A Brief History of Sanskrit-Pedagogy (with an aim to enchancing the effectiveness of self-pedagogical practice)

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1. Introduction

That Sanskrit is a language that no one ever entirely masters, no matter how much time they devote to it, is a common observation. The need for self-directed learning never ceases. The continual need to explicate obscure grammatical and lexical points is attested to in the numerous commentaries on Sanskrit texts. The extensive variant forms of Whitney's (1885) list of verb roots attests to the difficulty of mastering the language over all the historical epochs it encompasses. Sanskrit is thus the language for self-study par excellence and this is what this study focuses on. The goal here is to delineate ways in which, through the presentation of grammar and vocabulary, Sanskrit can be made simple and memorable for the learner.

The main thesis of this study is that the pedagogical presentation of Sanskrit matters, that certain ways of presenting the language to learners, usually self-learners, are more effective than others. Furthermore, further improvement is possible beyond the traditional Indian mode of presentation as well as subsequent more linguistic modes that build upon Whitney's approach. This standpoint is made most emphatically in Bucknell (1994) which argues that the presentation of knowledge about grammar and vocabulary should be provided in a way that reduces the inherent complexity of it, so that it can be more easily remembered and put to practical use while reading texts, which is the main activity that most Sanskrit learners outside of India put the language to." [1] Furthermore, research in second language acquisition that has focused mostly on acquiring the English language will be of help in this regard

1 Bucknell, 1994, ix-xv.

2. History of Sanskrit Pedagogy and Self-Pedagogy

Classical Approach: Lanham Reader, Dictionary & Grammar

The texts used to teach Sanskrit in the past provide a starting point for a history of Sanskrit pedagogy and self-pedagogy. From the late nineteenth century until the 1970s, Sanskrit pedagogy was based on the pedagogy of the classical languages Greek and Latin. An inductive approach was employed in which a student was handed reader, a dictionary and a grammar from which the student would figure out the language for themselves with periodic guidance from a teacher. The cornerstones of this approach were Lanham's reader *A Sanskrit Reader; Text and Vocabulary and Notes* (Lanham, 1884), Whitney's *Sanskrit Grammar, Including both the Classical Language, and the older Dialects, of Veda and Brahmana* (Whitney, 1889) and the Monier-Williams dictionary (Monier-Williams 1872). Perry's pedagogical grammar *A Sanskrit Primer* (Perry, 1885) also figured into this approach.

Dictionaries

For Sanskrit to English translation work, a Sanskrit to English dictionary of course is essential. Nowadays, web-based dictionaries can obviate some of the need for an actual physical paper dictionary in the form of a book. Dictionaries in book form require a time-consuming process of flipping through the pages of a dictionary to look up a word. However, once one arrives at a word, if one tarries for a moment and smells the lexical roses, one can encounter related words and definitions as well, so there are still some benefits of book-based dictionaries. [2]

The two main Sanskrit to English dictionaries used nowadays are the Monier-Williams dictionary (abbreviated MW hereafter) and the Apte dictionary. [3] MW uses transliteration, whereas Apte is entirely in Devananagari. MW draws words from a wider variety of sources and provides more detail in dictionary entries. [4] MW includes compounds and derivative words and is mainly based on the so-called "St. Petersburg Lexicon." MW also treats Vedic words in more detail than Apte as well. Apte focuses more on words from classical drama and poetry, providing quotes from these works as well. Apte is also better for philosophical terms and technical terms from Indian *sastras* or sciences. Apte enumerates all the various meanings of a word in a long list. Apte comes in a smaller student size as well with about 60% as many words. Smaller dictionaries such as Madonnell's and Apte's *Concise Sanskrit-English Dictionary* do have some advantages. First, it is easier to look up words. Only the primary meanings of a word are listed. In bigger dictionaries it is more difficult to pick out meanings because the list of meanings given is quite long. At the extreme end of coverage, there is an ambitious comprehensive dictionary project that aims to cover the entire Sanskrit language with an estimated 2 million words. This project began in 1948 and is still not even close to being finished, having not even completed the first letter of the alphabet. Because the dictionary uses a fixed corpus of texts to derive words from, whole areas of knowledge are sometimes excluded such as Buddhist Tantra, which remains to be added in the future.

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2 Computer searches for a subset of the letters of a word (e.g. 'vid' from 'vidanti') can also reveal related words. In fact, a more sophisticated dictionary lookup mechanism beyond that of sanskritdictionary.com can be employed, that reveals the many lexical possibilities that exist as you enter letters in the search box, narrowing the possibilities down as more letters are added to the search. This dictionary lookup has been used in the Sealang Thai dictionary created by computer scientist Doug Cooper (http://sealang.net/thai/).

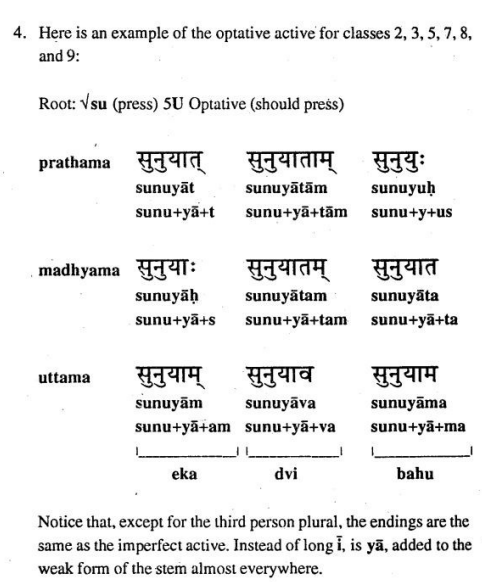
3 The enumeration of the features and strong and weak points of dictionaries is from Reigle and Reigle, 2006, 5-6.

4 Wikner (1997) provides an explanation and exercises on using the MW dictionary.

Pre-Primers

There is a class of Sanskrit study books that are very simple and can be used as a basic introduction to the language. These books can be characterized as ‘pre-primers’ and are good to study before diving into one of the principle pedagogical grammars. [5] The original textbook of this variety was Ballantyne’s *Sanskrit Grammar* of 1851. Tyberg’s *First Lessons in Sanskrit Grammar and Reading* (1941) was essentially a revised version of Ballantyne’s work. [6] First published by the Theosophical Press in 1941, the work underwent successive revisions and printings right up to 1964.

More recently Thomas Egene’s *Introduction to Sanskrit* (1989) in two volumes provides an easy to grasp survey of Sanskrit grammar of this pre-primer variety. [7] It provides answers to exercises, so it is good for self-study. Towards this end, it starts providing passages from the *Bhagavad Gita*, so it transitions into second year books based on readings in the Gita, to be covered shortly. The presentation is invitingly simple (which includes even the font-size and arrangement of material on the page) so this pre-primer seems to have the status of a sort of lifeboat or life-jacket that students put on when they feel they are drowning in the more complicated full primers described below. Egenes (1990) provides a whole supplementary book devoted to learning how to write the Devanagari script for Sanskrit. The second volume is the real keeper, providing a nice transition volume before full mastery of a primer such as Goldman. Among the features worth emulating is providing two elements in each slot of grammatical paradigms, one with the stem and endings separated (this plus this plus this…) and one after they have been combined by applying sandhi rules (see diagram above). [8]



4. Here is an example of the optative active for classes 2, 3, 5, 7, 8, and 9:

Root: √**su** (press) **5U** Optative (should press)

prathama	सुनुयात्	सुनुयाताम्	सुनुयुः
	sunuyāt	**sunuyātām**	**sunuyuḥ**
	sunu+yā+t	**sunu+yā+tām**	**sunu+y+us**
madhyama	सुनुयाः	सुनुयातम्	सुनुयात
	sunuyāḥ	**sunuyātam**	**sunuyāta**
	sunu+yā+s	**sunu+yā+tam**	**sunu+yā+ta**
uttama	सुनुयाम्	सुनुयाव	सुनुयाम
	sunuyām	**sunuyāva**	**sunuyāma**
	sunu+yā+am	**sunu+yā+va**	**sunu+yā+ma**
	eka	**dvi**	**bahu**

Notice that, except for the third person plural, the endings are the same as the imperfect active. Instead of long **ī**, is **yā**, added to the weak form of the stem almost everywhere.

