade to be the basic vowel grade as was suggested by Indian grammarians. The advantage of this assumption is that it offers a straightforward, unified approach to vowel gradation: setting off from the lowest grade, ablaut is always accomplished by adding a phonological unit (as will be explicated below); if, in contrast, guṇa were taken to be the basic grade, then vowel gradation would be the result of two different operations, ADD X and DELETE X, which would be an unnecessary complication of the analysis.

I deal with ablaut grades in terms of ternary scales, i.e., ordered relations between phonological classes, along the lines of Gnanadesikan (1997) and de Lacy (2006). The quantative ablaut scale moves from zero grade at one end, through *guṇa* grade, to *vr̥ddhi* grade at the other end. This "moving" on the scale from ⟨0⟩ to ⟨1⟩ and from ⟨1⟩ to ⟨2⟩ is accomplished by adding a certain phonological unit [P], as shown in table 7, where each such [P] is represented by a bullet (in analogy to de Lacy's 2002, 37 X-notation of the scale points).

Table 7
Sanskrit Quantitative ablaut scale

zero grade	*guṇa* grade	*vr̥ddhi* grade
		•
	•	•
•	•	•
⟨0⟩	⟨1⟩	⟨2⟩

In the case of quantitative ablaut scales, the "raising" from level ⟨0⟩ to ⟨1⟩ is accomplished by adding a vocalic feature [–hi] to a representation γ in a context X, and ⟨1⟩ → ⟨2⟩ is done by adding one mora with an associated value [–high]. The rules for these processes are given in (8) (in the form of rules of exponence):

(8) a. **Raising from Zero to Guṇa (⟨0⟩ → ⟨1⟩)**
[-hi] ↔ γ / __ X

b. **Raising from Guṇa to Vr̥ddhi ($\langle$1$\rangle \rightarrow \langle$2$\rangle$)**
[M-hi] $\leftrightarrow \gamma$ / __ X

If a monomoraic sound is enriched with the vocalic feature [–hi], then [–hi] attaches to the feature cluster already present. If, now, the feature cluster of the zero grade vowel contains a feature [+hi], then [–hi] and [+hi] coalesce, yielding /e/ and /o/, respectively. On the other hand, when a bimoraic sound is enriched with the feature [–hi], then this feature attaches to the free mora, yielding /ay/ and /av/. The change between /e/-/ay/ and /o/-/av/ is therefore determined by length; it is in itself not a qualitative ablaut. When a liquid undergoes gradation, then at any case the resulting sequence will be /aL/.

When a guṇa vowel is further enriched with a mora with an associated [–hi] feature, then in the case of monomoraic guṇa vowels the mora is simply added, yielding /ae/ and /ao/, which are assimilated to /ai/ and /au/[6], respectively (see the sandhi rules in section 2.5). If, on the other hand, the mora is added to a bimoraic guṇa vowel or liquid, then it associates with the mora which was added by the lengthening rule, yielding /ā/, /āi/ and /āu/ and /āL/.

2.5. Sandhi

Sanskrit has a system of regular sound assimilations (*sandhi*), which are at work at morpheme boundaries. Some examples are given in (9). Examples (9a) and (9b) show that primary hiatus is resolved by vowel fusion or glide formation:

(9) a. vinā + īr̥ṣy-ayā = vinerṣyayā
without jealousy-INS

b. api + avagacchasi = apyavagaccha-si
WH understand-2SG.PRES
'do you understand?'

c. nar-aḥ + rakṣa-ti = nararakṣati
man-NOM.SG protect-3SG.PRES
'the man protects'

The sandhi rules relevant to this analysis are shown in table 8 (taken from Coulson, 1976).

[6]No additional assumption has to be made about the linearisation of the two segments: the [–hi] feature always attaches to the left of the vowel to preserve bimoraity.

