

Teleology and the simplification of accentuation in Pāṇinian derivation

Peter M. Scharf

Considerable work has been undertaken over the past decade to create computational implementations of Pāṇinian derivational procedure. Shivamurthy Swamiji, P. Subrahmanyam, Amba Kulkarni, Anand Mishra, Girish Nath Jha, and I myself have all modeled segments of Pāṇinian grammar computationally. Others, such as Gérard Huet and Oliver Hellwig, are creating computational morphological generators and syntactic analyzers that do not attempt to model Pāṇinian procedure. The Sanskrit Computational Linguistics Consortium, which will hold its fifth symposium 3-8 January 2013 at IIT Bombay, provides a forum for sharing progress in this line of work. Attempts to model Pāṇinian procedure formulate determinative rules to produce finished speech forms from initial conditions consisting of semantic conditions and basic speech units such as roots and underived nominal stems. A computational implementation of Pāṇinian derivational procedure succeeds if the derivation of forms according to rules does not rely on knowledge of the finished form to be produced; that is, if the derivation is not circular. Robustness of the Pāṇinian linguistic description itself depends on the lack of circularity in the generative processes of the grammar.

Certain scholars have raised objections to the attempt to implement Pāṇinian procedure computationally on the grounds that Panini never intended his grammar to be a determinative generative grammatical device. Jan Houben, for instance, has recently argued that users of the grammar have certain speech forms in mind that they want to check for correctness and that these speech forms guide the derivational procedure which therefore does not proceed from semantic conditions and basic speech forms in a deterministic manner.

In Scharf 2011, I have demonstrated that Pāṇinian derivational procedure does indeed proceed from semantic conditions and basic speech forms. Yet I have also noted (Scharf 2011: 67-69) that there are three instances in which rules are formulated using the anticipatory device of the *viṣayasaptamī*. Patañjali escapes from the mutual dependence of the provision of an affix upon the presence of a preceding speech form and vice versa by stating that the affix in the locative is a locative of domain (*viṣayasaptamī*) rather than a right-context locative (*parasaptamī*).

Patañjali resorts to the locative of domain under A. 2.4.35 आर्धधातुके, A. 3.1.31 आयादय आर्धधातुके वा, and A. 4.1.90 यून लुक् (see Scharf 2011: 67–69). For example, A. 2.4.52 अस्तेभूः provides that the root *as* is replaced by the root *bhū* in the domain of an *ārdhadhātuka*-affix. A. 3.1.97 अचो यत् provides that the affix *yāt* occurs after a vowel-final root, and A. 3.1.124 ऋह्लोर्ण्यत् provides that the affix *nyāt* occurs after roots that end in *r* or in a consonant. The former affix conditions *guṇa* replacement of the final vowel of the root by A. 7.3.84 सार्वधातुकार्धधातुकयोः and high pitch on the first vowel of the derivate by A. 6.1.213 यतो ज्ञावः, while the latter conditions *vṛddhi* replacement of the final vowel of the root by A. 7.2.115 अचो ङिति and circumflex (*svarita*) on the affix vowel by A. 6.1.185 तित्स्वरितम्. In order to obtain the form *bhāvyaṃ* the affix *yāt* must occur after the root *bhū*. However, the affix *yāt* cannot occur until the root *as* is replaced by *bhū* since it only occurs after vowel-final roots; it does not occur after the root *as*, which ends in a consonant. If *ārdhadhātuke* were a *parasaptamī*, the replacement of the root *as* by the root *bhū* could only occur after the *ārdhadhātuka*-affix *nyāt* had been provided. The result would be the erroneous form **bhāvyām*, with *vṛddhi* replacement of the final *ū* of *bhū* and circumflex on the final vowel. The correct form *bhāvyaṃ* results if the replacement of the root *as* by

the root *bhū* occurs in the domain of an ārdhādhātuka-affix, prior to its provision. The locative of domain permits the comprehension of the affix prior to its provision; it is a technique of looking ahead in the derivation and implies that the user of the grammar has some foreknowledge of the speech form to be derived. The locative of domain therefore implies that teleology plays a role in rule implementation in the grammar.

While the device of a locative of domain is admitted only under duress and is avoided as far as possible by commentators beginning with Patañjali, the fact that it is resorted to at all raises the question whether the rule set itself was not composed with the intent to utilize such a device more prevalently. Now, attempts to interpret Pāṇinian procedure independent of commentators, especially independent of Patañjali, inevitably inspire suspicion. If nearly two and a half millennia of astute grammarians do not consider an issue, it is unlikely to be relevant. Yet there are criteria to judge the correct interpretation of a system independent of commentary. These criteria are the simplicity and adequacy of the system to its intended domain. If an interpretation of the Pāṇinian linguistic description under one interpretation accounts for correct Sanskrit usage more efficiently, more simply than under a second interpretation, evidence is served in favor of the first interpretation. The case is strengthened if support for the interpretation is found in the discussion of commentators.

There is a major section of the grammar consisting of rules with locatives interpreted by commentators as right-context locatives (*parasaptamī*) which if interpreted as locatives of domain (*viṣayasaptamī*) would lead to a simplification of accentual rules. In the section of rules that introduces stem-forming affixes (*vikaraṇa*), namely A. 3.1.34–90, the locatives from *leṭi* in A. 3.1.35 to *liṇi* in A. 3.1.86 are accepted by commentators as right-context locatives. The verbal terminations are taken to be introduced prior to the stem-forming affixes. Table 1 shows the gloss of these rules in the Kāśikā, and Table 2 shows their gloss in

the Siddhāntakaumudī, wherever the comment clarifies the case use. The commentaries do not mention or do not interpret the locative at all in the gloss of sūtras not listed; they never interpret any of these locatives as viṣayasaptamī. The Kāśikā utilizes the term *parataḥ* after a locative to show that it is a parasaptamī. Similarly, the Siddhāntakaumudī utilizes the term *pare*. For example, the Kāśikā paraphrases A. 3.1.68 कर्तरि शप्, “The affix *śap* occurs after a root when a sārvaadhātuka affix denoting an agent (*kartṛ*) follows (*parataḥ*).” The Siddhāntakaumudī paraphrases the same rule (SK. 2167), “The affix *śap* should occur after a root when a sārvaadhātuka affix meaning agent (*kartṛ*) follows (*pare*).” The use of the terms *parataḥ* and *para* implies that the verbal termination is already present following a root when the stem-forming affix is provided. In the derivations according to these commentators, therefore, the verbal terminations occur first and the stem-forming affixes subsequently.