Leidecker’s *Sanskrit Essentials and Language and Grammar* (1934) provides a high-level overview of Sanskrit and a map of the language that helps orient the student before diving into the details. [9] One of the most useful features of this book is its simple lists, such as the list of around 300 common verb roots with a simple gloss of their meaning. These verb roots are the basic building blocks of Sanskrit and Leidecker shows in a very simple fashion how nouns and verbs are built from these verb roots.

Primers

Moving on from pre-primers to primers, one finds first Bhandarkar’s *First Book of Sanskrit* (1864) which follows Panini by providing Sanskrit rules that are essentially translations of Panini. [10] There is a first book, a second book and also a book of answers for the first book’s exercises. These

5 Reigle and Reigle, 2006, 8-11.
6 Reigle and Reigle, 2006, 8-9.
7 Reigle and Reigle, 2006, 8-10
8 Egenes, 1989, 168
9 Reigle and Reigle, 2006, 9-10
10 Reigle and Reigle, 2006, 11-13.

volumes are old-school, but their simplicity can't be beat. With huge numbers of simple sentences and reading passages, Indian and western modes of grammatical explanation co-exist here as a fusion at the surprisingly early date of 1864 which predates Whitney: "while it [the grammar] adopts the terminology of the English grammarians of Sanskrit... it strictly follows Panini, and most of its rules are mere translations of his sutras." [11]

Following on from Bhandarkar's primers, Antoine's *Sanskrit Manual for High Schools* (1953) provides more explanations, placing stress on translation from English to Sanskrit rather than the usual translation from Sanskrit to English. [12] This grammar provides explanations of how cases are used that are clearer than those of Whitney or Kale and also comes with many useful charts. The passive is explained by having students transform sentences from the active to the passive and back to the active again.

Perry's *Sanskrit Primer* (1885) was based on a German primer by Buhler but Perry follows Whitney in his presentation of grammar, so is best used in conjunction with this more comprehensive reference grammar. [13] Perry tells students that the grammar can be finished in 16 to 17 weeks working at the pace of three lessons per week. After that, it is suggested that the student move on the Lanham reader.

Gonda (pronounced "honda") (1963) provides a new simplicity and clarity to the presentation of Sanskrit grammar. [14] This reflects a trend in native Indian grammatical explanation over thousands of years, as we will see, from the great grammarian Panini's original classical exposition to successive abstracts, and then abstracts of abstracts, of his exposition. Although Gonda's greatest contribution is arguably a simplicity of exposition that seems to have influenced all future grammars, it was also a pedagogical grammar that aimed at a very select group of well-qualified learners, namely linguists, complete with informative but limited exercises and translation passages for them. Mayrhofer's *A Sanskrit Grammar* (1972) has a similar clarity of exposition aimed at linguists but does not provide any pedagogical accoutrements.

From the 1970s, an explosion of Pedagogical Grammars

Beginning in the 1970s (or even before with the simple grammars produced by the Theosophical Society) and stretching through the 1990s there was an explosion of Sanskrit pedagogical grammars aimed at classroom use due apparently to increased interest in Indian religion and culture during these years. Hart's *Rapid Sanskrit Method* (1972), one of the first, is a short and simple Sanskrit grammar meant to be a one semester introduction to the language, meant to be followed after by an extensive reading strategy focusing on "rapid" reading of texts. [15] Hart apparently was the first to provide long lists of select verb roots transformed into a given grammatical form, such as the perfect, in the section devoted to the form. This helps the student intuitively grasp and recognize the form at a glance. Egenes (1989) adopts this practice as well. [16]

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11 Reigle and Reigle, 2006, 13.
12 Reigle and Reigle, 2006, 12, 14.
13 Reigle and Reigle, 2006, 11, 13-14.
14 Reigle and Reigle, 2006, 21-22
15 For extensive reading in English language pedagogy, see Nation and Day.
16 For a long list of verb roots transformed into the perfect, see Hart, 1972, 163-164, and Egenes, 1989, 159-161.

Coulson's *Sanskrit: An Introduction to the Classical Language* is good for self-study because the answers to exercises are given in appendices. Transliteration is used extensively, together with a notation to show what has been deleted by sandhi rules. The example sentences as well as sentences in the exercises come from actual classical Sanskrit drama texts such as the *Mudhra Raksasa*. This book also contains a whole section on how to read a commentary with an actual example from the famous commentator Mallinatha's commentary on the famous dramatist Kalidasa's play *Kumarasambhava*. Many of the explanations go beyond the superficial providing deeper insight. The fifteen chapters of numerous exercises with an answer key provide a great intensive and extensive reading opportunity. Coulson himself suggest that the student translate first from Sanskrit to English and then later translate from English to Sanskrit. In between, one can enage in intensive reading by re-reading the Sanskrit to re-derive and recall the meaning.

Goldmans and Sutherland's *Devavanipravesika: An Introduction to the Sanskrit Language* (1980) charts new territory for pedagogical grammars. It employs traditional Sanskrit grammatical terminology, and native *devanagari* script as well after an initial period of acclimatization. Grammatical paradigms for declension and conjugation are interspersed using the traditional Indian manner of presentation as well as the traditional *vigraha* approach to analyzing compounds. Perhaps most importantly, readings are simplified versions of Ramayana narrative that increase gradually in lexical and grammatical complexity to the point that in the final reading passage, the student is translating text that is nearly the same as the original Ramayana. These controlled vocabulary readings increases student vocabulary and grammatical knowledge in a gradual incremental fashion which, as we will see, mirrors contemporary extensive reading approaches to language learning as described in Nation (2013), for instance. The table of contents serves as a memorable list of grammatical topics that references into frequently as one begins to tackle real texts and needs to review grammar. The vocabulary lists are a sort of scaffold that one soon sees the limitations of when one begins to begins to break words into component parts and synthesize words up from these component parts.

Maurer's grammar (1995) has a reputation for being student friendly, even explaining English grammar, and is intended to be taught slowly over a two year period, explaining everything along the way. [17] It culminates, as other pedagogical grammars do, in reading passages from the Nala epic. Killingsley's grammar (1996) takes an even more gradual approach. It is good for repeated exposure to simplified Sanskrit sentences, increasingly the complexity and difficult of the material presented only very gradually. Towards the end, the grammar introduces reading passages from the Hitopadesa. One again, reading glossaries like one 'reads the dictionary', here the glossary of a pedagogical grammar, checking off the words one knows and making flash cards for those one does not know, can be an effective and cheap language learning strategy.

Deshpande's grammar (1997) is a very nuts and bolt type of grammar with a useful extensive and basic vocabulary featuring simple grammatical sentences with student translation exercises in both directions (Sanskrit to English, English to Sanskrit). [18] All texts are controlled artificial texts with no texts from actual Sanskrit works such as that which Coulson features. Many of its explanations are superior to those of others, such as the explanation of participles, the locative and genitive absolute or of nominal compounds. This pedagogical grammar seems particularly useful for the student who wants to go beyond reading and listening to Sanskrit texts and develop active skills of writing and conversing in Sanskrit.

17 Reigle and Reigle, 2006, 12, 17.
18 Reigle and Reigle, 2006, 12, 17-18.

Perhaps the greatest contribution of Ruppel's *Cambridge Introduction to Sanskrit* (2017) is simpler prose descriptions of grammar that are also conveyed in extremely concise and useful video presentations grammar which is truly an important innovation of this grammar. These videos can also be listened to as audio after they are converted to MP3 by an app, allowing Sanskrit grammar to be reviewed while walking, exercising or even shopping (for the completely Sanskrit-obsessed learner). Answers are given for all exercises and simple reading passages guide the student gradually to reading comprehension of more difficult passages. There are also flash cards associated with the book available from the book's webpage that can be practiced from one's mobile phone pointing to future directions of more personalized language self-pedagogy. The concise one line descriptions of various points of grammar provided in the book and the website are extremely useful for review. [19]

Readers, Interlinear Translations and Extensive Reading

Sanskrit readers have been a staple of Sanskrit pedagogy for hundreds of years. The old classic, Lanman's Sanskrit reader (1884), includes the Nala epic from the *Mahabharata* and stories selected from the *Hitopadesa*. both of which have become important sources reading texts in Sanskrit pedagogy. [20] Challenging vedic passages are also included. Even before Lanham's reader, the Nala epic was employed for pedagogy in Monier-Williams and Milman (1879), with a full glossary to make dictionary lookup and reading easier. Takahashi (1994) even goes as far as republishing the whole Nala epic with glossary in roman script instead of devanagari script to make things even easier for the beginning student. Since the glossaries to these readers are relatively short, one can even 'read the dictionary' to help acquire vocabulary, [21] checking off the words one is already familiar with, in what amounts to yet another poor man's (or woman's) language learning technique.