Table 8 *Sanskrit: Sandhi rules*

FINAL VOWELS								INITIAL VOWELS
a̯	**i̯**	**u̯**	**r̥**	**e**	**ai**	**o**	**au**	
ā	ya	va	ra	e	ā a	o	āva	a
ā	yā	vā	rā	a ā	ā ā	a ā	āvā	ā
e	ī	vi̯	ri̯	a i̯	ā i̯	a i̯	āvi̯	i̯
o	yu̯	ū	ru̯	a u̯	ā u̯	a u̯	āvu̯	u̯
ar	yr̥	vr̥	r̥̄	a r̥	ā r̥	a r̥	āvr̥	r̥
ai	ye	ve	re	a e	ā e	a e	āve	e
ai	yai	vai	rai	a ai	ā ai	a ai	āvai	ai
au	yo	vo	ro	a o	ā o	a o	āvo	o
au	yau	vau	rau	a au	ā au	a au	āvau	au

One more sandhi rule is of importance for this analysis: intervocalic /s/ becomes retroflex /ṣ/. The rule is given in (10).

(10) **Sandhi rule**
s → ṣ /V__V

Note that two identical phonological forms do not necessarily emerge from the same process. For example, the form /au/ can be the result of an underlying bimoraic /u/ on guṇa grade, a bimoraic /ū/ on vr̥ddhi grade, or the result of sandhi between /a/ and /au/. Likewise, /e/ can be an /i/ on guṇa grade or the result of sandhi between /a̯/ and /i̯/.

3. Distributed Morphology

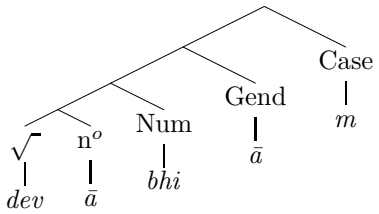
The analysis proposed here makes use of the framework of Distributed Morphology (see Halle & Marantz, 1993, 1994; Embick & Noyer, 2004 rev. 2005, among many others). I assume that the complex nominal endings of Sanskrit can be decomposed into smaller morphemes which are inserted one after the other into the n, Num and Case heads delivered by the morphology. The morphological subanalysis has two decisive advantages: firstly, more syncretisms among inflectional forms can be captured; for example, *-bhi-*, which occurs in ins, dat and abl dual *bhyām*, ins plural *bhiḥ* and dat and abl plural *bhyaḥ*, can be analysed as one single vocabulary item marking [-sg +obl -attr]. Secondly, a subanalysis of inflectional markers is the most straight-

forward account of the observation that sandhi, the systematic assimilation assumed to be at work only between morpheme boundaries, occurs within the inflectional ending (e.g., in non-oblique cases dual neuter, the theme vowel *-a-* assimilates with the *-i-* marking [–sg –obl], yielding *-e-*).

I assume the morphological structure of Sanskrit DPs like (11a) to be the one in (11b):

(11) a. dev- ā- bhy- ā- m
god- THEM- DUAL- M/F/N- INS/DAT/ABL

b.



Here the root $\sqrt{\text{DEV}}$ has an inherent feature [+th], which triggers merge of the root with an n head with a feature specification [+th], on which the noun class marker is realised.

Some crucial points have to be examined before we are setting out with the analysis. Firstly, the "hyperagglutinating" structure proposed here is by no means inevitable; it can be easily translated into a morphological analysis with just one inflectional head and multiple vocabulary insertion. However, such a "hyperinflecting" approach has to make sure that the sandhi mechanism recognises the single vocabulary items as distinct morphemes. Secondly, it is a widely accepted assumption that features are deleted once vocabulary insertion has taken place. However, the Sanskrit data show that vocabulary insertion largerly depends upon contextual features, being sensitive both inwards and outwards. For example, the morpheme /u/, which is inserted on Gend^o, must have access to class, number and case features:

(12) /u/ ↔ [+m] / __ [+cons –sg –pl –obl]

I therefore propose that the complete set of morphological features is accessible at each step of vocabulary insertion (therefore partly arguing against Bobaljik, 2000), and that morphological features are not deleted completely once the vocabulary has been inserted, but is still part of the representation.