Table 3 shows the derivation of *kurutaḥ*, the third person dual present indicative active of the root *kr*, according to Pāṇinian tradition. Steps 1-6 show the semantic conditions leading to the introduction of the *l*-affix *laṭ* after the root *kr*. Step 7 replaces the *l*-affix *laṭ* by the appropriate verbal termination; steps 7a-f determine the selection of the verbal termination *tas*. Steps 8-9 concern accent, which is the issue at hand. The affix has a high-pitched vowel in accordance with A. 3.1.3 (step 8).

Now, accents accompany items when they are introduced and are adjusted at each stage in a derivation in accordance with the principle, stated in 6.1.158 अनुदात्तं पदमेकवर्जम्, that a pada contains no high-pitched vowel save one (step 9). As Cardona (1997: 376) writes, “At each stage of derivation, an accentual adjustment is made such that, in general, the accentuation proper to the unit introduced at this stage cancels a previously existing accentuation.” The principle is articulated by Kātyāyana under A. 6.1.158, in vt. 9: सतिशिष्टस्वरबलीयस्त्वं च (step 9a). Patañjali

comments: सतिशिष्टस्वरो बलीयान्भवतीति वक्तव्यम् (MBh. III.99.23) (step 9b). Hence the accent of the verbal termination overrides the accent of the root.

An exception is made, however, to the accentuation principle that the accent of what is taught overrides the accent that was formerly present. The exception states that the accentuation of a stem-forming affix (*vikaraṇa*) does not override the accentuation of a *sārvadhātuka* verbal termination. Step 11 of the derivation introduces the stem-forming affix *u* which is high-pitched, just as was the verbal termination *tas*, in accordance with A. 3.1.3 (step 12). Yet instead of the accent of the newly introduced affix *u* overriding the accent of the verbal termination already present in accordance with the *satisiṣṭa* principle, the accent of the stem-forming affix must yield to the accent of the verbal termination, even though stem-forming affix is introduced later. Kātyāyana notes this exception to the *satisiṣṭa* principle in vt. 11, स्यादिस्वराप्रसङ्गश्च तासेः परस्यानुदात्तवचनात्, under A. 6.1.158 (step 13a). Patañjali comes to the point, “The accent of the stem-forming affix, even though it is taught while the other accent is already present, does not block the accent of the verbal termination.” (step 13b).¹ The rest of the derivation culminates in step 24 with the form *kurutáh*, with the accent on the verbal termination rather than on the stem-forming affix.² In general the accent of a verbal termination prevails over the accent of a stem-forming affix.

In order to achieve the proper accentuation of verbal forms such as *kurutáh* — which are quite prevalent in ordinary Sanskrit as well as in Vedic — an exception to the principle that the accent of the item introduced later prevails must be stated. The statement of such an exception can be avoided, however, if the stem-forming

1. सति शिष्टो ऽपि विकरणस्वरो लसार्वधातुकस्वरं न बाधते । (MBh. III.100.8-11).

2. In Devanagari, I use a vertical stroke above the headbar to indicate high pitch (*udātta*) and leave other pitches unmarked.

affix is introduced prior to the replacement of the *l*-affix by the verbal termination. Doing so requires understanding the locatives in the rules that introduce stem-forming affixes as locatives of domain rather than right-context locatives: the verbal terminations are not yet there but are anticipated. Table 4 shows the modifications necessary to the derivation. Step 7, instead of replacing the *l*-affix by an appropriate verbal termination, introduces the stem-forming affix *u*. The accent of the stem-forming affix overrides the accent of the root in accordance with the general accentuation principle that the accent of the item introduced later prevails (steps 9-9b). Then in step 10 the *l*-affix is replaced by the appropriate verbal termination *tas*. The accent of the verbal termination then prevails over the accent of the stem-forming affix by the same general accentuation principle (step 13-13b). No exception to the general accentuation principle is needed.

Now, the view that there is an exception to the general principle that the accent of what is taught overrides the accent that was formerly present in the case of vikaraṇas has a long history. The question comes up in the discussion of accentuation under A. 6.1.158. In vārttika 8 (सिद्धं तु प्रकृतिस्वरबलीयस्त्वात्प्रत्ययस्वरभावः), Kātyāyana states that the accent of an affix overrides the accent of the base, and in vārttika 9 (सतिशिष्टस्वरबलीयस्त्वं च), that the accent of what is taught overrides the accent that was formerly present (the *satiśiṣṭa* principle). In vārttika 10 (तच्चानेकप्रत्ययसमासार्थम्), he states that the latter is necessary in the case of multiple affixes and in the case of complex compounds. The derivation of verbal forms such as *kurutāḥ* is a case where multiple affixes occur. Now, Patañjali raises an objection to the solution presented in vārttika 9. If the *satiśiṣṭa* principle applies, then the accent of the vikaraṇa would block the accent of the verbal termination in *sunutāḥ* and

cinutáh.³ This objection assumes that the vikaraṇa is taught after the replacement of an *l*-affix by a verbal termination because विप्रतिषेधे परं कार्यम् applies throughout the grammar so that replacements to *l*-affixes taught in 3.4.78 occur before the vikaraṇas taught in 3.1.33-90.