Besant and Das's (1905) version of the Bhagavad Gita is a good second year reader, once grammar has been mastered. [22] It is written in comparatiely easy epic Sanskrit of the Mahabharata with word-by word meanings which saves the student time doing dictionary lookups. It also provides full analysis of nominal compounds or *vigraha*. In its use of what is basically a word-by-word interlinear translation, the book is said to be good for getting student to think in Sanskrit. In this it is said to excel over Winthrop Sargeant's (2009) more well-known detailed translation and explanation of the Bhagavad Gita.

The best of this inter-linear translation variety of reader is Scharf's *Ramopakhyana - the Story of Rama in the Mahabharata* (2003) which at 945 pages provides the most material for study of any Sanskrit reader. [23] This reader comes closest to following the traditional Indian approach to learning Sanskrit through reading texts as outlined above and in Gerow (2002). Also unique is the active provision of both pedagogical suggestions for instructors and self-pedagogical suggestions for individual learners, exactly what this study aims to emulate. [24] Unfortunately, the text chosen for this very large reader is derivative and not exactly at the pinnacle of Sanskrit literary achievement that a student would most likely want to familiarize herself with. Poetical works by Kalidasa or the

19 The *Cambridge Introduction to Sanskrit* website is located at: https://www.cambridge-sanskrit.org/
20 Reigle and Reigle, 2006, 18-19.
21 Something to do while one is whiling away an hour on the reclining cycle exercise machine in the gym.
22 Reigle and Reigle, 2006, 18-20.
23 Reigle and Reigle, 2006, 18, 20-21.
24 See "Suggestions for Use" section in Scharf, 2003, 65-70.

Kirratajuniya would have been more enticing as a choice. One is left to follow their pedagogical example which is a good one.

How could one create one's own Sanskrit reader of texts? One would have to provide a glossary with word meanings and grammatical functions for every lexical item in the chosen texts. As for identifying the grammatical functions of lexical items, there is one reference work that aims to make this easier for the language learner. Bucknell's *Sanskrit Manual* (1994) provides a concise description of Sanskrit grammar and a set of verb identification tables for 423 verbs found in the Lanham (1884) reader, excluding those that are found in exclusively Vedic texts. The last four tables in the book (27-30) are the most important:

- **Table 27**, the Principal Parts of Verbs, is much like Whitney's (1885) reference work on verb roots but simpler with all the information on variant forms during different historical eras removed. Unlike Whitney (1885) the limited information with a simple presentation is easier to comprehend and memorize for language-learning purposes. Egenes (1989) has a similar, even more stripped down, verb principle parts reference in an appendix.

- **Table 28**: the verb stems with an entry such as "296 per" which provides a verb tense (perfect) and points to verb 296 among the 423 verbs in the 'principle parts of verbs' table. [25] Verb stem recognition identifies the verb as a vocabulary item that can be mapped to a meaning or mre refined sense (denotation, connotation). Verb stem recognition is a subset of the more general problem of word recognition which includes determining: 1. core word meaning, and 2. grammatical function. Once one recognizes the verb stem, one can locate the exact meaning and sense of the verb by looking it up in the dictionary, if one has not already memorized it.

- **Table 29**: verb endings with an entry such as "Aor Act 3 sg" provides a tense (aorist), a mood (active), a number (singular). Verb ending recognition identifies the grammatical function of the verb. The Digital Corpus of Sanskrit (DCS) provides this for a core set of important texts, but when these are exhausted the student will can use this table as an aid. The student can also test herself by splitting a sloka into lexical parts as DCS does. Scharf (2003) which resembles DCS (but came first and is the likely model for DCS) follows this approach of suggesting that a student use their fully parsed slokas to test themselves on language skills such as applying sandhi rules to split the text into lexical items. [26]

- **Table 30**: the noun/adjective endings with an entry such as "6[29] acc pl" provides the case (accusative) and number (plural) and points to a noun declension paradigm in a separate set of tables (declension 29 of table 6).

The basic idea behind the learning strategy of "extensive reading" and Nation's *Learning vocabulary in another language* (2013) is that to acquire word recognition and knowledge essential for reading comprehension, one must encounter a word repeatedly and develop an understanding of what the word means in different contexts. Towards this end a strategy of extensive reading is employed with a controlled vocabulary of simple high-frequency words with the reader gradually expanding the depth and breadth of their vocabulary into more refined but less frequent words. How to put this into practice in Sanskrit in which the definitions and boundaries of a word are less clear cut, in for instance a

25 Bucknell, 1994, 68.

26 See "Suggestions for Students" in "Suggestions for Use" section in Scharf, 2003, 66-69.

nominal compound where grammatical knowledge is also needed for understanding, is not so clear cut. One perhaps has to divide word recognition into two steps: 1. stem recognition (Bucknell's Table 28), and 2. ending recognition (Bucknell's Tables 29 and 30).

Using a reader to study Sanskrit has to go hand-in-hand with building up an extensive vocabulary to facilitate automatic word recognition in reading. By repetitively reading and listening to the passages, in an activity that might be termed 'intensive' listening or reading, basic vocabulary can become progressively less difficult to comprehend. Here it will be proposed essentially that the age-old Indian indigenous practice of repetition and memorization as presented in the next section, might have the same ultimate result in language acquisition as extensive reading's repetitive exposure to a word in progressively more lexically complex settings. In a later section of this paper, an approach to exploiting Sanskrit language learning materials towards this end of vocabulary acquisition will be provided.

Traditional Indian Approach

Gerow's *Primary Education in Sanskrit: Methods and Goals* (2002) presents the details behind the teaching method used in the Indian education system as he encountered it as a student attending the Mysore Sanskrit College in his youth. Gerow contrasts the success of traditional Indian pedagogical methods compared to western methodologies ("how much effort goes into how little result") (664) which indicates that perhaps at least some aspects of Indian methodology are worth borrowing, granted that in the Indian case language instruction proceeds from a much earlier age well-suited to language acquisition for many more years.

The early stages of the traditional Indian learning process consist of memorization in various forms with the memorized information gradually being put into use. The highest level and culmination of the whole educational process is known as 'akanksapatha' which consists of a six-fold process that bears great resemblance to the textual decomposition and explanation found in traditional Sanskrit commentaries. The six states are known as:

1. vyakarana (parsing)
2. padarthokti (glossing)
3. vigraha (analysis)
4. vakyayojana (prose reordering)
5. akanksa
6. visesokti

The first stage of 'vyakarana' consists of the grammatical parsing of the text, identifying the basic words of the sloka, and determining the stem, number, case and gender for each word. This first stage remains implicit in western grammars and consists, as it would in reading any classical language such as Greek or Latin, in mapping the memorized vocabulary list of the pedagogical grammar to the words of the text while also using memorized grammatical paradigms for noun declensions and verb conjugations to understand the inflected endings of the words. As 'padaccheda' or 'word discrimination' this stage also corresponds to the first basic function of Sanskrit commentaries.

The second stage of 'padarthokti' (glossing) consists of word-for-word translation of the text. The third stage of 'vigraha' consists of the rewriting of the Sanskrit text of grammatical chunks such as nominal compounds which have much of their meaning implicit in terms of the grammatical way that

elements of the compound modify other elements of the compound, in a form that makes the implicit explicit. This is now considered an explicit part of western textbook approaches to learning Sanskrit and is included in Goldman's first year pedagogical grammar, for instance. This stage also corresponds to the second basic function of Sanskrit commentaries

The fourth stage of 'vakyayojana' (prose reordering) consists of the creating of a more natural linear contiguous ordering of the text of a sloka along semantically meaningful lines. Since the sloka is poetry that conforms to poetic meter, the author has to often make meaningful chunks of text non-contiguous to conform to the meter they are working with. Whereas meter may be useful in memorizing the poetic text,, prose reordering, a sort of de-metricizing of poetic text, is useful teachnique to get at the meaning of that text.

