CHAPTER TWO

2 GRAMMATICAL THEORY CONSTRUCTION-I

ASPECTS OF PÂÑINI’S RULE CONSTRUCTION AND RULE ORDERING

2.1 NATURE OF SUBSTITUTION RULES IN ASTADHYAYI

In a given derivation, substitution rules can be quite involved. In Pâṇini’s grammatical system a unit Y is allowed to occur in place of another unit X, Y being called ēdeśa ‘substitute’ and X sthānīn ‘substituend’. Further, elements introduced as initial, final and internal elements of other items are recognised in Pâṇini’s system. P.1.1.46 ady-antav.tak-itau provides introduction of elements marked with ū as ādi ‘initial’ parts of items while elements marked with k as anta ‘final’ parts of items. P.1.1.47 m-id aco’ntyāt paraḥ provides that an element marked with m occurs para ‘after’ the antya ‘last’ of the item to which it is introduced. Elements so marked are recognised as āgamas ‘augments’, though Pâṇini did not explicitly so name them. The substituends and replacements can be bases, affixes or sounds. Among the affixes which are subject to replacements are abstract elements, the L-suffixes. For instance the derivation of rājñāḥ puruṣo grāmam gacchati ‘The king’s man is going to the village’ starts from a stage much earlier than rajan-as puruṣa-s grāma-am gam-a-ti when the root gam is followed by the L-suffix laṭ. This L-
suffix is then replaced by the ending \textit{ti}. The \textit{-as} of \textit{rājan-as} is replaced by \textit{-r}, in turn replaced by \textit{-h}, the \textit{-s} of \textit{puruṣa-s} is replaced by \textit{-r}, which in turn is replaced by \textit{-u}, \textit{-o} then substitutes for \textit{aA}. The two sounds \textit{-a-1} and \textit{a-2} in \textit{grāma-am} are both replaced by \textit{a1}. Again, there are zero replacements, the \textit{-a-} of \textit{rājan} in \textit{rājan-as} is deleted, as also the \textit{-n} of \textit{rājan} in the compound \textit{rāja-puruṣa}. Similarly, the endings contained in the compound \textit{rājan-as-puruṣa-s} is replaced by zero.

It is to be noted, however, that a zero replacement of an affix has a particular status. When an affix is replaced by zero 'pratyaya-lope, the operation which would apply in its presence 'pratyaya-lakṣaṇam still applies as provided by P.1.1.62 pratyaya-lope pratyaya-lakṣaṇam. For instance, the \textit{-n} of \textit{rājan} 'king' is deleted if it is pada-final as in \textit{rāja}. The deletion also applies to \textit{rājan} in the compound \textit{rāja-puruṣa}, where the element \textit{rājan} derives from \textit{rājan-as} which is a \textit{pada}, according to P.1.4.14 sup-\textit{tiṁ-antām-padām}. Though, the ending \textit{as} is deleted, the remaining \textit{rajan} is still treated as a \textit{pada}. Likewise, the endings contained in a taddhita derivative such as \textit{aupagava} from \textit{upagu-as-a} are also replaced by zero. In grammatical operations, it can be said that \textit{Y} replaces \textit{X}. Actually, this amounts to saying that, in the given context, \textit{X} does not occur, \textit{Y} being used instead.
The composition of the Astādhyāyī in sūtra style meant for committing to memory and oral transmission in continuous recitation brings with it its own peculiar problems. But it also has merits in that unlike external memory on paper, the whole Astādhyāyī would be available in the mind for processing on line, to borrow a computer terminology. However, the important problem areas of the sūtra style are how to achieve the necessary economy, how to achieve and indicate connection between sūtras and how to identify the boundary of a sūtra to mark it off as a distinct sūtra.

Economy is achieved by anuvṛtti-procedure by which items or parts of rules or complete rules are carried over, so that the rules become intimately connected as a single rule. The formal framework provided by the adhikāras within which the sūtras are ordered by means of utscharga-apavāda relation.

2.2 ANUVṛTTI AS PLAYING CRUCIAL ROLE IN ORGANISING AND INTERPRETING SŪTRAS OF ASTADHYAYI

Anuvṛtti ‘carrying over of items’ is one of the many devices used in the Astādhyāyī to achieve economy in grammatical statements. In addition, it also adds precision to such statements, since any redundancy may tend to confuse the matter. The arrangement of the rules in the Astādhyāyī is such that the scope of the rules is often determined by the preceding rules. The main aim of the device of
**anuvṛtti** being avoidance of repetition, **anuvṛtti** supplies the elements from the preceding rules. Though **anuvṛtti** is often resorted to in ordinary speech, it has become a mechanical notation in the Astādhyāyī, which has greater precision than in ordinary speech. The Astādhyāyī with its technical intricacies can be interpreted only with the help of **anuvṛtti**, which plays a crucial role in organising and interpreting the sutras of the Astādhyāyī.

### 2.3 ABSENCE OF CRITERIA FOR DEMARCATING INDIVIDUAL RULES AND INDICATING CONNECTION BETWEEN RULES

The text of Astādhyāyī being designed for convenience in oral transmission in continuous recitation, one often finds it very difficult to get a clear-cut idea of the individual rules and connection between them since the Astādhyāyī neither gives any criteria for demarcating individual rules nor does it indicate the connection between the rules. How the words are to be supplied from the preceding rules are not indicated in the Astādhyāyī. The Mahābhāṣya and the kaśikavṛtti also do not explicitly state all the principles of the device of **anuvṛtti**.
2.4 Lack of Consistency in the Use of Anuvṛtti Device in Astādhyāyī

Though, Pāṇini's conventions of anuvṛtti are remarkably precise and simple, the new additions to his grammar made by his successors, to bring Pāṇini's grammar up-to-date, has often resulted in the interruption of the continuity of the topic concerned. The Astādhyāyī as we have it now, therefore, lacks consistency in the use of the device of anuvṛtti.

2.5 Status of Anuvṛtti in Ordinary Speech and Pāṇini's Meta Language

Many principles of anuvṛtti can be traced back to ordinary speech. In elliptical sentences, something said in a previous sentence is understood in a subsequent sentence. Some of the following rules are valid both for ordinary speech and Panini's meta language:

1. An old item recurs in a subsequent statement unless blocked by a new incompatible item, provided the process item 'vidheya' is the same. The meta linguistic items are continued even if a process is changed.

2. A new item cancels a similar old incompatible item.
3 A new modifier does not cancel an old head provided that the process item is the same³.