Kātyāyana's vārttika 11 on A. 6.1.158 (स्यादिस्वराप्रसङ्गश्च तासेः परस्यानुदात्तवचनात्) answers the objection. According to this vārttika, the mention of *tāsi* in A. 6.1.186 तास्यनुदात्तेऽङ्दुपदेशाल्लसार्वधातुकमनुदात्तमन्विङोः is an indication (*jñāpaka*) of an exception for vikaraṇas. A. 6.1.186 teaches that a verbal termination after *tāsi* (which is a vikaraṇa), among other speech forms, is anudātta. Teaching that a verbal termination after *tāsi* is anudātta indicates that the accent of a vikaraṇa does not block the accent of a sārvaadhātuka affix taught in place of an *l*-affix, even though the vikaraṇa is taught later than such a sārvaadhātuka affix. The fact that one has to state that after *tāsi* such sārvaadhātuka affixes are anudātta indicates that they wouldn't be anudātta just by the satiṣiṣṭa principle. It implies an exception to the satiṣiṣṭa principle for vikaraṇas, if one accepts that replacements to *l*-affixes taught in A. 3.4.78 occur prior to the vikaraṇas taught in A. 3.1.33-90.

However, this statement assumes that विप्रतिषेधे परं कार्यम् applies throughout the grammar so that replacements to *l*-affixes taught in 3.4.78 occur prior to the vikaraṇas taught in 3.1.33-90. Yet if this is not the case, if vikaraṇas occur first and verbal terminations subsequently, then the satiṣiṣṭa principle itself lets the accent of the terminations take precedence, and there is no need for 6.1.186 to indicate it. Still A. 6.1.186 has to be stated to bring about the low pitch of the sārvaadhātuka affixes in the specific cases mentioned because they would otherwise keep their high-pitched

3. यदि सतिशिष्टस्वरबलीयस्त्वमुच्यते स्यादिस्वरः सार्वधातुकस्वरं बाधेत । सुनुतः चिनुतः । (Mbh. III.100.6-7).

accent by the *satiṣiṣṭa* principle. This is exactly what Kaiyaṭa states in his commentary on the MBh. on vt. 11. He writes,

[A. 6.1.186] is said to be an indication by resorting to the derivation according to which the stem-forming affix *tāsi* occurs after replacements for *l*-affixes have already been made because the latter are provided by later rules. However, [A. 6.1.186] is not an indication if the *sārvadhātuka* (replacements) arise after the stem-forming affix *tāsi* has been added at the stage of the *l*-affixes because the provision of low pitch [by A. 6.1.186] serves the purpose of blocking accentuation of the *sārvadhātuka* replacements for *l*-affixes which would obtain because of the *satiṣiṣṭa* principle.”⁴

The *satiṣiṣṭa* principle by itself, without special exception for *vikaraṇas*, applies to allow the accent of the verbal termination to remain; high-pitch accent is specifically overridden by 6.1.186.

In *vārttika* 12 (शास्त्रपरविप्रतिषेधानियमाद्वा शब्दपरविप्रतिषेधात्सिद्धम्), Kātyāyana considers an alternative explanation for the fact that the *vikaraṇa* does not get the accent in forms such as *sunutáḥ* and *cinutáḥ*. He states that because the principle that the later rule applies in cases of conflict cannot properly restrict the accent, it succeeds because of the principle that the later speech form gets the accent in cases of conflict. The details of the proposal, the objection raised to it, and its solution are not immediately relevant here.⁵ What is relevant is that Kātyāyana and

4. परत्वाल्लादेशेषु कृतेषु तासिरिति प्रक्रियाश्रयेण ज्ञापकमुच्यते । लावस्थायां तु तासौ कृते सार्वधातुकोत्पत्तौ न ज्ञापकं भवति लसार्वधातुकस्वरस्य सतिशिष्टतया प्रसङ्गात् तद्बाधनार्थत्वाद् अनुदात्तविधानस्य ॥ (Pr. 4.492).

5. The proposal in *vārttika* 12 under A. 6.1.158 is objected to because in the case of the provision of *dhātu*-forming affixes such as *kāmya*, *āya*, and *īya*, the accent of the affix would take precedence over the accent of the root. Since the root is the whole sequence of base + affix while the affix is just the later part, the accent provided by 3.1.3 आद्युदात्तश्च would take precedence over the accent provided by 6.1.162 धातोः (अन्तः उदात्तः १५९). The latter provides that the final vowel of the root is high-pitched, the former that the first vowel of the affix is high-pitched. If the accent of the affix took precedence, one would then erroneously get **putrakāmyati*, **gopāyati*, **ṛtīyate* instead of the correct *putrakāmyāti*,

Patañjali consider an alternative to the principle that the later rule applies in cases of conflict throughout the grammar.

The principle that the later rule applies in cases of conflict is stated in A. 1.4.2 विप्रतिषेधे परं कार्यम् under the heading A. 1.4.1 आ कङारादेका सञ्ज्ञा. As Scharf (2012) discussed in detail, Patañjali applies the principle that the rule which is stated later prevails in cases of conflict throughout the grammar. Yet he concludes under A. 1.4.2 that it is the desired rule that applies rather than the later rule (MBh. 1.306.4–10) thereby casting doubt upon the use of the principle for rule ordering generally. Modern scholars limit the principle that the later rule applies in cases of conflict to the section of technical terms headed by A. 1.4.2 and do not accept that it applies generally throughout the grammar.