The fifth stage of 'akanksa' is the most complicated of the stages and is named after the whole process. It consists of the teacher going through a process of asking rhetorical socratic questions about the phrases in the sloka to bring out to elicit from the student an understanding of how grammar and vocabulary combine to form meaning. English language teachers will be familiar with this technique as well, for instance in the phrase "the red ball" the teacher would ask "what kind of ball?" and the students would answer "red." In the process of asking questions, the questions get progressively more complicated and longer and more information from the previous question is brought along from the previous answer, thus vocabulary is repeated thus facilitating memorization. This whole process is worth systematizing as a formal drill to facilitate its application as it has been for the teaching of English and if time permits this paper will address this as well. It is worth noting that this is a technique that can be applied by a teach on the fly with little preparation to any learning text. Such techniques are gathered together into a handy little volume by pro-lingua. Since this technique consists of a dialogue in simple Sanskrit between teacher and student it also stands as a proto-conversation in spoken Sanskrit. When we met informally in a reading group with Ian we played a game of asking twenty questions to indentify something that a student was thinking of. This too is a simple Sanskrit conversational drill or exercise re-purposed as a game, so games could figure into this dimension of Sanskrit learning.

The sixth and final stage of 'visesokti' (mention of particularities) is higher-order literary analysis proper, corresponding to the final higher order function of commentaries. This stage matches best what we do in our weekly seminar and thus will be addressed in a later section that deals with this topic. Progress between primary and intermediate education in the reading of kavya is is marked by a move from *sabda* (word, sound) to *artha* (meaning) (674-5).

According to the traditional Indian approach to learning Sanskrit two fundamental strategies are employed, memorization and translation: "the student's native language is utilized in order to rationalize the target language, or reliance is had on mechanical and repetitive drills intended to inculcate an ability, before it is put to any use at all" (664). At the beginning level, rote memorization is applied in three areas: lexicon, grammar and the metrics of poetry. The last element of metrics and poetry is only an introduction to the subject, only taken up fully at the intermediate "kavya" level of instruction. Dictionary learning from the Amarakosa dictionary (1808) consists of memorizing 'versified vocabulary' [27] This consists of, "of memorizing lists of near synonyms, each word serving to anchor its neighbors in recall. Memorization of verse-accompanied only by an occasional gloss in the

27 Reigle and Reigle, 2006, 33-34.

student's native language-cultivates both pronunciation and respect for the phrasal integrity of the language" (664). Pattern drills, as found in western language instruction as well, are used for grammatical memorization, being based on a text known as the *sabda-rupavali*, or *rupavali* for short, that lists the inflected forms of grammatical paradigms in a table format much like western pedagogical grammars. (666) The learning of syntax proceeds through a Socratic-like question-answer dialogue between teacher and student in which the grammatical function of words is drawn out. Here Sanskrit is reduced to a basic conversational level that perhaps served as the basis for so-called "conversational Sanskrit," resembling in many respects the dialogues of *Conversational Sanskrit: A Microwave Approach* (1984), the most substantial textbook to be found in this area. (668)

At the intermediate "kavya" level of instruction, full attention is given to reading poetic texts and uncovering the meaning of these texts through translation. In the previous level memorization and syntactic pattern drills have instilled in the student the meaning of the cases (karika) but at this level this ingrained knowledge is finally put to use in reading the classics Mahakavyas of Sanskrit poetry such as Kalidasa's *Raghuvamsa, Kumarasambhava,* his *Meghaduta* and Dandin's *Dasakumaracarita*. (669).

The traditional Indian approach to learning Sanskrit is strongly associated with the Panini and his grammar the Astadhyayi. [28] In fact though, it is not his grammar that is used but rather later derivatives of it known as the *Siddhanta-kaumudi* (1904-1907) and the *Laghu-kaumudi* (1849). [29] Although it is claimed that in the past the sutras of Panini's text itself were memorized, and there have been attempts to revive such a tradition, for quite a while it has actually been the "drastic reordering" or rearrangement of Pannian sutras in a work known as the *Siddhanta-kaumudi* that is memorized. [30] The language learner is better serve by the grammatical categories such as noun, verb and indeclinable in these reordered texts that emanate from such new topical foci as, "the descriptive categories of the grammar-morphophonemics, inflectional morphology, stem-formation, Vedic 'irregularities'." For the language learner the new grammatical structure that emerges from these works is more useful than the traditional order of sutras in Panini's original grammar which takes a more "purely methodological emphasis" in which "economy of presentation and demonstrative rigor" take priority. [31] In these works a conservative care is taken only to reorder the sutras and not to reformulate the sutras in a manner more suited for the new order. This actually creates new problems that are addressed, in turn, by new commentaries. [32] To aid in the memorization of, "the patha of kaumudi" even further abstracts or abridgments from the re-orderings have been made such as the *Laghu-kaumudi* which filter out the more important sutras to be memorized, leaving out the exceptions and grammatical points mentioned only one time ('nonce phenomena'). In the Indian traditional method the *Laghu-kaumudi* is used at lower levels and the full *Siddhanta-kaumudi* at higher levels. The process of deriving grammatical forms using grammatical rules is a painstaking process:

> "The portions of the Kaumudi that are, in the Mysore curriculum, of greatest moment (apart from some basic sandhi rules) are those that concern the "regular" noun and verb paradigms. The masculine short -a stems, as no Sanskritist will find surprising, are taken up first. For the typical stem Rama-, the first-occurring form is the nominative singular: Rama-h. In principle,

28 Reigle and Reigle, 2006, 33-34.
29 Reigle and Reigle, 2006, 33-34.
30 Gerow, 2002, 674.
31 Gerow, 2002, 674-675.
32 Gerow, 2002, 675.

> the full Kaumudi will have cited, in preparation for this singular effect, all the sutras that must be presumed in order to "generate" that form-not only certain sandhi rules, but "definitions" such as "stem," "ending," "singular," etc., certain interpretive rules (paribhasa), which tell us how to read the sutras themselves, and the inventory of possible inflections, of which -s (-h) is one. The form Ramah is finally able to be quoted after the 187th rule in Bhattoji's rearrangement.39 This done, we are ready to confront the nominative dual form Ramau, which requires just one additional rule, no. 1" [33]

As we will see, the traditional Indian approach to reading the versified sloka presented in Gerow (2002) is reflected in the unified pedagogical approach to reading taken in the UH Sanskrit seminar, which is analyzed next.

4. Translating the Sloka: Unified Pedagogical Approach

Process tracing is used here as a theory-building mechanism. The advanced Sanskrit seminar at the University of Hawaii at Manoa engages in a structured process of thinking aloud in the process of decomposing the verses (slokas) of classical Sanskrit poetical works, a process which eventually after much deliberation arrives at a suitable translation. This process resembles what has become known as a “process tracing” methodology in social sciences which in its original form consists of a protocol pof “thinking aloud” to elicit data in the form of analytical verbalization which is then transcribed and coded, that is assigned categorizations to bring out structure in the data. This formal methodology, here is only used as an informal guide, with a more formal treatment available in Beach and Pedersen (2019) and Bennett and Checkel (2015).