4 A new head cancels an old modifier. In the case of meta linguistic elements, a new head does not cancel the preceding modifier.

5 A new modifier cancels an old head when the new process is introduced. However, this does not hold good for meta linguistic elements.

While in ordinary language, anuvṛtti device has not developed beyond a rudimentary stage, it has reached the status of a mathematical notation in the Astādhyāyī. As ordinary language does not work in a mathematical framework, the use of anuvṛtti in ordinary language to this extent will come in the way of proper communication. Thus, one can conclude that, anuvṛtti has attained a special status in Pāṇini's grammar.

2.6 **DISCOVERING ANUVṛTTI CONVENTIONS INDEPENDENTLY BASED ON CONSISTENCY AND SIMPLICITY AS SUPERIOR TO ADHOC PROCEDURES ADOPTED BY COMMENTATORS**

As the Astādhyāyī is composed in the sūtra style for attaining the maximum possible brevity based on paribhāṣā 'formal conventions', these conventions play a crucial role in organising and interpreting the rules of the Astādhyāyī. One does not get any clear cut idea of the rules of the Astādhyāyī merely by
reading them. Since the Astādhyaśi and the kāśika do not explicitly state the conventions relating to anuvṛtti, the only alternative left is to find out such basic conventions or principles independently based on the criteria of simplicity and consistency, rather than go by adhoc procedures of anuvṛtti sometimes adopted by
commentators who have not discussed the conventions by which the scope of \textit{anuvṛtti} is regulated.

Though the device of \textit{anuvṛtti} in the form of ellipsis is used in the ordinary language, its use in the \textit{Aśṭādhyāyī} is as an artificial notation which sometimes allows a complete sentence to be mechanically dropped. The deletion of a rule consisting of repeated elements in the \textit{Aśṭādhyāyī} is often made known by particle \textit{ca} for instance, in the following examples the repeated items are put in brackets:

\textbf{P.1.2.7,} \texttt{mṛḍamṛḍagudhakuṣakliśavada\textsubscript{a}vā saḥ ktvā (kit)}

\textbf{P.1.2.8a} \texttt{rudavidamuṣagrahisvapipra cehah (ktvā kit)}

\textbf{P.1.2.8b} \texttt{( rudavidamuṣagrahisvapipracchaḥ ) san (kit)}

When the repeated items are left out and the unrepeated items in P.1.2.8a and P.1.2.8b are retained, the following rule is derived:

(i) \texttt{rudavid amuṣagrahisvapipracchaḥ saṃs ca} where the particle \textit{ca} gives the clue that elements of the following one more rule are left out:

(ii) \texttt{( rudavidamuṣagrehisvapi} \texttt{papr} \texttt{acchaḥ k} \texttt{tvā kit)}

This type of abbreviative interpretation achieved by the particle \textit{ca} is not found in ordinary language.
2.7 MENTION OF PARTICLE CA CANCELS INCOMPATIBILITY
PERMITTING ORIGINAL ITEM STILL TO CONTINUE IN
ANUVṛtti

Pāṇini has adopted the use of anuvṛtti device to avoid repetition of words. Rules or segments of rules are carried over in subsequent rules. Items are carried over until they are blocked by incompatible items. Cancelling of items takes place when a new item belonging to the same category is introduced in subsequent rules. Cancelling takes place selectively. The preceding nominative, ablative, genitive, locative items are cancelled by the new nominative, ablative, genitive, locative items. Thus, an old item is always cancelled by a similar item in a subsequent rule unless an incompatibility-cancelling ca is introduced. The mention of the particle ca cancels the incompatibility permitting the original item still to continue.

2.8 PARTICLE CA HELPS RESOLVE AMBIGUITIES REGARDING BOUNDARIES BETWEEN RULES AND EXACT DIVISION OF TEXT

From these basic principles, it emerges that a new modifier does not cancel an old head, a new head does not cancel an old modifier and a new process item cancels preceding modifiers. With the help of these principles, one can mark boundaries between rules, resolve ambiguities with regard to exact division of text, reinforce some elements through the use of the particle ca, and have abbreviative interpretation
either conjunctively or disjunctively through the use of the particle ca.

2.9 **COMPATIBILITY WHICH DEPENDS ON COREFERENTIALITY INDICATES CONTINUATION OF ANUVRTTI**

Continuation or discontinuation of items depends upon compatibility and incompatibility which act as a formal device. Compatibility is indicated by *samanādhikarana* items showing head-modifier relation while incompatibility is indicated by items occurring in the same or different case endings which do not show a head-modifier relation. Compatibility implies coreferentiality while incompatibility implies lack of coreferentiality.

In the examples: P.7.3.101 *ato dīrgho vañī* (*sārvadhātuke from P.7.3.95*) 'the short vowel a is lengthened before a *sārvadhātuka* suffix beginning with a consonant belonging to *vañ pratyāhāra*.

P.7.3.102 *supi ca* (*ataḥ dīrghaḥ vañī*) i 'also the short vowel - a is lengthened before a case ending beginning with a constant belonging to *vañ pratyāhāra*'.

P.7.3.103 *bahuvacane ihalī et* (*ataḥ supi*) '(the short vowel a is replaced) by e before a plural ending (beginning with a consonant belonging to) ihal pratyāhāra.'
Since the properties of \textit{suptva} and \textit{gārvadhātukatva} do not reside in the same item, the item \textit{gārvadhātuke} in P.7.3.101 is not continued in P.7.3.102. \textit{Suptva} and \textit{gārvadhātukatva} are mutually exclusive since the \textit{sup} stands for case endings added to a nominal stem, mentioned in p.4.1.2 whereas the term \textit{gārvadhātuka} stands for personal endings and suffixes marked by the \textit{anubandha} \textit{s} which are added to the verbal base. Therefore, even though \textit{supi} and \textit{gārvadhātuke} occur in the same case ending, \textit{supi} cancels \textit{gārvadhātuke}. Since \textit{vaṅ́tva} and \textit{suptva} can reside in one and the same item, the item \textit{vañī} in P.7.3.101 is continued in P.7.3.102. For example, \textit{va} and \textit{bhvan} are both \textit{sup} and \textit{vañī}. Since both are case endings and both begin with a \textit{vañī} consonant. Thus the items \textit{supi} and \textit{vañī} indicate head-modifier relation and accordingly \textit{supi} does not cancel \textit{vañī}. Since in the instrumental, dative, ablative and locative plural suffixes \textit{bhīs}, \textit{bhvas} and \textit{su}, both the properties of \textit{suptva} and \textit{bahuvacanatva} reside, the word \textit{supi} in P.7.3.102 is continued in P.7.3.103. Thus \textit{supi} and \textit{bahuvacane} are mutually compatible\textsuperscript{9}. 
2.10 **Mutual Compatibility of Process Items Which Depends on Mutual Coreferentiality** Indicates Continuation of Anuvṛtti

In the case of process items, referential compatibility and incompatibility are not considered since the process items which are to be prescribed are not yet established entities and therefore, one cannot say whether they reside or do not reside in one thing. Thus in the case of process items, if the process items can be co-applied they are regarded as mutually compatible and if they cannot be co-applied, they are regarded as mutually incompatible.