Although the principle that the later speech form gets the accent in cases of conflict is dismissed, the fact that an alternative to the principle that the later rule applies in cases of conflict is considered in the context of the *satisiṣṭa* principle is pertinent. It is precisely this consideration that the present paper pursues. Since the principle that the later rule takes precedence in cases of conflict does not apply throughout the grammar, there is no reason to effect the replacement of *l*-affixes by verbal terminations prior to the provision of the *vikaraṇa*. Let the locatives such as *sārvadhātuke* in A. 3.1.67 सार्वधातुके यक् be *viṣayasaptamīs*. Let the *vikaraṇas* arise before the verbal terminations replace *l*-affixes. Then, since the verbal terminations occur subsequent to the *vikaraṇas*, the

gopāyāti, rīyāte. The objection is dismissed on the grounds that the principle that the later speech form gets the accent in cases of conflict applies only where both accents are possible at once, but it is not the case that both accents are possible at once here. As Kaiyaṭa explains, the accent of the affix is taught outright at first, when the accent of the affix has already been effected, once the speech form ending in the affix has been termed *dhātu* by A. 3.1.32 सन्नाद्यन्ता धातवः, only then does the accent of the root take effect. Kaiyaṭa therefore concludes that one only needs to resort to the *satisiṣṭa* principle, i.e., that the accent of what is taught overrides the accent that was formerly present.

satiśiṣṭa principle by itself accounts for the proper accent. There is no need for an exception to the satiśiṣṭa principle and no need to interpret A. 6.1.186 as an indication (*jñāpaka*) of such an exception. The interpretation of A. 6.1.186 as such an indication is only valid under the assumption that vikaraṇas occur subsequently to the replacement of *l*-affixes by verbal terminations. In the absence of such an assumption, that is, if the replacement of *l*-affixes by verbal terminations is provided subsequent to vikaraṇas, the accent of the termination takes precedence over the accent of the vikaraṇas just by the satiśiṣṭa principle alone. Thus the terminations *ḍā*, *rau*, and *ras* of the so-called periphrastic future (*luṭ*) after the vikaraṇa *tāsi* would be high-pitched by the default accentuation rule A. 3.1.3 and the satiśiṣṭa principle. In this situation, to avoid the undesired high-pitch in certain speech forms, A. 6.1.186 serves simply to effect the low pitch of the terminations *ḍā*, *rau*, and *ras* as well as of other verbal terminations following the specific items mentioned in the rule. A. 6.1.186 is just as much an indication (*jñāpaka*) that verbal terminations replace *l*-affixes subsequent to the provision of vikaraṇas as it is of an exception to the satiśiṣṭa principle. Verbal terminations can replace *l*-affixes subsequent to the provision of vikaraṇas if the locatives in A. 3.1.33-90 are understood as locatives of domain (*viśayasaptamī*) rather than right-context locatives (*parasaptamī*).

The derivation of accent can be achieved more simply by understanding the locatives in rules that introduce stem-forming affixes as locatives of domain rather than right-context locatives. Simplification is a virtue in scientific description just as *lāghava* is in the ancient Indian grammatical tradition. Moreover, the approach proposed is supported by the fact that commentators suggest an alternative to the principle that the later rule applies in cases of conflict.

The Mahābhāṣya discusses the type of *saptamī* in stem-forming affixation rules only once (MBh. II.60.19-20 [on A. 3.1.78]) where

reference is made to A. 1.4.13 यस्मात्प्रत्ययविधिस्तदादि प्रत्यये ऽङ्गम् in a pūrvapakṣa. The locative is there interpreted as a parasaptamī, paraphrasing यस्माच्च प्रत्ययविधिस्तदादिप्रत्यये परतो ऽङ्गसंज्ञं भवति. The fact that the affix *śnam* does not occur after roots such as *bhid* but after their last vowel (in accordance with A. 1.1.47 मिदचो ऽन्त्यात्परः), and that the stem with respect to the affix *śnam* does not terminate with that last vowel (for example *bhi* of *bhid*) shows that in fact *pratyaye* in A. 1.4.13 cannot be a parasaptamī.

Understanding the locatives as viṣayasaptamī implies a less mechanistic procedure of rule selection. Specific conditions for the occurrence of stem-forming affixes in the form of specific verbal terminations must be envisioned prior to the replacement of *l*-affixes by those verbal terminations. This implies that a fore-knowledge of the form to be derived guides the derivational procedure teleologically. To this extent, it may be correct to assert that Pāṇinian derivation begins with speech forms: it is undertaken with the target speech form in mind, at least to the extent that the user envisions an affix to be used as a viṣayasaptamī prior to the introduction of the affix. Such envisioning does not compromise the robustness of the Aṣṭādhyāyī as a linguistic description of Sanskrit, but it does complicate the ability to undertake a computational implementation that closely models the rules. Computational implementation must rely on some procedure of rule implementation that permits anticipation of conditions.

Scharf (2010) describes such a procedure to implement a forward-looking rule where a decision at an early stage in the derivation requires evaluation of conditions that do not obtain until a subsequent stage in the derivation. The situation concerns the addition of the affix-initial augment *i* (*iṭ*) in the derivation of perfect active participle forms such as *jagmivān*. A. 7.2.67 वस्वेकाजाद्विसाम् provides the addition of the initial augment *i* to the affix *vas* (*kvasu*) on the condition that the root be single-syllabled

after stem-internal changes and root doubling (A. 6.1.1 etc.) have applied. The problem is that stem-internal changes and root doubling require the prior addition of the augment *i*. The root is doubled by A. 6.1.8 लिटि धातोरनभ्यासस्य after 6.4.98 गमहनजनखन-घसां लोपः क्ङित्यनङि applies. The latter in turn deletes the penultimate vowel of the mentioned roots *gam*, etc. followed by a vowel-initial affix other than *n̄* marked with *k* or *n̄*. Note that the root vowel is deleted only if the affix is vowel-initial. The affix is vowel-initial only *after* the augment *i* is added by A. 7.2.67. The problem is therefore that A. 7.2.67 must evaluate whether the root is going to turn out to be single-syllabled in order to determine whether to add the augment or not but the root can turn out to be single-syllabled only once the augment has already been added. Scharf (2010) describes implementation of a decision delay mechanism that produces both options, with and without the augment *i*, and eliminates the incorrect option at a subsequent point in the derivation where the monosyllabicity is able to be evaluated. Hence, although the decision whether or not to implement A. 7.2.67 is forward-looking, i.e., requires knowledge of a subsequent state in advance, it is not indeterminate.