The first step of learning Sanskrit in a seminar setting is the selection of a text to read. The professor uses his knowledge of the Sanskrit textual world together with his familiarity with student competence level and research interests to select a text. Here the problem of selecting a text by the student by herself without the advice of a pundit or professor is addressed. One key criteria of text selection for such seld-pedagogy is the existence of suitable materials for self-learning. We construct here a table that assembles together the currently known Sanskrit materials for self-pedagogy. Central to this table are the extensive versions of Sanskrit classics edited and translated by M.R. Kale each of which contains the Sanskrit text and lengthy literal translation of each *sloka* together with an important commentary on the work. Also central is the labor-saving device of the Digital Corpus of Sanskrit (DCS) which provides: 1. each Sanskrit sloka in roman script, 2. a chunking of text into nominal compounds, for each distinct lexical item, 3. its grammatical function (karika), and 4. uninflected stem form, together with 5. a lookup from the Monier-Williams Sanskrit dictionary for that stem form. The student can use the information in DCS and Kale’s translation to reverse-engineer or parse the sentence arriving eventually, after a process of deliberation, at a suitable translation. This process here will simply be called the “puzzle-solving recipe” which consists of the following steps:

33 Gerow, 2002, 675.

Puzzle-Solving Recipe for Slokas of Sanskrit Maha-Kavya

1. Copy out sentence in roman script from DCS or Gretil.
2. Bracket nominal compounds to get lexical items/chunks.
3. Label lexical items with grammatical function.
4. Put parentheses around semantical chunks in Kale's English translation.
5. Locate these English semantic chunks in the Sanskrit text
6. Label contiguous Sanskrit text chunks with the English semantic text chunks as glosses.
7. Note how the English semantic text chunks map to Sanskrit text chunks, in a possibly non-linear, non-contiguous fashion.
8. Label each Sanskrit lexical item with possible English glosses, using DCS and Pundit-Professor's knowledge of Sanskrit.
9. Identify core simple sentence structure of subject, verb and object (S-V-O).
10. Use the knowledge from the resulting decomposition of the sloka to string lexical items into phrases and phrases into a translation for the whole sloka.

Steps #6 through #8 are the critical steps in which the Pundit-Professor plays a critical irreplaceable role. The process of self-pedagogy must try to imitate what he does and this is where process tracing as a methodology comes in. Although, I have not engaged in a formal study using process tracing, I have taken extensive notes during Sanskrit seminar for many semesters which constitute raw data for applying a process tracing methodology at least in spirit to arrive at some understanding of how the Pundit-Professor facilitates steps #6 through #8. These notes will now be used to trace the process of translation in the "puzzle-solving recipe" given above. First, after text selection self-pedagogy materials as given in the following table must be assembled:

Title	Kale	DCS	Clay	Other
Hitopadesa of Narayana	X	X	X	
Panchatantra of Visnusarman	X	X	X	
Abhijnanasakuntalam of Kalidasa	X		X	
Meghadūta of Kālidāsa	X	X	X	
Kumarasambhava of Kalidasa	X		X	
Ritusamhara of Kalidasa	X			
Vikramorvaśīyam of Kālidāsa	X			
Mālavikāgnimitra of Kālidāsa	X			
Kiratarjuniyam of Bhāravi	X	X		M2, R1
Mrichchhakatika of Sudraka	X		X	
Dasakumaracarita of Dandin	X		X	
Kādambarī by Bāṇa	X			
Niti And Vairagya Satakas Of Bhartrhari	X			
Priyadarśikā of Srī Harṣadeva	X			
Ratnavali of Srī Harṣadeva	X			
Pratima Nataka of Bhasa	X			
Fourth & Fifth Tantras of Vishnusarman	X			
Ramayana of Valmiki		X	X	IS2

Mahabharata		X	X	
Buddhacarita of Aśvaghoṣa			X	IS1
Yoga Sutras of Patanjali				
Arthasastra of Kautilya		X		T
Nitisara of Kamandaki				E, M1
Manusmṛti				T
Bṛhatkathāślokasaṃgraha of Budhasvāmin			X	T
Tarka-Sangraha of Annambhatta				T
Kāvyālaṅkāra of Bhamaha		X		T
Kāvyādarśa of Daṇḍin		X		T

ANNOTATED BIBLIOGRAPHY OF ESSENTIAL SELF-PEDAGOGY MATERIALS

[IS1] Aśvaghoṣa., and Irma Schotsman. *Aśvaghoṣa's Buddhacarita : the Life of Buddha : Sanskrit Text with Word-by-Word Translation, Melodies for Chanting and Verses in English Grammatical Explanation*. 1st ed. Saranath, Varanasi: Central Institute of Higher Tibetan Studies, 1995.

A word for gloss or 'inter-linear translation' of passages in *Aśvaghoṣa's Buddhacarita*, known as the first of the Mahakavya genre of court poetry. Irma Schotsman's glosses save the student the time of looking up words in the dictionary which allows greater exposure to vocabulary, self-testing of vocabulary, thus serving as a sort of substitute for the language learning methodology of extensive reading of texts with simplified vocabulary advocated in Nation (2013), see below.

[IS2] *Hanuman in Valmiki's Ramayana* (Sanskrit Text of Selected Chapter with Word-by-Word Translation in English) by Irma Schotsman (2002-02-02)

A word for gloss of passages in the Ramayana that include the story of the monkey hero Hanuman.

[R1] Mallinātha., J. A. F. Roodbergen, and Bhāravi. *Mallinatha's Ghaṇṭapatha on the Kirat−Arjuniya*, I-VI. Leiden: E.J. Brill, 1984.

The sole instance of a Sanskrit commentary translated into English, one of the classical commentaries of Mallinatha. Important for understanding what commentaries are doing.

[S] Scharf, Peter. *Ramopakhyana-The Story of Rama in the Mahabharata: A Sanskrit Independent-Study Reader*. Routledge, 2014.

A work of Sanskrit repurposed for self-study. Serves as a model in this respect.

[TB] Tubb, Gary A., and Emery R. Boose. *Scholastic Sanskrit: A Handbook for Students*. American Institute of Buddhist Studies, 2007.

Essential preparatory information for reading the classic commentaries of Mallinatha as well as others.

[G1] Gerow, Edwin. "Primary education in Sanskrit: Methods and goals." *Journal of the American Oriental Society* (2002): 661-690.

Describes the process of traditional Indian Sanskrit education as it existed in India in the 20th century.

[G2] Gerow, E., 2012. *A glossary of Indian figures of speech* (Vol. 16). Walter de Gruyter.

The essential reference for understanding literary figures or ornamentation (*alankara*) in Sanskrit.

[K] Killingley, Siew-Yue, and Dermot Killingley. *Sanskrit*. Vol. 18. Languages of the World. Lincom Europa, 1995.

A concise linguistic description of Sanskrit.

[P1] Pollock, Sheldon. "What Was Philology in Sanskrit?." in *World Philology* eds. Sheldon Pollock, Benjamin A. Elman and Ku-ming Kevin Chang (Cambridge, Massachusetts: Harvard University Press, 2015): 114-136

An overview of the development of the Sanskrit commentary as it relates to the western-derived notion of 'philology'.

[B] Bucknell, Roderick S., ed. *Sanskrit manual: a quick-reference guide to the phonology and grammar of Classical Sanskrit*. Motilal Banarsidass Publ., 1994.

A set of tables with a guiding philosophy that tries to simplify Sanskrit grammar as conceptualized in sets of tables, and that claims to be able to untangle the grammar of any Sanskrit lexical item so that one can assign it an accurate grammatical function label (*karika*).

[RR] Reigle, David and Nancy Reigle. *Sanskrit Language Study: An Annotated Bibliography of Selected Materials in English*. Eastern Tradition Research Institute. 2006. Retrieved on 5/10/2020 from https://docplayer.net/37512279-Bibliographic-guides-sanskrit-language-study-an-annotated-bibliography-of-selected-materials-in-english-eastern-tradition-research-institute.html

An extensive bibliographical essay that covers every variety of Sanskrit language learning aid available in English that has appeared over the last 100 years including rather obscure and hard to find ones.

[N] Nation, I. S. P. 2013. *Learning vocabulary in another language*. Second Edition. Cambridge: Cambridge University Press.