In the examples P.6.4.71 Ṽʊɲlɭɭɬɪɭɕv ad udāṭṭaḥ 'the augment aT is prefixed to a verbal base before the aorist, imperative and conditional ending and it is accented', P.6.4.72 aą ajađ细心 (Ṽʊɲlɭɭɬɪɭɕv uĎaṭṭaḥ) 'the augment aT is prefixed to a verbal base beginning with a vowel before the aorist, imperative and conditional endings'. The item udāṭṭa in P.6.4.71 is continued in P.6.4.78 since an udāṭta accent and the augment aT can be coapplied in one and the same derivation and therefore, they are compatible.

In the examples P.6.1.77 iko vaŋ aći (sämhitavām) 'when a close union is to be formed ɨ, u, x and l are replaced by y, v, x and l before a vowel.', P.6.1.78 eco'vavāvāva (aći sämhitavām)' when a close union is to be formed έ, o, ai and ə are replaced by
av, av, āv and āv before a vowel. The genitive item ecaḥ in P.6.1.78 is incompatible with the genitive item ikhaḥ in P.6.1.77 since iktva and actva both cannot reside in one and the same items. Also, the process items van and ayayaavah are mutually incompatible since they cannot be co-applied simultaneously in place of diphthongs in the same derivation. Thus the new process item ayayaavah cancels the preceding process item van.

2.11 **THOUGH THEORETICAL CONTINUATION IS SUPERFLUOUS, ITS ANUVRTTI IS USEFUL IN THE SUBSEQUENT RULE TO AVOID DEFECT OF MANḌŪKAPLUTI**

Items whose continuation or discontinuation produces the same result are theoretically continued unless they are cancelled by incompatible items. When the continuation of items leads to the undesired result, Pāṇini repeats the same item or uses the word nityam. Though the continuation of an item is superfluous, its anuvrtti is useful in the subsequent rule and this theoretical continuation avoids the defect of manḍūkapluti 'skipping over a rule'.

For instance, the word ātmanepadesu continuously flows from P.1.2.11 to P.1.2.17 whether it serves a purpose or not. The continuation of the word ātmanepadesu in P.2.1.14 does not serve any purpose since before the active endings han is always replaced by vadha - in the aorist (p.2.4.42) and so the rule is
automatically applicable in the middle ending. Still, the word ātmanepadesaṁ is continued since its anuvṛtta is useful in the subsequent rule to avoid mapuṇakapuḷuti.

2.12 PURPOSEFULNESS OF APPARENT REDUNDANCY OF PĀṇINĪ’S RULES OR ELEMENTS INDICATING CONTINUATION OR ANUVṛTTI

The continuation or the discontinuation of items is indicated by sāmarthya ‘something is otherwise redundant’ or jñāpaka ‘clue’. Pāṇinī’s rule or elements will be redundant if we do not assume jñāpaka or sāmarthya and will become purposeful only when the continuation or discontinuation is assumed. The correctness of the particular issue is inferred on the basis of jñāpaka, the principle of anuvṛtti being not rigid.

2.13 SĀMARTHYA ARGUMENT AS REMOVING APPARENT

The sāmarthya argument often comes in handy to remove apparent inconsistencies in the anuvṛtti technique. For example, the word dvivacanam is discontinued in P.1.1.12 adasā māt (Ī dúdet pragṛhyam) ‘the vowels i, u, and e coming after the m of the pronoun adas are pragṛhya’ from the previous rule P.1.1.11 Ī dúded dvivacanam ‘a dual ending in i or u or e is called pragṛhya’. The pragṛhya vowels do not undergo sandhi operations. P.1.1.12 would become superfluous, had the word dvivacanam been continued
since then the examples P.1.1.12 would be covered by P.1.1.11. The discontinuation of dvivacanam is dictated by common sense and no explicit principle is called for this.

2.14 METALINGUISTIC STEM AS CONTINUED IN ANUVRTI UNTIL IT IS BLOCKED BY INCOMPATIBLE ITEM UNLESS INCOMPATIBLE ITEM IS FOLLOWED BY PARTICLE CA

Metalinguistic grammatical terms in the Astādhyāyī may be categorised as:

i) the elements whose meaning is defined by the grammar. Eg. anunāsika (P.1.1.8), savarṇa (P.1.1.9), dhātu (P.1.3.1), prātipadika (P.1.2.45)

ii) the terms defined by enumeration Eg. tatpurusa (P.2.1.22), pratyaya (P.3.1.1), kṛtra (P.3.1.95)

iii) the undefined terms, Eg. prathamā, visarga, anusvāra, used in the construction of the grammar

iv) the elements representing the underlying elements, Eg. gān, khvān, lat, līt

v) augments, sthānīna 'substitutes' and vidheya 'processes'

These meta linguistic elements which are used in four case-endings have a technical meaning in the Astādhyāyī, the nominative representing either uddēśya 'subject item' or vidheya 'the process item, the ablative representing for a preceding context at a
derivational stage, the genitive standing for an item which is to be replaced at a derivational stage, the locative standing for a following context at a derivational stage.

In the context of the meta linguistic, meta linguistic items, the basic rule is that a meta linguistic item is continued until it is blocked by an incompatible item unless the incompatible item is followed by the particle ca.

2.15 **SUBJECT ITEM 'UDDESYA' OR PROCESS ITEM 'VIDHEYA' AS CONTINUED-AUTOMATICALLY UNTIL IT IS BLOCKED BY SUBJECT OR NEW PROCESS ITEM**

As cancelling occurs selectively, the above rule can be stated in other ways according to context. Thus the nominative subject item, uddesya or process item vidheya is continued automatically until it is blocked by a new subject item or a new process item. For example, the process item vrddhi is blocked by the new process item guna and therefore, the term vrddhi is discontinued in P.1.1.2 adav gunah 'the vowels a, e and o are called guna from P.1.1.1 vrddhir adaic 'the vowels a, ai and au are called vrddhi.
2.16 Words 'vā', 'vibhāṣā' and 'anyatarasyām' are continued in anuvṛtti in the subsequent rules as long as same process continues.