The situation is similar in the case of the *viṣayasaptamī*. Just as the forward-looking condition in the case of the derivation of perfect active participles was not indeterminate, the *viṣayasaptamī* is not indeterminate either. A decision delay procedure is capable of determining the correct result in the same way. In the case of the derivation of the form *bhāvyaṃ* in the example above, one can produce both options, proceeding on one option as if the subsequent affix is *ārdhadhātuka* and on the other as if it is not, until the affix is introduced and its status is known. Then discard the incorrect option. In this way no indeterminism is introduced. The simplification of accentuation rules by the expanded use of the *viṣayasaptamī* therefore would not introduce the fault of indeterminacy into the grammatical procedure.

Table 1
Significance of the locative in rules introducing stem-forming affixes
according to the Kāśikā

३।१।३३ स्यतासी लृलुटोः	लृलुटोः	लृरूपमुत्सृष्टानुबन्धं सामान्यमेकमेव । तस्मिँल्लुटि च परतो धातोर्यथासङ्ख्यं स्यतासी प्रत्ययौ भवतः ।
३।१।३४ सिब्वहुलं लेटि	लेटि	धातोः सिप्प्रत्ययो भवति बहुलं लेटि परतः ।
३।१।३५ कास्प्रत्ययादाममन्त्रे लिटि	लिटि	कासृ शब्दकुत्सायाम् । ततः प्रत्ययान्तेभ्यश्च धातुभ्य आम्प्रत्ययो भवति लिटि परतो ऽमन्त्रविषये ।
३।१।३६ इजादेश्च गुरुमतो ऽनृच्छः		इजादिर्यो धातुर्गुरुमानृच्छतिवर्जितस्तस्माच्च लिटि परत आम्प्रत्ययो भवति ।
३।१।३७ दयायासश्च		दय दानगतिरक्षणेष्ु । अय गतौ । आस उपवेशने । एतेभ्यश्च लिटि परत आम्प्रत्ययो भवति ।
३।१।३८ उषविदजागृभ्यो ऽन्यतरस्याम्		उष दाहे । विद ज्ञाने । जागृ निद्राक्षये । एतेभ्यो लिटि परतो ऽन्यतरस्यामाप्प्रत्ययो भवति ।
३।१।३९ भीहीभृहुवां श्लुवच्च		जिभी भये । ही लज्जायाम् । डुभृज् धारणपोषणयोः । हु दानादानयोः । एतेभ्यो लिटि परत आम्प्रत्ययो भवत्यन्यतरस्यां श्लाविव चास्मिन्कार्यं भवति ।
३।१।४० कृञ्चानुप्रयुज्यते लिटि	लिटि	आम्प्रत्ययस्य पश्चात्कृञनुप्रयुज्यते लिटि परतः ।
३।१।४३ च्लि लुङि	लुङि	धातोश्च्लिः प्रत्ययो भवति लुङि परतः ।
३।१।४८ णिश्रिदुसुभ्यः कर्तरि चङ्		सिजपवादश्चङविधीयते । ण्यन्तेभ्यो धातुभ्यः श्रि दु सु इति एतेभ्यश्च परस्य च्लेश्चङादेशो भवति कर्तृवाचिनि लुङि परतः ।
३।१।५२ अस्यतिवक्ति- ख्यातिभ्यो ऽङ्		असु क्षेपणे । वच परिभाषणे ब्रूजादेशो वा । ख्या प्रकथने चक्षिडादेशो वा । एभ्यः परस्य च्लेरङादेशो भवति कर्तृवाचिनि लुङि परतः ।
३।१।५४ आत्मनेपदेष्व- न्यतरस्याम्	आत्मने- पदेषु	लिपिसिचिह्न आत्मनेपदेषु परतश्च्लेरङादेशो भवत्यन्यतरस्याम् ।

३।१।५५ पुषादिद्युताद्युदितः परस्मैपदेषु	परस्मै- पदेषु	पुषादिभ्यो द्युतादिभ्य लृदिद्भ्यश्च धातुभ्यः परस्य च्लेः परस्मैपदेषु परतो ऽङादेशो भवति ।
३।१।६० चिण्ते पदः	ते	पद गतौ । अस्माद्धातोः परस्य च्लेश्चिणादेशो भवति तशब्दे परतः ।
३।१।६१ दीपजनबुधपूरितायि- प्यायिभ्यो ऽन्यतरस्याम्		चिण्ते इति वर्तते । दीपी दीप्तौ । जनी प्रादुर्भावे । बुध अवगमने । पूरी आप्यायने । तायु सन्तानपालनयोः । ओप्यायी वृद्धौ । एतेभ्यः परस्य च्लेस्तशब्दे परतो ऽन्यतरस्यां चिणादेशो भवति ।
३।१।६२ अचः कर्मकर्तरि		अजन्ताद्धातोः परस्य च्लेः कर्मकर्तरि तशब्दे परतश्चिणादेशो भवति ।
३।१।६६ चिण्भावकर्मणोः		धातोः परस्य च्लेश्चिणादेशो भवति भावे कर्मणि तशब्दे परतः ।
३।१।६७ सार्वधातुके यक्	सार्व- धातुके	भावकर्मवाचिनि सार्वधातुके परतो धातोर्यक्प्रत्ययो भवति ।
३।१।६८ कर्तरि शप्		कर्तृवाचिनि सार्वधातुके परतो धातोः शप्प्रत्ययो भवति ।
३।१।८३ हलः श्नः शानज्झौ	हौ	हल उत्तरस्य श्नाप्रत्ययस्य शानजादेशो भवति हौ परतः ।
३।१।८६ लिङ्गाशिष्यङ्	लिङि	आशिषि विषये यो लिङ्गस्मिन्परतश्छन्दसि विषये ऽङ्गप्रत्ययो भवति ।

Table 2
Significance of the locative in rules introducing stem-forming affixes
according to the Siddhāntakaumudī