The third point that needs some clarification is the status of vowel lengthening and ablaut. Both processes are sensitive to morphological information, but modify the phonological structure of vocabulary items. For example,

the dative singular of masculine and neuter thematic nouns is additionally marked by mora insertion at n^o, as shown in (13):

(13) [M-] ↔ [+th] / __ [+sg –f +obj +obl –attr]

There are two possible ways of implementing this observation. First, it could be assumed that morpho-phonological rules apply after vocabulary insertion has taken place, possibly in the form of Readjustment rules at a point where the phonological structure of vocabulary items can be modified, while grammatical information is still available. The alternative is to treat phonological features as vocabulary items and insert them at Morphology proper. This, however, works only under the assumption that phonological modification is possible at Morphology proper (i.e., that phonological information is legible). I will make use of the second solution. Possible evidence for this implementation is that the class of athematic nouns is determined by phonological features of the stem, which, if correct, indisputably shows that phonological information is interpretable at this point of the derivation. In addition, this solution has the advantage of offering a unified approach to quantificational and qualificational ablaut.

4. Analysis: Sanskrit Noun Inflection

As was argued in section 2.1, noun class is partly determined by a feature [TH], and partly by phonological features of the stem. This can be implemented by assuming that roots have an inherent feature [±TH]. Merge with n is then determined by the rules given in (14):

(14) a. Merge ROOT with n[+th +voc +cons] / $\_\_\sqrt{[+\text{TH}]}$
b. Merge ROOT with n[–th +voc –cons] / $\_\_\sqrt{[-\text{TH}]\ \text{V-}}$
c. Merge ROOT with n[–th +voc +cons] / $\_\_\sqrt{[-\text{TH}]\ \text{R-}}$
d. Merge ROOT with n[–th –voc +cons] / $\_\_\sqrt{[-\text{TH}]\ \text{C-}}$

Theme vowels underlie qualitative ablaut. The rules for theme vowel insertion are given in (15):

(15) **Rules of Exponence for n^o**
[M-] ↔ [+voc +cons] / __ [+th +sg –f +obj +obl –attr]
[M-hi] ↔ [+voc +cons] / __ [+th +sg –f +obj +obl -attr]
[M-] ↔ [+voc +cons] / __ [+th +pl +obj +obl +attr]
/a/ ↔ [+th] / __ [+sg –subj –obj +obl –attr –f]
/a/ ↔ [+th] / __ [+pl +obj +obl +attr –f]

[M-] ↔ [+voc +cons] / __ [+th +pl +subj +obl]
[M-] ↔ [+voc +cons] / __ [+th –sg –pl +obl]
[M-] ↔ [+voc +cons] / __ [+th –sg –obl –f]
[-hi] ↔ [+voc +cons] / __ [+th +sg +subj +obl]
[M-hi] ↔ [+voc +cons] / __ [+th +sg -subj +obl]
[-hi] ↔ [+voc +cons] / __ [+th –sg +obl]
/i/ ↔ [+th] / __ [αsg –pl +obl –αattr]
/i/ ↔ [+th] / __ [αsg –αpl αf +obl]
[M-] ↔ [+voc +cons] / __ [+th +f]
/a/ ↔ [+th]
/ø/ ↔ [ ]

Before morphemes are inserted at the next head the Impoverishment rules given in (16) apply at Num^o:

(16) **Impoverishment Rules for Num^o**
[+m] → [–m] / [αth αcons +sg +obl +subj]
[–m] → [+m] / [+th +sg –subj +obl]
[–f] → [+f] / [+th –sg –pl –m (a-class dual n wie f)]

Now the Number morphemes /bhi, n, s, si/ are inserted, as shown in (17):

(17) **Rules of Exponence for Num^o**
/si/ ↔ [+sg] / __ [+th –f +obj +obl +attr]
/n/ ↔ [+pl] / __ [+voc +obj +obl +attr]
/n/ ↔ [+sg] / __ [+obl –f –m]
/n/ ↔ [–sg] / __ [–obl –f –m]
/s/ ↔ [+pl] / __ [–obj +attr]
/bhi/ ↔ [–sg] / __ [+obl –attr]