Modifiers comprising the adverbs and particles mentioned below form a basis by which the rules of the Astādhyāyī can be divided into the following four classes:

i) a) rules forming a disjunction which is indicated by adverbs va 'preferably', vibhāṣā 'marginally' and anyatarasyām 'optionally'.

b) rules forming a disjunction which is indicated by the particle ca 'both / all separately'.

ii) rules forming a conjunction which is indicated by the particle ca 'both / altogether'.

iii) rules forming negation / prohibition which is indicated by the particle na / a (n).

iv) rules forming obligation which is indicated by the adverb nityām 'always'.

The continuation of these modifiers is governed by different rules given below:

The words vā, vibhāṣā and anyatarasyām are continued in the subsequent rules as long as the same process continues. As soon as a new process is introduced, their continuation is cancelled.
The word vā in P.3.1.70 is continued in P.3.1.71-72 which deal with the same process 'syāN but it is not continued in P.3.1.73 which deals with a different process, namely śnu.

2.17 IN RULE DEALING WITH NEW PROCESS, PARTICLE CA REINFORCES TERM FOR OPTIONALITY FROM PRECEDING RULE

If the continuation of vā, vibhāsā and anyatarasyāṁ is required in the rule introducing a new process, the use of ca is necessary. The particle ca in the rule dealing with a new process reinforces the term for optionality from the preceding rule. For example, the particle ca in P..3.73 reinforces the word anyatarasyāṁ from P.2.3.72 which would otherwise not continue in the rule teaching a new process.
2.18 PRECEDING RULE IS INDICATED AS OPTIONAL IF

If a following rule contains nityam 'always' in it a preceding rule is understood to be optional. Every occurrence of the word nityam is meant for the discontinuation of a word for optionality in a rule containing the word nityam. For example, P.4.3.144 deals with the same process mayaT. Therefore, va in the preceding rule will be continued. But the discontinuation of va in P.4.3.144 is indicated by the mention of nityam.

2.19 FUNCTION OF CA IN DISTINGUISHING WHETHER A STATEMENT IS MADE UP OF A SINGLE RULE OR TWO RULES

The particle ca connects two statements by way of conjunction 'both / all together' or disjunction 'both / all separately'. In other words, the function of the particle ca is to link two independent statements. Had it not been for the function of ca, we would not have been able to know whether a statement consists of two rules or one rule. The particle ca gives a hint that the rule containing [item + (word + ca)]
is in fact made up of two rules, namely, (i) item and (ii) (word + ca). In other words, the particle ca indicates that repetition of common elements is to be avoided. The particle ca indicates that whatever precedes (word + ca) is always considered to be a separate statement. For example, the conjunction
process *kuk* which is introduced as an associative
disgression in P.5.2.129 is not continued in P.5.2.130.

2.20 **A NEGATIVE RULE AS PROHIBITING GRAMMATICAL**
**OPERATION WHICH IS ALREADY APPLICABLE BY A VIDHI**
**RULE, OTHERWISE.**

The continuation or otherwise of the negative
particle *naḥ* is determined on the basis of *sāmarthya*
since otherwise the rule will be redundant. In other
words, a rule can prohibit the grammatical operation
which is already applicable by a *vidhi* rule, otherwise
not. For example, P.1.3.5 cannot prohibit the process
*itr-saṃīnāḥ* since it is not already prescribed by any
other rule. Accordingly, the particle *naḥ* is
discontinued in P.1.3.5 and thus P.1.3.5 becomes a
prescriptive rule.

2.21 **QUALIFIERS RESTRICTING DOMAIN OF RULE TO OLDER**
**STAGE OF LANGUAGE OR COLLOQUIAL SPEECH ARE NOT**
**CONTINUED BEYOND A RULE IN WHICH THEY OCCUR.**

The terms used to indicate regional and
stylistic variations or qualifiers can be divided into
the following three groups:
1) Words representing different stages of sanskrit, viz., chandasi 'in sacred literature', vajusi 'in sacrificial formulas', ṛci 'in vedic stanzas', brahmane or in a brahmaṇa text, mantra 'in the Samhita text of the vedas', sāmāni 'in the hymns', nigame 'in the mantra text', bhāṣāyām 'in ordinary usage'.

2) Words standing for regional variation, viz., prācam 'in the speech of Easterners' udīcam 'in the speech of Northerners', and

3) The word sāmīñāyām standing for conventional idiomatic meanings not discussed in the grammar but known from the speech community.

The qualifiers like bhāṣāyām, chandasi, vajusi etc., which restrict the domain of a rule to an older stage of language or to colloquial speech are not continued further from a rule in which they occur. For example, the item bhāṣāyām is not continued in P.3.2.109 from P.3.2.108 although the rule deals with the same process.

2.22 **Lexical Items as Continuing Until Blocked By Incompatible Items Even If Process Is Changed**

The qualifiers prācam 'in the Easterners' speech' and udīcam 'in the Northerners' speech' are not continued in subsequent rules. For example, prācam is not continued in P.4.1.44 from P.4.1.43.
The word samānāyām is not continued beyond a rule in which it is mentioned. For example, samānāyām is not continued in P.2.4.21 from P.2.4.20.

Pāṇini's rules require specific mention of the lexical items which mainly belong to the category of prātipadika or dhātu. The continuation of lexical items in the following rule is governed by the same principles as in the case of meta linguistic elements. Lexical items are continued until they are blocked by incompatible items even if the process is changed. For example, the lexical item karoteḥ is continued from P.6.4.108 to P.6.4.110 and in P.6.4.111 śnasoh cancels karoteḥ.

2.23 **CATEGORICAL SEMANTIC TERMS AS CONTINUED AUTOMATICALLY TILL THEY ARE CANCELLED BY A NEW INCOMPATIBLE CATEGORICAL TERM**

Non-lexical semantic terms like vartamāna, anadvatana bhūta, bhavisvyaḥ etc., which are called categorical terms whose meanings are not defined in Pāṇini's grammar are the basic terms from which the grammatical system is constructed. Lexical meanings which are not used in the construction of the grammatical system, and categorical meanings behave differently with regard to the convention of anuvṛtti.
The categorical semantic terms are continued automatically till they are cancelled by a new incompatible categorical term. The categorical meaning term vartamāne in P.3.2.123 cancels the incompatible item bhēte from P.3.2.84 - 122.