2167	३।१।६८	कर्तरि शप्	कर्त्रर्थे सार्वधातुके परे धातोः शप् स्यात् ।
2186	३।१।३३	स्यतासी लृलुटोः	धातोः स्यतासी एतौ स्तो लृलुटोः परतः ।
2239	३।१।४०	कृञ्चानुप्रयुज्यते लिटि	आमन्ताल् लिट्पराः कृभ्वस्तयो ऽनुप्रयुज्यन्ते ।
2269	३।१।५७	इरितो वा	इरितो धातोश्चलेरङ् वा स्यात् परस्मैपदे परे ।
2312	३।१।४८	णिश्चिद्रुसुभ्यः कर्तरि चङ्	ण्यन्तात् श्यादिभ्यश्च च्लेश्चङ् स्यात्कर्त्रर्थे लुङि परे ।
2321	३।१।७०	वा भ्राशङ्गाशभ्रमु- क्रमुक्कुमुत्रसितुटिलषः	एतेभ्यः श्यन्वा स्यात्कर्त्रर्थे सार्वधातुके परे।
2328	३।१।६१	दीपजनबुधपूरि- तायिप्यायिभ्यो ऽन्यतरस्याम्	एभ्यश्च्लेश्चिण्वा स्यादेकवचने तशब्दे परे ।
2338	३।१।७५	अक्षो ऽन्यतरस्याम्	अक्षो वा श्नुप्रत्ययः स्यात्कर्त्रर्थे सार्वधातुके परे ।
2375	३।१।४९	विभाषा घेट्श्र्योः	आभ्यां च्लेश्चङ्वा स्यात्कर्तृवाचिनि लुङि परे ।
2513	३।१।६०	चिण्ते पदः	पदश्च्लेश्चिण् स्यात् तशब्दे परे ।
2557	३।१।८३	हलः श्नः शानज्झौ	हलः परस्य श्नः शानचादेशः स्याद् धौ परे ।
2756	३।१।६७	सार्वधातुके यक्	धातोर्यक् प्रत्ययः स्याद्भावकर्मवाचिनि सार्वधातुके परे ।
2758	३।१।६६	चिण्भावकर्मणोः	च्लेश्चिण् स्याद्भावकर्मवाचिनि तशब्दे परे ।
2768	३।१।६२	अचः कर्मकर्तरि	अजन्तात् च्लेश्चिण् वा स्यात्कर्मकर्तरि तशब्दे परे ।
3434	३।१।८६	लिङ्गाशिष्यङ्	आशीर्लिङि परे धातोरङ् स्याच्छ्रन्दसि ।

Table 3
The derivation of कृत्: (the third person dual present indicative active of कृ)
according to Pāṇinian tradition

1	स्वतन्त्रताविशिष्ट-द्वित्वविशिष्टाश्रय-वर्तमानकालीन-करणानुकूल-व्यापारः			They two do
2	द्वित्वविशिष्टकर्तृक-वर्तमानकालीन-करणानुकूल-व्यापारः	1.4.54	स्वतन्त्रः कर्ता	The independent participant in the action is termed ‘agent’ (<i>kartr</i>).
3	कृ	MDhV. 8.12	डुकृञ् करणे	do, make
4	कृ[धातु]	1.3.1	भूवादयो धातवः	The items in the list beginning with <i>bhū</i> are termed <i>dhātu</i> .
5	कृ	6.1.162	धातोः (अन्तः उदात्तः १५९)	The last vowel of a root is high-pitched.
6	कृ-लट्	3.2.123	वर्तमाने लट्	The <i>l</i> -affix <i>laṭ</i> occurs after a root if the action it denotes occurs in present time.
6a		3.4.69	लः कर्मणि च भावे चाकर्मकेभ्यः (कर्तरि ६७)	The <i>l</i> -affixes occur when a direct object (<i>karman</i>) is to be denoted and, after roots without a direct object, when the action (<i>bhāva</i>) is to be denoted, as well as when the agent (<i>kartr</i>) is to be denoted.
7	कृ-तस्	3.4.78	तिप्तस्झि...इडृहि-महिङ् (लस्य ७७)	The affixes <i>tip</i> etc. occur in place of an <i>l</i> -affix.
7a		1.4.22	द्वेकयोर्द्विवचनैक-वचने	A dual or singular termination occurs to denote dual or singular number respectively.
7b		1.3.78	शेषात्कर्तरि परस्मैपदम्	A parasmaipada verbal termination occurs when an agent is to be denoted after the remainder, i.e., after any root under any conditions for which an ātmanepada termination has not been provided.
7c		1.4.99	लः परस्मैपदम्	A replacement for an <i>l</i> -affix is generally termed <i>parasmaipada</i> .

7d		1.4.101	तिङ्स्त्रीणि त्रीणि प्रथममध्यमोत्तमाः	Triplets of the affixes <i>tiñ</i> etc. are termed respectively <i>prathama</i> , <i>madhyama</i> and <i>uttama</i> .
7e		1.4.102	तान्येकवचनद्विवच- नबहुवचनान्येकशः	Affixes within each triplet are termed <i>ekavacana</i> , <i>dvivacana</i> , and <i>bahuvacana</i> respectively.
7f		1.4.108	शेषे प्रथमः	An affix termed <i>prathama</i> occurs in the remainder, i.e., where there is no correferentiality with a first or second person pronoun, whether such a pronoun is actually used or not.
8	कृ-तस्	3.1.3	आद्युदात्तश्च (प्रत्ययः १)	The first vowel of an affix is high-pitched.
9	कृ-तस्	6.1.158	अनुदात्तं पदमेकवर्जम्	A pada contains no high-pitched vowel save one.
9a		6.1.158 vt. 9	सतिशिष्टस्वरबलीय स्त्वं च	
9b		Patañjali	सतिशिष्टस्वरो बलीयान् भवति (MBh. III.99. 22-23)	
10	कृ-तस्[सार्वधातुक]	3.4.113	तिङ्शित्सार्व- धातुकम्	The verbal terminations (<i>tiñ</i>) and affixes marked with <i>ś</i> are termed <i>sārvadhātuka</i> .
11	(कृ-उ)- तस्[सार्वधातुक]	3.1.79	तनादिकृञ्भ्य उः (सार्वधातुके ६७, कर्तरि ६८)	The stem-forming affix <i>u</i> occurs after a root in the list beginning with <i>tan</i> and after the root <i>kr</i> followed by a <i>sārvadhātuka</i> affix if an agent is to be denoted.
12	(कृ-उ)- तस्[सार्वधातुक]	3.1.3	आद्युदात्तश्च (प्रत्ययः १)	(see step 8)
13	(कृ-उ)- तस्[सार्वधातुक]	6.1.158	अनुदात्तं पदमेकवर्जम्	(see step 9)
13a		6.1.158 vt. 11	स्यादिस्वराप्र- सङ्गश् च तासेः परस्यानुदात्त- वचनात्	