At this point Impoverishment applies at the Gend head, and the gender morphemes /u, i, a/ are inserted:

(18) **Impoverishment Rules for Gend^o**
[–subj +obj] → [+subj –obj] / [–th –voc +pl]
[+obj] → [–obj] / [–sg –pl +obl]
[+th] → [–th] / [+sg +obl +obl –attr]
[+sg] → [–sg] / [+th –pl +f –subj –obl –obl]

(19) **Rules of Exponence for Gend^o**
/ø/ ↔ [+m] / ___ [–th –cons +sg –subj αobj +obl αattr]
[-hi] ↔ [αf] / ___ [–th –cons +sg -obj +obl +attr +m]
[M-] ↔ [–f] / ___ [–th –sg –pl –obl –m +voc]
/a/ ↔ [–αm] / ___ [αth +cons +sg +obj –obl αf]
/i/ ↔ [αm] / ___ [–th +sg +obj +obl –attr f]
/i/ ↔ [αm] / ___ [+sg –f –obj +obl +attr f]
[-hi] ↔ [–f] / ___ [–th +sg +obj +obl -attr]
[-hi] ↔ [αf] / ___ [+cons –sg –pl –obl +m]
/u/ ↔ [αm] / ___ [–sg –obj +obl +attr f]
/u/ ↔ [+m] / ___ [+cons –sg –pl –obl]
[M-] ↔ [+f] / ___ [+th +sg +subj +obl]
[M-] ↔ [–f] / ___ [–th +sg +subj +obl]
[M-] ↔ [αf] / ___ [–sg –pl +obl -attr]
[M-] ↔ [αf] / ___ [+pl +obj +obl +attr]
/ø/ ↔ [αm] / ___ [+pl +obj –obl –αf]
/ø/ ↔ [αm] / ___ [+pl +subj +obl f]
/a/ ↔ [αm] / ___ [+pl –obj –obl f]
[M-] ↔ [+f] / ___ [–cons +sg +obl]
[-hi] ↔ [αf] / ___ [–sg –pl +attr]
/i/ ↔ [αm] / ___ [–sg –obl f]
/a/ ↔ [αm] / ___ [+obl f]

Now the Impoverishment rules in (20) operate at the Case head, and the rules of exponence for Case^o apply:

(20) **Impoverishment Rules for Case^o**
[subj obj –m] → [–subj +obj +m] / [+th +sg –obl –f]
[+sg –pl] → [–sg +pl] / [–th +voc +cons +m –subj –obl –obl]
[+f –m] → [–f +m] / [–cons +subj –obl]

(21) **Rules of Exponence for Case^o**
/t/ ↔ [–subj –obj +obl –attr] / ___ [+th +sg +m]
/ø/ ↔ [+obj +obl +attr] / ___ [+th +sg +m]
/m/ ↔ [–obj +obl +attr] / ___ [+sg αf –αm]
/h/ ↔ [+subj –obl] / ___ [αth αcons +sg +m]
/n/ ↔ [+obj –obl] / ___ [+voc +pl +m]
/h/ ↔ [–subj αobj +obl αattr] / ___ [+sg]
/ø/ ↔ [–obj +obl +attr] / ___ [+pl]
/h/ ↔ [+obl –αattr] / ___ [–sg αpl]

/h/ ↔ [–obl] / __ [+pl αf –αm]
/m/ ↔ [obl] / __ [+sg αm –αf]
/m/ ↔ [+obl] / __ [–sg]

Vocabulary insertion has now applied completely. Now the vowel assimilations given in table 8 and (10) above are at work.

4.1. Conclusion

The analysis of the Sanskrit nominal inflection has shown that vocabulary insertion is maximally sensitive inwards and outwards, and, consequently, that the morphological information on a morphological head is still part of the representation once the vocabulary has been inserted. This, of course, raises the question of how and when these features are finally deleted before Transfer to the sensorimotor system (Legibility). A possible (though radical) solution would be to assume that morphological features need not be explicitely erased at PF, as they are automatically deleted at Transfer if they were satisfied at vocabulary insertion. I leave this question open to further research.

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