The lexical meanings which do not play any role in constructing the grammatical system are not continued beyond the rule in which they occur. For example, the lexical meaning vipralāpe from P.1.3.50 is discontinued in P.1.3.51.

2.24 ADHIKĀRA AS INDICATING HOMOGENEITY OF TOPICS

While the device of anuvṛtti is used to avoid repetition of the same item, the device of adhiķāra is used to indicate the homogeneity of the topic. The adhiķāras enable the subject wise division of the Aṣṭādhvāyī into about fifty topics or section-headings. The adhiķāras marked by means of śvarita accent according to tradition (P.1.3.11) often consist of one word.

An adhiķāra may designate a subject or process as in P.3.1.1 pratyāyāh, P.2.1.3 samāsaḥ, or lexical environments as in P.3.1.91 dhātoḥ or grammatical conventions P.8.2.1 purvatrāsiddham, or technical designations as in P.1.4.56 nipatāḥ or meaning conditions as in P.1.4.23 kārake or basic theoretical concepts as in P.6.4.1 āṅgasya. The scope of an adhiķāra may extend beyond a pada or even an
adhyāya as in P.2.1.3 samāsah extending upto P.2.2.38 or P.3.1.1 pratvayāḥ running through the fifth adhyāya. The asiddha topic known as tripādi (P.8.2.1 to end) comprises a separate section.

2.5

CONTINUATION OR DISCONTINUATION OF ITEMS DEPENDING ON COMPATIBILITY OR OTHERWISE

Sandhi rules which apply when a close union is to be formed are dealt with by samhita sections P.6.1.72, P.6.3.114, P.8.2.108. These samhita rules remove the occurrence of boundaries between two adjacent segments and are applied last in derivation. Just like anuvṛtti, adhikāra is also concerned with rules of continuation and discontinuation of items.

Wide ranging adhikāras may be temporarily set aside by incompatible items and then become effective again. Thus, an adhikāra is not necessarily continued in each of the rules belonging to that section. For example, P.2.1.1 anabhihite which is the section-heading rule dealing with kārakavibhaktis exerts its influence upto p.2.3.73. It is continued in rules dealing with karākavibhaktis and discontinued in rules dealing with upapadavibhaktis and the condition anabhihite becomes effective again when a rule introduces a kārakavibhakti. What determines the continuation or discontinuation is the general principle of compatibility and incompatibility. Normally, the rules which govern the anuvṛtti also govern the adhikāra.
A new head introduced as an adhikāra cancels an old head introduced as an adhikāra. Cancelling occurs selectively, the new context cancelling the similar earlier context.

2.6 **DOMAIN OF ADHIKĀRA AS DETERMINED BY SPECIFICATION OF LIMIT COMPATIBILITY / INCOMPATIBILITY AND CRITICAL JUDGEMENT**

The domain of an adhikāra is determined on the basis of the three factors, namely, specification of limit by the use of prāk 'before' and a 'upto', for example, P.2.1.3 prāk kadārat samāsaḥ, P.5.1.120 
ā ea tvāt, compatibility / incompatibility and vyākhyāna / sāmartya.

The extent of adhikāra rules were not known to Kātyāyana and Patañjali. The extent of adhikāra rules depends on vyākhyāna 'critical judgement' which may find out the limit to which an adhikāra continues.

2.27 **ADHIKĀRA RULES AS GOVERNING INTERPRETATION AND APPLICATION OF VIDHI RULES**

Like saṁjña and paribhāṣā rules, adhikāra rules form conventions of grammar and do not function independently. Adhikāra rules are temporarily cancelled and they come back. Unlike the anuvṛtti elements which is always supplied in the vṛtti to complete the meaning of rules, the adhikāra is not always supplied in the gloss of rules. Adhikāra rules
govern the interpretation and application of *vidhi* rules which deal with syntax, morphology, morphophonemics and phonology, just like *samjña* and *paribhása* rules. The *adhikāra* rule becomes effective in the rules following it and governed by it. The rules which are not concerned with syntax, morphology, morphophonemics and phonology may be considered as the rules of organisation of the grammar. Like *samjña* and *paribhása* rule, *adhikāra* rules also do not require and special mark. Thus, P.1.3.11 *svaritenadhikārah* 'an adhikāra item is marked with *svarita* accent' which does not indicate which particular vowel of the *adhikāra* item is marked with *svarita* appears to be a later insertion.

2.28 **TOPICS ARE ALSO EXPECTED TO BE UNDERSTOOD ON**

The *samjña* rules are grouped together in the first two *padas* of the *Aṣṭādhyāyī*. Kātyāyana suggested in the first *vārttika* : *samjñādhistkārah samjñāsampratvavārtthah* 'the section-heading *samjña* should be introduced for clear understanding of the topic of technical terms'. However, topics or sections need not necessarily be introduced by the section-heading rules. This is clear from the second *vārttika* : *acāryācārat samjñā siddhin* 'topics could be established because of the Teacher's (Pāṇini's) style. Thus topics are expected to be understood on the basis of Pāṇini's style of phrasing the rules.
2.29 INCONSISTENCIES ARISING DUE TO REVISIONS AS DISTURBING FINELY BALANCED GRAMMATICAL SYSTEM OF

Scholars have accepted that the basic text of the Astādhyāyī has undergone changes at the hands of commentators who revised the text by adding or reformulating the rules. These commentators include not only Katyāyana and Patañjali but even their predecessors, as even pre-Katyāyana text of Pāṇini's rules appears to have contained interpolations or borrowings. These revisions had an adverse effect on the conventions of anuvṛtti assumed in the basic text of the Astādhyāyī. When the anuvṛtti of a topic is interrupted by introducing a new topic excluding associative digression and when an earlier topic is picked up again in a subsequent rule, it is called maṇḍūkapluti 'frog-jump'. As the maṇḍūkapluti disturbs the flow of anuvṛtti of items which are picked up again in subsequent rules are regarded as interpolations. Joshi and Roodbergen claim that taddhita and the samāsa sections stem from an author different from the one who framed the original Astādhyāyī and feel justified in assuming a different and later source for these since such major inconsistencies do not allow a good solution to this question within the system on the basis of the present text of the Astādhyāyī.
For example, P.1.1.73 *vṛddhir vasyācām ādis tad vṛddham* 'a word whose first vowel among the vowels is *vṛddhi* is called *vṛddha*’ is not connected with P.1.1.75 *eṇ prācāṃ deśē (vasya acām ādis tadvṛddham)* ‘a word that has a vowel e or o as the first vowel among the vowels is also called *vṛddha* in the language of easterners. The words *vṛddhir vasya acāṃ ādīḥ* which are discontinued in p.1.1.74 *tyadādīni ca (vṛddham)* ‘also the pronominal stems tyad etc., are called *vṛddha*’ are resumed again in P.1.1.75. Thus this is the case of *mandūkapluti*. Further these rules are exclusively confined to the *taddhita* section and also as the last rule contains *prācām* in it, these three rules are suspected to be later addition to the *Āstādhvāyi*.