13b		Patañjali	सति शिष्टो ऽपि विकरणस्वरो लसार्वधातुकस्वरं न बाधते (MBh. III. 100.8-11)	
14	(कृ- उ[आर्धधातुक])- तस्[सार्वधातुक]	3.4.114	आर्धधातुकं शेषः	The remainder of affixes taught explicitly after a verbal root (<i>dhātu</i>) are termed <i>ārdhadhātuka</i> .
15	(कृ[अङ्ग]- उ[आर्धधातुक])- तस्[सार्वधातुक]	1.4.13	यस्मात्प्रत्यय- विधिस्तदादि प्रत्यये ऽङ्गम्	The speech form beginning with that after which an affix is provided is termed 'stem' (<i>aṅga</i>) with respect to that affix.
16	(कृ-उ)- तस्[सार्वधातुक]	7.3.84	सार्वधातुकार्ध- धातुकयोः (गुणः ८२, अङ्गस्य ६। ४।१)	A stem followed by a <i>sārvadhātuka</i> or <i>ārdhadhātuka</i> affix is subject to replacement by a <i>guṇa</i> vowel.
16a		1.1.2	अदेङ्गुणः	<i>a</i> , <i>e</i> and <i>o</i> are termed <i>guṇa</i> .
16b		1.1.3	इको गुणवृद्धी	<i>Guṇa</i> and <i>vṛddhi</i> vowels occur in place of a vowel <i>i</i> , <i>u</i> , <i>r</i> or <i>l</i> .
16c		1.1.50	स्थाने ऽन्तरतमः	The most similar among possible replacements occurs in place of its substituend.
17	(कर्-उ)- तस्[सार्वधातुक]	1.1.51	उरप्रपरः	A vowel <i>a</i> , <i>i</i> or <i>u</i> that occurs in place of <i>r</i> is followed by <i>r</i> .
18	करु[अङ्ग]- तस्[सार्वधातुक]	1.4.13	यस्मात्प्रत्ययविधि- स्तदादि प्रत्यये ऽङ्गम्	(see step 15)
19	करु[अङ्ग]-तस्[ङ्]	1.2.4	सार्वधातुकमपित् (ङित् १)	A <i>sārvadhātuka</i> affix not marked with <i>p</i> is marked with <i>ñ</i> .
20	कुरु-तस्[ङ्]	6.4.110	अत उत्सार्वधातुके (अङ्गस्य १, क्ङिति ९८, उतः प्रत्ययात् १०६, करोते: १०८)	The <i>a</i> of the stem <i>karu</i> of the root <i>kr</i> ending in the affix <i>u</i> , followed by a <i>sārvadhātuka</i> affix marked with <i>k</i> or <i>ñ</i> is replaced by <i>u</i> .

21	कुरु-तस्[ङ्]	1.1.5	किङ्ति च (न ४, इको गुणवृद्धी ३)	Guṇa and vṛddhi do not occur if the affix that would otherwise condition them is marked with <i>k</i> or <i>ñ</i> .
21a		7.3.84	सार्वधातुकार्ध- धातुकयोः (गुणः ८२, अङ्गस्य ६। ४।१) blocked	
22	कुरुतस्[पद]	1.4.14	सुप्तिङन्तं पदम्	A speech form ending in a nominal termination (<i>sup</i>) or verbal termination (<i>tiñ</i>) is termed <i>pada</i> .
23	कुरुतस्[उ]	8.2.66	ससजुषो रुः	The final <i>s</i> of a pada is replaced by <i>ru</i> (<i>r</i> marked with <i>u</i>).
24	कुरुतः	8.3.15	खरवसानयोर्वि- सर्जनीयः	Before a voiceless consonant or pause, pada-final <i>r</i> is replaced by <i>h</i> .

Table 4

Alternative derivation of कुरुतः (third person dual present indicative active of कृ)

7	कृ-उ-लट्	3.1.79	तनादिकृञ्भ्य उः (सार्वधातुके ६७, कर्तरि ६८)	The stem-forming affix <i>u</i> occurs after a root in the list beginning with <i>tan</i> and after the root <i>kr</i> in the domain of a <i>sārvadhātuka</i> affix if an agent is to be denoted.
8	कृ-उ-लट्	3.1.3	आद्युदात्तश्च (प्रत्ययः १)	The first vowel of an affix is high-pitched.
9	कृ-उ-लट्	6.1.158	अनुदात्तं पदमेकवर्जम्	A pada contains no high-pitched vowel save one.
9a		vt. 9	सतिशिष्टस्वर- बलीयस्त्वं च	
9b		Patañjali	सतिशिष्टस्वरो बलीयान् भवति (MBh. III.99. 22-23)	
10	कृ-उ-तस्	3.4.78	तिप्तस्झि...इङ्ग्रहिम् हिङ् (लस्य ७७)	The affixes <i>tip</i> etc. occur in place of an <i>l</i> -affix.
10a-f				= Table 3, steps 7a-f
11	कृ-उ-तस्	3.1.3	आद्युदात्तश्च (प्रत्ययः १)	The first vowel of an affix is high-pitched.
12	कृ-उ- तस्[सार्वधातुक]	3.4.113	तिङ्शित्सार्वधातुक म्	The verbal terminations (<i>tiñ</i>) and affixes marked with <i>ś</i> are termed <i>sārvadhātuka</i> .
13	कृ-उ- तस्[सार्वधातुक]	6.1.158	अनुदात्तं पदमेकवर्जम्	A pada contains no high-pitched vowel save one.
13a		vt. 9	सतिशिष्टस्वर- बलीयस्त्वं च	
13b		Patañjali	सतिशिष्टस्वरो बलीयान् भवति (MBh. III.99. 22-23)	

References and abbreviations

Abhankar, K. V.