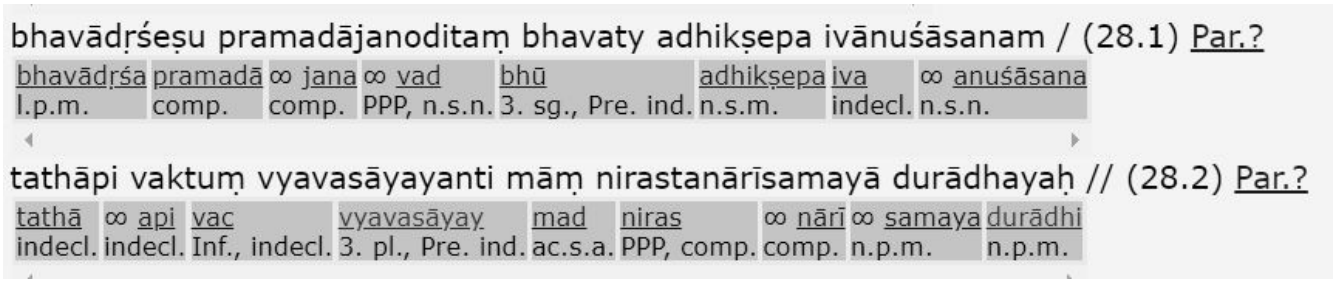
Steps of Sloka Puzzle-Solving Recipe

1. Copy out sentence in roman script from DCS or Gretil:

From Gretil:

bhavādṛśeṣu pramadājanoditaṃ bhavaty adhikṣepa ivānuśāsanam /
tathāpi vaktum vyavasāyayanti mam nirastanārīsamayā durādhayaḥ // // BhKir_1.28

From DCS:

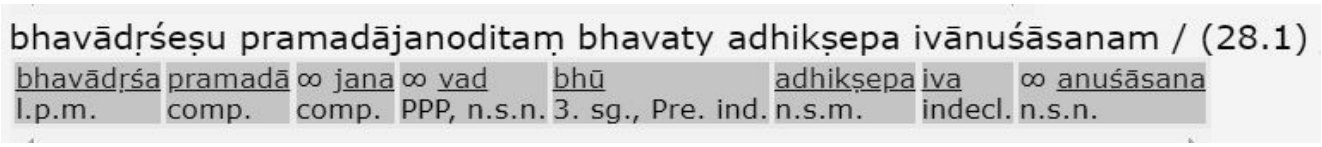


2. Bracket nominal compounds to get lexical items/chunks.

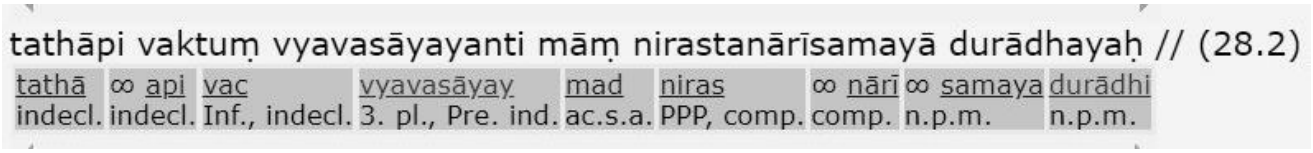
bhavādṛśeṣu [pramadājanoditaṃ] bhavaty adhikṣepa [ivānuśāsanam] /
[tathāpi] vaktum vyavasāyayanti mam [nirastanārīsamayā] durādhayaḥ // // BhKir_1.28

3. Label lexical items with grammatical function.

loc. nom. V nom ind. nom



ind. inf. pap acc. nom. nom.



4. Put parentheses around semantical chunks in Kale's English translation. Locating first Kale's translation of the sloka:

> 28. Advice given by a woman (lit. one of tne woman class) to persons like you is like an insult; still agonising mental afflictions, setting aside (making me overstep) the bounds of conduct proper for women, prompt me to speak.

In the case of the *Kiratajuniya* we also have a translation by Roodbergen, as can be seen in the self-pedagogy material table:

Stanza 1.28

Instruction spoken by women to persons like you is like an insult. Still, worries which cause me to overstep (the boundaries of) womanly conduct impel me to speak up.

Next parentheses are put around the semantical chunks:

> [Instruction] [spoken by women] [to persons like you] [is like an insult]. [Still], [worries which cause me to overstep (the boundaries of) womanly conduct] [impel me to speak up].
>
> [Advice] [given by a woman (lit. of the woman class)] [to persons like you] [is like an insult]; [still agonising mental afflictions, setting aside (making me overstep) the bounds of conduct proper for women,] [prompt me to speak].

5. Locate these English semantic chunks in the Sanskrit text
6. Label contiguous Sanskrit text chunks with the English semantic text chunks as glosses.

loc. nom. V nom ind. nom

bhavādṛśeṣu pramadājanoditaṃ bhavaty adhikṣepa ivānuśāsanam / (28.1)

bhavādṛśa	pramadā	∞ jana	∞ vad	bhū	adhikṣepa	iva	∞ anuśāsana
l.p.m.	comp.	comp.	PPP, n.s.n.	3. sg., Pre. ind.	n.s.m.	indecl.	n.s.n.

[to persons like you] [is like an insult] [Instruction]
[spoken by women]

ind. inf. pap acc. nom. nom.

tathāpi vaktuṃ vyavasāyayanti māṃ nirastanārīsamayā durādhayaḥ // (28.2)

tathā	∞ api	vac	vyavasāyay	mad	niras	∞ nārī	∞ samaya	durādhi
indecl.	indecl.	Inf., indecl.	3. pl., Pre. ind.	ac.s.a.	PPP, comp.	comp.	n.p.m.	n.p.m.

[still] [impel me to speak up] [worries which cause me to overstep womanly conduct]

Or fully bracketing and mapping Kale's English translation to the Sanskrit original:

loc. nom. V nom. Ind. nom.
[bhavādṛśeṣu] [pramadājanoditaṃ]] [bhavaty adhikṣepa iva] [anuśāsanam] /
[to persons like you] [is like an insult] [instruction]
[spoken by women]

ind. inf. pap acc. nom. nom.
[tathāpi] [vaktum vyavasāyayanti mam] [[nirastanārīsamayā] durādhayaḥ] // // BhKir_1.28
[still] [impel me to speak up] [worries which cause me to overstep womanly conduct]

7. Note how the English semantic text chunks map to Sanskrit text chunks, in a possibly non-linear, non-contiguous fashion.

> After having fully carried out the bracketing and mapping, it is apparent that the chunks of the Sanskrit and the English translation are not in the same order, that is the English maps to the Sanskrit in a "non-linear, con-contiguous fashion."

8. Label each Sanskrit lexical item with possible English glosses, using DCS and Pundit-Professor's knowledge of Sanskrit.

> This is where the imperfect nature of the Sanskrit dictionaries that are currently available becomes apparent. The glosses provided by DCS below each word are cut off, which is a bug in the program, but besides this there is a lot of lexical semantic information missing that could potentially help the student make a suitable translation. This is where the professor-pundit with his vast storehouse of accumulated lexical knowledge comes in and adds inestimable value to the translation and pedagogy process. This is the part of the Sanskrit seminar in which the student is furiously scribbling in her notes various lexical glosses and their subtle shades of meaning. What results, unless a suitably large-sized piece of paper is used, is a hard to untangle jumble of pencil jottings crammed into the spaces of the page. One can see this in the scanned copies of notes provided in the appendix, however here the lexical glosses are extracted from the notes and made into a vocabulary list. This step, as well as all the previous steps presented here, takes time and it already takes quite a long time to read a sloka in seminar, so the best format for students remains taking notes for each sloka on a suitably large-sized piece of paper. Practically speaking one side of A4 copier paper would suffice for one sloka of text.

Vocabulary List for Sloka:

bhava – you
adṛśa – like ...
bhavādṛśa, bhavādṛśeṣu – to persons like you
pramada – woman
jana, ajana – person
pramadājana – women, one of the woman class
vad, uditaṃ – spoken
bhū, bhavati - he, she it is (verb to be)
adhikṣepa – insult
iva – like, as if, as it were
anuśāsana, anuśāsanam – instruction

tathāpi – even so, still
vac, vaktum – to speak(inf)
vyavasāyay, vyavasāyayanti – impel, cause, force, incite, goad
mad, mam – me (acc)
nirasta – overstep, set aside, overthrow, upturn
nārī – womanly
samaya – conduct, rules, norms, agreement, etiquette
nirastanārīsamayā – worries which cause me to overstep womanly conduct
durādhi, durādhayaḥ – mental afflictions, worries

9. Identify core simple sentence structure of subject, verb and object (S-V-O)

Instruction is like an insult. Also: Mental afflictions impel me to speak.