2.30 **INCONSISTENCY WITH PRECEDING AND FOLLOWING CONTEXTS AND IRRELEVANTLY PLACED SEQUENCE OF RULES AS SUGGESTING INTERPOLATION**

There are some rules which are most consistent with the preceding and following contexts indicating that these *sūtras* may be interpolations introducing unrelated topics. In such cases even if we drop the whole sequence, their removal from the text does not disturb the connection between the preceding and the following rules. Sometimes, the sequence of rules not needed in a particular context and could well have been placed in a different section is introduced at the wrong place indicating a later addition to the
pre-existing body of *sūtras*. For instance, following the definition of *aprkta* in P.1.2.41, needlessly the rules deal with the definition of *karmadhārāya* and *upasarjana* in P.1.2.42 and P.1.2.43, whose proper place would have been the *samāsa* section after P.2.1.4. This lack of harmony in the arrangement of rules leads to the conclusion that these are later additions to the pre-existing body of *sūtras*.

2.31 **SPLITTING OF RULES AS CALLED FOR WHEN RULES ARE WRONGLY UNITED**

The technique of *yogayābhāga* 'splitting of one rule into two' has to be resorted to when the rules concerned are wrongly united into one rule *vibhāga iti parināma* is change of one case ending into another case ending and *lingaviparināma* is change of one gender into another. For example the rule P.1.2.17 *sthāghvoh ic ca* contains two rules P.1.2.17 (i) *sthāghvoh* (sic) ic ca (sthāghvoh) 'sic added to the verbal bases sthā-, dā- and dhā- is marked with the *anubandha K* and P.1.2.17 (ii) ic ca (sthāghvoh) "also the final vowel of sthā-, da- and dha- is replaced by short i. Although the form sthāghvoh is the same, still, it has to be assigned ablative value in rule P.1.2.17 (i) and genitive value in the rule P.1.2.17 (ii) since the substitute item it cannot be construed with the ablative sthāghvoh, because of the requirement of a sthānin to be in the genitive.
Similarly in the rule P.3.1.108 hanas ta ca contains two rules P.3.1.108 (i) hanah (kyap anupasarge supi) 'the suffix Kyap is added to the verbal base han- 'to kill' when it is accompanied by a case-influnted words as an upapada excluding a proverb and P.3.1.108 (ii) ta ca (hanah) 'and t comes in the place of the final n of han'. The ablative hanah which is construed with kyap cannot be construed with ta and therefore, we have to change it into the genitive.

2.32 CHANGE IN GRAMMATICAL NUMBER TO FACILITATE AGREEMENT WITH NEW

In the course of its continuation, a word may undergo a change in grammatical number to facilitate agreement with the new context. For example, the word it in P.1.3.2 upadesa' i anunasiaka it 'a nasalized vowel in the underlying representation is it' becomes itan in P.1.3.4 na vibhaktau tasmah (it) 'the dental class constants, s and m in inflectional endings are not it' and itan in P.1.3.7 cutu (pratyayasya adhir), 'the palatal and retroflex class consonants occurring as the initials of a suffix are it.

2.33 SOMETIMES CORRECT INTERPRETATION AS NEEDING CHANGE FROM LOCATIVE TO NOMINATIVE CASE

Sometimes for the correct interpretation of the rule, the locative case is to be changed into the nominative case. In the sutras P.7.1.89 pumso' suñ (sarvanamasthane) 'the final s of pums is replaced by
asUN before the strong endings', P.7.1.90 gotonit (sarvanāmasthāne) 'the strong endings coming after the stem go are marked with the anubandha N', we assume that the item sarvanāmasthāne introduced in P.7.1.86 should function as the subject item. If the locative item as it is in P.7.1.89 is retained the rule would mean that after the stem go before the strong ending something is marked with the anubandha N. However, this does not make sense since there is no item which occurs between go and the sarvanāmasthāna suffixes. The question now is how to interpret sarvanāmasthāne nit. The rule P.1.1.67 states that when a word is mentioned in the ablative the word uttarasya 'in place of a following element' is supplied. But when the process item is mentioned in the nominative case the paribhāṣā is not applied. For example, gotonit does not mean gotonitah 'after the stem go something is substituted in place of nit'. Similarly the locative item sarvanāmasthāne which is continued cannot be changed into genitive sarvanamasthānasya since it makes no sense. Therefore, the locative item sarvanāmasthāne cannot be supplied. To get a correct construction one has to change sarvanāmasthāne into the nominative form sarvanāmasthānam to make it agree with the nominative word nit.
2.34 **CHANGE OF GENITIVE SECTION HEADING TO NOMINATIVE IN NOMINATIVE CONTEXT**

The genitive section-heading is to be changed into the nominative to make it agree with the nominative context. In the rule P.6.4.163 *prakṛtyaikaś* (bhasya igheteme yassu)30 ‘a mono syllabic bha-stem retains its original form without undergoing any sandhi operations before the suffixes īṣṭha, iman and īyas’, the genitive form bhasya is continued from P.6.4.129. However, we have to change it make it agree with the nominative.

2.35 **VIHAKTI PARINAMA IN ORDINARY SPEECH**

Vihaṅkti Pariṇāma is also traceable back to sentences in ordinary speech and is not a special technique used only in the Āstādhyāyī. In the sentence rājā gacchati namaskuru ‘the king goes, pay (him) tribute’, we cannot supply the nominative form ‘he’ corresponding to the nominative rājan. For a correct construction, it has to be changed to ‘him’ to correspond to accusative rājānam.