1962–72 *The Vyākaraṇa=Mahābhāṣya of Patañjali, edited by F. Kielhorn, third edition, revised and furnished with additional readings, references and select critical notes.* Three volumes. Poona: Bhanarkar Oriental Research Institute.

Cardona, George.

1997 *Pāṇini: His Work and its Traditions.* Vol. 1, *Background and Introduction.* Second edition. Delhi: Motilal Banarsidass.

Cardona, George, Ashok Aklujkar and Hideyo Ogawa

2012 *Studies in Sanskrit Grammars (Proceedings of the Vyākaraṇa Section of the 14th World Sanskrit Conference, 1-5 September 2009, Kyoto University, Kyoto).* New Delhi: D. K. Printworld.

Dwarikadas Shastri

1983 *The Mādhavīyā Dhātuvṛtti* [A treatise on Sanskrit roots based on the *Dhātupāṭha* of Pāṇini] by Sāyaṇācārya. Second edition. Kamachha, Varanasi: Tara Book Agency.

Houben, Jan E. M.

2009 Pāṇini's grammar and its computerization: a construction grammar approach, in Kulkarni and Huet 2009: 6-25.

2012 Studies in India's Vedic grammarians, 1: Nārāyaṇabhaṭṭa's *Prakriyāsarvasva* and Pāṇini's *Śe*, in Cardona, Aklujkar, and Ogawa 2012: 163–194.

Huet, Gérard, Amba Kulkarni, and Peter Scharf

2009 *Sanskrit Computational Linguistics: First and Second International Symposia, Rocquencourt, France, October 2007; Providence, RI, USA, May 2008; Revised Selected and Invited Papers.* Lecture Notes in Artificial Intelligence 5402. Berlin-Heidelberg: Springer-Verlag.

Jha, Girish Nath

- 2010 *Sanskrit Computational Linguistics: 4th International Symposium, New Delhi, India, December 2010, Proceedings*. Lecture Notes in Artificial Intelligence 6465. Berlin; Heidelberg: Springer-Verlag.

Kāśikā *Kāśikāvṛtti*. See Sharma, Aryendra, Khanderao Deshpande and D. G. Padhye

Kulkarni, Amba and Gérard Huet

- 2009 *Sanskrit Computational Linguistics: Third International Symposium, Hyderabad, India, January 15-17, 2009, Proceedings*. Lecture Notes in Artificial Intelligence 5406. Berlin; Heidelberg: Springer-Verlag.

Mbh. *Mahābhāṣya*. See Abhyankar, K. V.

MDhV. *Mādhavīyā Dhātuvṛtti*. See Dwarikadas Shastri.

Pansikar, Vasudev Lakshman Shastri,

- 1985 *The Siddhāntakaumudī with Tattvabodhinī commentary of Jñānendrasarasvatī and Subodhinī commentary of Jayakṛṣṇa*. [Tattvabodhinī-samākhya-vyākhyā-saṃvalitā śiddhāntakaumudī nāma Bhaṭṭojidīkṣita-praṇītā pāṇinīya-vyākaraṇa-sūtra-vṛttiḥ. Jñānendrasarasvatī-viracitottarakṛdantāntaṃ Tattvabodhinī-vyākhyā, svara-vaidikyoḥ Jayakṛṣṇakṛtā Subodhinī. Vāsudevaśarmaṇā ṭippaṇyādibhiḥ pariṣkṛtā saṃśodhitā ca.] New Delhi: Meharcand Lachhmandass Publications.

Pr. *Pradīpa*. See Vedavrata.

Scharf, Peter M.

- 2008 Pāṇinian accounts of the Vedic subjunctive: let *kṛṇvaite*. *Indo-Iranian Journal* 51.1: 1-21.
- 2010 Rule-blocking and forward-looking conditions in the computational modeling of Pāṇinian derivation, in Jha 2010: 48-56.
- 2011 On the semantic foundation of Pāṇinian derivational procedure: the derivation of *kumbhakāra*. *Journal of the American Oriental Society* 131.1: 39-72.

- 2012 Rule selection in the *Aṣṭādhyāyī* or is Pāṇini's grammar mechanistic?, in Cardona, Aklujkar, and Ogawa 2012: 319–50.
- Sharma, Aryendra, Khanderao Deshpande and D. G. Padhye
 1969-70 *Kāśika, A Commentary on Pāṇini's Grammar by Vāmana & Jayāditya*. Two volumes. Sanskrit Academy Series 17, 20. Hyderabad: Sanskrit Academy, Osmania University. Reprinted in one volume, 2008.
- Shivamurthy Swamiji
 2010 *Gaṇakaṣṭādhyāyī*. Version 6.5 revised. <http://www.taralabalu.org/panini/>
- Siddhāntakaumudī See Pansikar 1985.
- SK *Siddhāntakaumudī*. See Pansikar 1985.
- Vedavrata
 1963 *Śrībhagavatpatañjaliviracitaṃ vyākaraṇa-mahābhāṣyam [śrīkaiyyaṭakṛtapradīpena nāgojībhaṭṭakṛtena bhāṣyapradīpodyotena ca vibhūṣitaṃ]*. Part 4 (adhyāyas 5-6). Rohatak: Haryana Sahitya Sansthan.