10. Use the knowledge from the resulting decomposition of the sloka to string lexical items into phrases and phrases into a translation for the whole sloka.

Here one can just arrive at Kale's translation, as a West Point cadet might arrive at a fully assembled rifle again after proceeding through the pedagogical process of completely disassembling and reassembling it, or one might arrive at a deeper translation and understanding that emerges from the lexical chaos and catalytic mass generated during the pundit-led translation-brainstorming. Such a deeper translation might, for instance draw out deeper meanings associated with court poetry as an instructional device for the ministerial class or young princes (mirror for princes). This apparently was the audience that the Kiratajuniya Mahakavya targeted. This was the nature of the deeper translation arrived at under the guidance of our pundit-professor Jesse Knutson at the University of Hawaii Sanskrit seminar.

A deeper translation oriented towards Indian political theory based on notes taken during the extensive discussion of this passage during the seminar might read:

Draupadi speaks: "Instruction spoken by women to persons like you is an insult. Even though, the mental afflictions by which the rules or norms of behavior for women are over-stepped here

[excusing herself in a culturally appropriate gesture of respect that perhaps seems sexist from contemporary standards], these afflictions impel me to speak up.

4. Memory Enhancing Interventions

The idea that Sanskrit resembles a computer program is certainly not a new one. [34] This metaphor can unlock ways of thinking about thinking that are productive in language learning.

Let's begin with a concrete example, stem formation for the ten '*gunas'* or 'verb classes' of the present system. Goldman provides a table that allows the student to comprehend this in a glance (see table 7.12 "the ganas of the present system" below). Egenes, however, makes Goldman's table more compact and memorable by reducing it to a math-like symbolic notation that resembles a computer program. The Egenes table could, in fact, be transformed into a 'case statement' as found in most programming languages (see below).

7.12 **The गण-s (*gaṇa*-s) of the Present System**

number	name root	gaṇa sign	placement of sign	stem strength	लट्	meaning
1.	भू √bhū	अ a	suffix to root	गुण of root vowel in *all* forms where possible (see 7.16)	भवति bhavati	he is, becomes
2.	अद् √ad	(Ø)	_	गुण of root vowel in strong forms	अत्ति atti	he eats
3.	हु √hu	अभ्यास (abhy -āsa)	prefix to root	गुण of root vowel in strong forms	जुहोति juhoti	he offers
4.	दिव् √div	य ya	suffix to root	none	दीव्यति dīvyati (note long ī)	he plays
5.	सु √su	नु nu	suffix to root	गुण of गण sign vowel in strong forms	सुनोति sunoti	he presses
6.	तुद् √tud	अ a	suffix to root	none	तुदति tudati	he pushes
7.	रुध् √rudh	न/न् na/n	infixed in root	infix is न (-na-) in strong forms, न् (-n-) in weak	रुणद्धि ruṇaddhi	he blocks
8.	तन् √tan	उ u	suffix to root	गुण of गण sign vowel in strong forms	तनोति tanoti	he stretches
9.	क्री √krī	ना/नी nā/nī	suffix to root	suffix is ना (-nā-) in strong forms, नी (-nī-) in weak	क्रीणाति krīṇāti	he buys
10.	चुर् √cur	-अय -aya	suffix to root	गुण of root vowel where	चोरयति corayati	he steals

Case(Gana) of:
1: gana(root) + a
2: Case(Strong): gana(root)
   Case(Weak): root
3: Case(Strong): abhyasa(root) + gana(root)
   Case(Weak): abhyasa(root) + root
4: root + ya
5: Case(Strong): root + no
   Case(Weak): root + nu
6: root + a
7: Case(Strong): insert_after_vowel(root, na)
   Case(Weak): insert_after_vowel(root, n)
8: Case(Strong): root + o
   Case(Weak): root + u
9: Case(Strong): root + naa
   Case(Weak): root + nii
10: gana(roo) + aya

SUMMARY OF VERB CLASSES

1. Here is a table that reviews the ten classes of verbs:

#	GANA	STEM	PRESENT	ENGLISH
1.	√**bhū (P)**	**guṇa** of root + **a**	**bhava+ti**	he is
2.	√**ad (P)**	**guṇa** of root (strong)	**at+ti**	he eats
		root (weak)	**at+taḥ**	those two eat
3.	√**hu (P)**	**abhyāsa** + **guṇa** of root (strong)	**juho+ti**	he offers
		abhyāsa + root (weak)	**juhu+taḥ**	those two offer
4.	√**div (P)**	root + **ya**	**dīvya+ti**	he plays
5.	√**su (U)**	root + **no** (strong)	**suno+ti**	he presses
		root + **nu** (weak)	**sunu+taḥ**	those two press
6.	√**tud (U)**	root + **a**	**tuda+ti**	he pushes
7.	√**rudh (U)**	**na** after vowel of root (strong)	**ruṇaddhi** (**ruṇadh+ti**)	he blocks
		n after vowel of root (weak)	**runddhaḥ** (**rundh+taḥ**)	those two block
8.	√**tan (U)**	root + **o** (strong)	**tano+ti**	he stretches
		root + **u** (weak)	**tanu+taḥ**	those two stretch
9.	√**krī (U)**	root + **nā** (strong)	**krīṇā+ti**	he buys
		root + **nī** (weak)	**krīṇī+taḥ**	those two buy
10.	√**cur (U)**	**guṇa** of root + **aya**	**corayati**	he steals

34 For a well-presented example of 'Sanskrit as a computer program' see Mishra (2016).

For another example, juxtaposing the ‘secondary conjugations’ of the causative, desiderative and intensive with their ‘primary conjugations’ in a table as Coulson does (see below), conveys the full combinatory potential of verbal roots at one glance with combined forms such as ‘future causative’ or ‘desiderative causative’, a juxtaposition that provides more immediate insight and understanding than the typical lengthy prose description.

Primary verb	*Secondary verb*
Present	Present causative
nayati ‘he leads’	**nāyayati** ‘he causes to lead’
(Included in the present system:	(*Imperfect* **anāyayat** ‘he caused
Imperfect **anayat** ‘he led’	to lead’
Imperative **nayatu** ‘let him	*Imperative* **nāyayatu** ‘let him
lead’	cause to lead’
Optative **nayet** ‘he may lead’)	*Optative* **nāyayet** ‘he may cause
	to lead’)
Perfect	Periphrastic perfect
nināya ‘he led’	**nāyayām āsa** ‘he caused to lead’
Aorist	Reduplicated aorist (an
	independent formation)
anaiṣīt ‘he led’	**anīnayat** ‘he caused to lead’
Future	Future causative
neṣyati ‘he will lead’	**nāyayiṣyati** ‘he will cause to
	lead’)
(*Conditional* **aneṣyat** ‘he	(**anāyayiṣyat** ‘he would have
would have led’)	caused to lead’)
Passive	Causative passive
nīyate ‘he is led’	**nāyyate** ‘he is caused to lead’
Secondary verbs	*Tertiary verb*
Causative (see above, second	Desiderative causative
column)	
nāyayati ‘he causes to lead’	**ninīyayiṣati** ‘he wants to cause
	to lead’
Desiderative	
ninīṣati ‘he wants to lead’	**ninīyayiṣu** ‘wanting to cause
(*Adjective* **ninīṣu** ‘wanting to lead’	to lead’
Substantive **ninīṣā** ‘the wish to lead’)	**ninīyayiṣā** ‘the wish to cause to lead’)
Intensive	
nenīyate ‘he leads forcibly’	

In general, bringing together and juxtaposing related things visually in a table makes relations more comprehensible and thus is a good strategy for language learning and teaching. Again this table logic is one step away from computer program logic and derives from the same thought process. One can generalize and speculate that the reformulation of any one of the complex and difficult to untangle prose descriptions of Sanskrit grammatical phenomena found in Sanskrit grammars might be better conveyed pedagogically with concise and highly visual tables and diagrams.