2.36 **PHRASING OF A SEPARATE RULE AS HINTING CONTINUATION OR DISCONTINUATION OF WORDS**

Phrasing of a separate rule is resorted to only when it is not possible to combine it with a preceding or a following rule. Thus, phrasing of a separate rule gives us a hint for the continuation or a discontinuation of some words. For example, if
P.3.3.158 samānakartṛkesu tumun (icchārtheṣu dhātoḥ)

'the suffix tumun is added to a verbal base when it is accompanied by a verb denoting wishing if the two verbs have the same agent' and P.3.3.159 liṅ ca (icchārtheṣu samānakartṛkesu dhātoḥ) 'also the suffix liṅ is added to a verbal base when it is accompanied by a verb denoting wishing if the two verbs have the same agent' are combined into one as samānakartṛkesu tumunliṅau, both the items tumun and liṅ would continue in P.3.3.160. However, if we phrase a separate rule liṅ ca then only liṅ would continue. Thus Pāṇini deliberately phrases a separate rule liṅ ca as he desires the continuation of liṅ only in the following rule P.3.3.160 icchārthebhyo viphāsā vartamāne (liṅ dhātoḥ) 'the suffix liṅ is marginally added to the verbal bases denoting wishing in the sense of present action'.

2.37 TWO DVANDVAS OF EQUAL NUMBER OF ELEMENTS COMPRISING A SINGLE RULE ARE TO BE CONNECTED WITH EACH OTHER IN RESPECTIVE ORDER

When a single rule contains two dvandvas containing an equal number of elements, they are to be connected with each other in respective order. Whenever, Pāṇini does not wish this respective order, he phrases a separate rule. For example, Pāṇini has phrased two separate rules P.5.3.45 dvitryoś ca dhamuṇ (dhāḥ anyatarasyām) 'and when dhā is added to dvi and tri it is optionally replaced by dhamuṇ and P.5.3.46
edhāc ca (dvitryoh dhaḥ anyatarasyām) ‘also edhac optionally replaces dhā when it is added to dvi and tri. Had Panini said dvitryoh dhamuṇedhācau, the suffix dhamuṇ would be connected with dvi and edhāc with tri. As this is not what is desired by Pāṇini, he has phrased the two rules separately.

2.38 PARTICLE CA AS A TOOL TO SEPARATE INCORRECTLY UNITED RULES IN TRADITION

Because of the oral tradition of transmission by continuous recitation, there is the problem regarding the exact division of the sūtras given in the kaśikā vṛtti into individual sūtras. Thus many rules containing [(items)+(word+ca)]33 are read as single rules, though they actually form two rules, (items) forming one rule and (word+ca) forming the other rule. In other words, when we have a phrase which contains (word-ca) it marks the fact that what precedes it is an independent rule. In the oral tradition, the hidden pauses between rules containing (items) and (word+ca) disappeared and such rules were incorrectly united into one rule. In the Astādhvāyi the particle ca which acts as a sentence-connective is invariably placed after the first word. The particle ca helps in marking the boundary of the preceding and the following rules and enables division of the texts in a proper manner.
For example, the rule P.1.2.8 rudavidamusagrah is vapipracchah samś ca may be divided into two rules P.1.2.8 (i)
rudavidamusagrahisvapipracchah (ktva kit) 'the gerund suffix ktva added to the verbal bases rud- 'cry', vid- 'to know', mus- 'to steal', grah- 'to hold' svap- 'to sleep', pracch- 'to ask' is marked with the anubandha K, and P.1.2.8 (ii) (rudavidamusagrahisvapipracchah)
samś ca (kit) 'also the desiderative suffix saN added to the verbal bases rud-, vid-, mus-, grah-, svap- and pracch- are marked with anubandha K'. Though the tradition incorrectly united these two rules into a single rule, the particle ca after san marks the boundary of the preceding rule. Thus, P.1.2.8 (i) is a separate rule37

2.39 REPETITION OF ITEM THOUGH ALREADY AVAILABLE BY ANUVṛTTI AS SIGNALLING DISCONTINUATION TO SIMILAR CONNECTED

The repetition of the item in the same form which is available by anuvṛtti signals the discontinuation of a similar item connected with a repeated item. For example, in the rules P.1.4.48 upānvadhyānvasah (ādhārah karma kārake) 'the location in connection with the verbal base vas- 'to dwell in' preceded by upa, anu, adhi and ān is called karmān when it brings about an action' and P.1.4.49 kartur īspita tamaṁ karma (kārake) 'the object
positively reached by the action of the agent is called karman when it brings about an action, the word karman can be continued from P.1.4.46. The continuation of the item karman and discontinuation of the item ādhāra is desired. As there is no incompatible item in p.1.4.49 to cancel the item ādhāra it will be continued. Thus, in order to indicate the discontinuation of ādhāra the item karman is repeated in P.1.4.49.

2.40 OCCURRENCE OF REPEATED ITEM IN DIFFERENT CASE-ENDING AS NOT SIGNALLING DISCONTINUATION

When the repeated item occurs in the different case-ending it is not meant to discontinue something. The repetition being mainly meant to indicate sthānyādeśabhāva 'the relation between the original and the substitute, that is, the replacer-replaced relation'. For example, in the rules p.1.2.46 kṛttaddhitamārasaḥ ca (prātipadikam) 'a kṛt derivative, taddhita- derivative and a compound form are called prātipadika' and P.1.2.47 bravesvo napumsake prātipadikasya 'a short vowel replaces the final phoneme of a prātipadika 'nominal stem. The repetition prātipadikasya is not meant to discontinue something. If we go by Pāṇini's characteristic style the word tasva could have been used by him to refer back to the item prātipadika. Thus, this rule appears to be a later addition to the text of the Āstādhyāyī. The intermediate rules between the definition of
pratipadika by P.1.2.46-47 and definition of dhātu by P.1.3.1 do not deal with designations at all. P.1.2.47 should have been placed in the sixth chapter as it deals with substitution.

2.41

NEW PROCESS

The word vibhāṣā is not used in a rule which introduces a new process. For example, in the rules P.3.1.139-140 dadātidadhātyorvibhāṣā jvalitikasantebhyonah, it is not clear whether the element vibhāṣā is to be grouped with dadātidadhātyoh or with jvalitikasantebhyoh. With the above criterion, however, it is clear that nah being a new process, vibhāṣā is not part of jvalitikasantebhyonah.