Yet another example is the pedagogical description of sandhi which has been improved by placing it in tables. Such sandhi tables have been a feature of pedagogical grammars starting with Coulson (1972) and then Bucknell (1994), Egenes (1989) and Ruppel (2017). However, the mechanical act of table lookup does not seem to be conducive to learning and gaining an intuitive understanding of how a sandhi rule is applied. One wants instead for the student to gain an intuitive feel of a rule being applied, eventually memorizing it and not needing the table anymore. Sandhi rules formulated as rewrite rules in the form of equations make sandhi rules stand out and become more memorable. One equation for one rule is presented as an autonomous unit, not many rules lumped together into an indiscriminate mass. This also mirrors computer programming where the guiding rule is always “KISS” meaning “Keep It Simple and Stupid.”

(a) **t + ca = cca ; t + cha = ccha**
(b) **t + ṭa = ṭṭa ; t + ṭha = ṭṭha**
(c) **ṭ + śa = ccha**
(d) **t +** all nasals **= n**nasal
(e) **t + ja = jja ; t + jha = jjha**
(f) **t + ḍa = ḍḍa ; t + ḍha = ḍḍha**
(g) **t + la = lla**
(h) **t + ha = ddha** (**ha** becomes **dha**.)

The computer programming metaphor can also lead to a simpler way of looking at the overall complexities of how Sanskrit grammars work as complex systems. Imagining how the different parts of Sanskrit grammar work together as modules can lead to simpler descriptions of that grammar. *Modules* simplify by separating functionality into separate distinct units:

> "Modular programming is a software design technique that emphasizes separating the functionality of a program into independent, interchangeable modules, such that *each contains everything necessary to execute only one aspect of the desired functionality*." [35]

Modules are linked by *interfaces*. After one module performs a limited and well-defined task, the work is passed on through an interface to the next module which performs another task:

> "A module interface expresses the *elements that are provided and required by the module*. The elements defined in the interface are detectable by other modules."

MacDonnell's grammar can be conceived of as a set of autonomous interfaced modules. The sections of his grammar are the modules. Each section has sub-sections which are sub-modules. There are also interfaces between modules located in different sections of the grammar. These are given in MacDonnell as *cross-references* between sections.

MacDonnell breaks nouns into subcategories corresponding to submodules. This is a relatively simple structure when presented as a tree or hierarchy of sub-modules, but rather complex when embedded in dense prose:

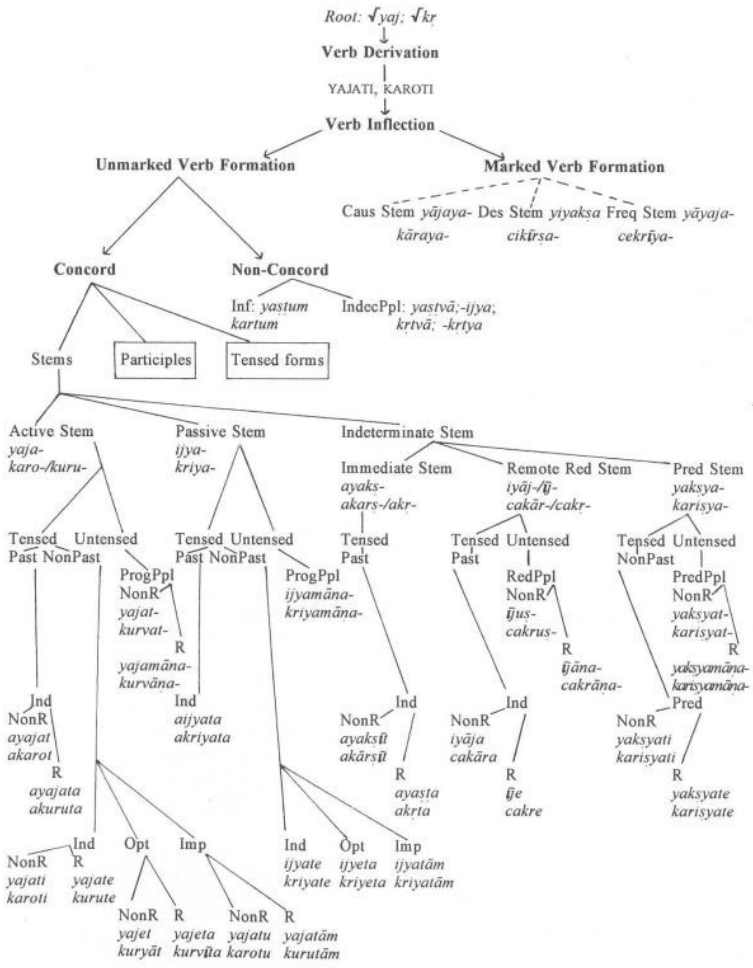
I. Stems ending in consonants
- A. unchangeable
  - a. stems with final dental (77)
  - b. stems with final labial (78)
  - c. stems with final palatal (79)
  - d. stems with final cerebral (80)
  - e. stems with final h (81)
  - f. stems with final r (82)
  - g. stems with final s (83)
- B. changeable
  - a. nouns with two stems (strong, weak)
    - i. stems in final 'at' (85)
    - ii. stems in final 'mat' and 'vat' (86)
    - iii. stems in final 'in' (87)
    - iv. stems in final 'iyas' (88)
  - b. nouns with three stems (strong, weak, weakest)
    - i. stems in final 'vas' (89)
    - ii. stems in final 'an' (90-92)
    - iii. stems in final 'ac' (93-95)

II Stems ending in vowels

35 https://en.wikipedia.org/wiki/Modular_programming

A. a and long a
B. i and u
C. i and long u
D. vocalic r
E. ai, o and au

In the MacDonnell section on “participles, gerunds and infinitive” (sections 156-167) there are cross-references back to sections 87 and 89, meaning that there is an interface between the participle and the noun declension modules. To be more specific, there are references back to the declension section, to adjectives formed with the suffix “-at” (87) for the stem of present and future participles (156) or to “nouns with three stems” (89) for the reduplicated perfect participle (157).



What is happening here is that non-finite verb forms such as “participles, gerunds and infinitive” that play the role of a noun or adjective in sentences, quite reasonably need to use modules in the noun section of the grammar to get their final form.

The language learner needs to figure this out for themselves by untangling the dense prose description but diagrams that bring out the simple higher level structure of what is going on can help him. Once again, a computer programming metaphor can lead to simplified visual depictions of interfaced modules with specialized functionality working together to produce finished grammatical lexical items in sentences.

Diagrams of interfaced modules would take more space on the page but they would allow the large-scale structure of Sanskrit to be comprehended with a single glance.

Killingley and Killingley (1995) provides a high-level linguistic description of Sanskrit grammar featuring such an intriguing tree-like diagram of sub-modules (see diagram to left).

Such module trees can provide a high-level map through the dense and complicated forest of the Sanskrit language. They can also be productively expanded upon to zoom in for more detail. (Note that the active-middle or parasmaipada-atmanepada distinction is located on the leaves of the tree R-NonR and the submodules of ‘Participles’ and ‘Tensed forms’ are broken into separate sub-trees included on the next page).

This has only provided a flavor of the sort of simplification of Sanskrit that can aid in. One normally does not think much about the process of looking words up in the dictionary or using one's grammatical knowledge to determine the grammatical identity and function of a word and its meaning. The idea that Sanskrit resembles a computer program in performing these routine but time-consuming and tedious tasks is certainly not a new one. This metaphor has the potential unlock ways of thinking about the thinking involved in reading and translating that are productive in the larger context of Sanskrit language learning.

5. Discussion and Conclusion

This study began with a brief overview of where Sanskrit has traveled in recent history in terms of pedagogical grammars and then looked briefly at where it came from in the ancient past in terms of the traditional Indian teaching of Sanskrit. It then moved to analyzing the way that learning proceeds in the advanced Sanskrit seminar at University of Hawaii, relating this to how texts can be used for self-pedagogy. Finally, this study has taken a brief look at certain visual features of pedagogical grammars that can aid in the presentation of the Sanskrit language pedagogically. As such, it attempts to present a self-reflective map for future refinement in self-pedagogy which, as stated in the beginning, is where all Sanskrit language learners eventually end up. Historical reflection, reflection on one's everyday learning activities, and finally reflectively taking what is effective and what works in everyday language learning practice and then applying it to new areas, are the three main types of reflective practice proposed and advocated here for Sanskrit self-pedagogy.

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