2.42 ANYATARASYĀM AS NOT FIGURING INITIALLY IN THE RULES OF THE ASTADHYAYI

The word anyatarasyām never figures initially in the rules of the Astadhyayi. By this criterion, for example, we cannot stop at padah and regard anyatarasyām tābṛci as one sūtra in the rules P.4.1.8-9 pādhyatatarasyamṭabṛci.
2.43 PARTICLE CA AS NOT IMMEDIATELY FOLLOWED BY TERMS FOR OPTIONALITY

The particle *ca* is not immediately followed by the terms for optionality. For example, in the rules P.6.2.66-67 *yukteca vibhāsādhyakṣe*, the particle *ca* indicates the break between *yukte ca* and *vibhāsādhyakṣe*.

The text of the *Aṣṭādhyāyī* being orally transmitted in continuous recitation, it becomes difficult to divide the *samhita* text into separate rules. As the words *vā*, *vibhāsā* and *saṃjñāyām* occur at the beginning or end of a rule, it leads to ambiguity whether these words are to be connected with a preceding part or with a following part. Often, the insertion of particle *ca* is helpful in determining the correct division of the text of the *Aṣṭādhyāyī*.

A word followed by *ca* indicates the boundary of the preceding statement. For example, with rules P.5.3.12-13 *kimodvāhacachandasi*, in the absence of *ca*, it would not be clear whether the element *va* is to be connected with *kimo’d* or with *ha ca chandasi*. Thus, the particle *ca* inserted after *ha* marks the boundary of the earlier rule *kimo’d vā*. However, tradition incorrectly divides these two rules into p.5.3.12 *kimo’t* and P.5.3.13 *vā ha ca chandasi* and also further suggests that *va* be read into the preceding rule by *apakāra* 'drawing back'. However, the above arguments suggest that we have to divide these rules into (i) *kimo’d vā* and (ii) *ha ca chandasi*.
2.44 **RULE CONTAINING THE NEGATIVE PARTICLE AS NOT CONTAINING ANY OTHER MODIFIER IN IT**

The rule containing the negative particle does not contain any other modifier in it. For example, in the rules P.6.2.19-20 nabhūvākeiddhiśuvābhuvanam, the particle na helps in isolating the rule vā bhuvanam.

2.45 **AN ELEMENT OF GENITIVE TATPURUSA COMPOUND AS CONTINUING IN RULES FOLLOWING**

Since the elements in a genitive tatpurusa compound are not interlocked, one of the elements in a genitive tatpurusa compound can continue in the rules following. For example, 6.2.111 uttarapadaśiḥ (udāttah) 'the first syllable of the final member is accented', which is a section-heading rule, extends its influence upto P.6.2143 antaḥ (uttarapadasya) 'the final syllable of the final member of a compound is accented'. But P.6.2.143 is a section-heading rule which exerts its influence upto the end of P.6.2. The part uttarapadasya of the genitive compound uttarapadaśiḥ continues while adiḥ which is incompatible with antaḥ does not continue.
2.46 **CONTINUING OR DISCONTINUING OF ELEMENTS OF DVANDVA COMPOUND TOGETHER IN RULE FOLLOWING**

Elements of a *dvandva* compound must be continued or discontinued together in the following rule. Elements in a *dvandva* compound are disjunctively connected. As items are not interlocked in a *dvandva* compound unless they are connected with some common elements; they must be continued or discontinued together.

For example, the elements *lin* and *sic* mentioned in the *dvandva* compound *linsican* in P.1.2.11 *liṅsicāv ātmanepadem* (iṅhā *jhal* ṭalantāt *kit*) ‘LIN *preactive marker sīyUT*’ or *sic* ‘aorist marker’ beginning with *jhal* consonant that is, *s* used in the middle voice coming after the verbal bases ending in a consonant that adjoins an *ik*- vowel is marked with the *anubandha K*’, are continued together in 1.1.12 *uśca* (*liṅsicau ātmanepadesu jhal*) ‘also LIN ’preactive marker’ or *sic* ‘aorist marker’ beginning with *jhal* consonant that is, *s* used in the middle voice coming after a verbal base ending in a short *u* is marked with the *anubandha K*’ and P.1.1.13 *vā gamah* (*liṅsicau ātmanepadesu jhal kit‘ LIN preactive marker sīyUT* or *sic* ‘aorist marker’ beginning with *jhal* consonant, that is, *s* used in the middle voice coming after the verbal base *gam-* to go is marked preferably with the *anubandha K*’. However, we want to discontinue the item *lin* in P.1.2.14 *hanah sic* (atmanepadesu kit) ‘sic’ aorist
marker' beginning with jhal consonant, that is, s used in the middle voice coming after the verbal base han- 'to kill' is marked with the anubandha K. Thus the mention of sic becomes purposeful only in the context of above mentioned principle.

2.47 CONVENTIONS OF ANUVRVTTI IMPLICIT IN THE ORGANISATION OF ASTADHYAYI ARE O BE DISCOVERED RATHER THAN FOLLOW AD HOC TRADITIONAL DICTATES

From the above discussions, it is clear that convention of anuvṛttī are implicit in the organisation of the Astādhyāyī and are helpful for a proper interpretation of the Astādhyāyī. The few traditional anuvṛttī which have come down to us through Mahābhāṣya and the Kāśikā are ad-hoc and overgeneralized in character and some of these traditional principles are unlikely to have ever been accepted by Panini himself. What Panini did was to develop more fully same principles of anuvṛttī used in ordinary speech and make use of the fully developed device in his grammatical theory construction. As some of the apparent counter examples do not disprove the principles discussed above, it is claimed that the apparent counter-examples are manifestations of later insertion, which, quite often, interfere with the flow of anuvṛttī. Thus, there is a great need for studying Panini independently, by pure reason rather than go by tradition which itself is discontinuous. Such studies, though are already progressing fruitfully,
such successes have still not made a dent in the followers of Patañjali to examine the empirical evidence with an open mind and to restore the order which Panini so carefully built up in grammatical theory construction. In the Vedic and nipātana rules which are added at the end of rules dealing with the classical facts are removed from the Aṣṭādhyāyī, the remaining part of the text could still continue smoothly and no one would notice these mixing rules. It has also been shown that many inconsistencies found in the Aṣṭādhyāyī are not due to oversight of Panini but due to the insertion of taddhita and samāsa rules between the rules dealing with the formation of verbs. These and other later additions which present heterogeneous material are mainly responsible for the failure of the conventions of anuvṛtti which otherwise work satisfactorily. The modern student owes it to Panini to eliminate the clever additions which have corrupted the delicate mathematical balance constructed by Panini. The task is all the more difficult as the final editor of the Aṣṭādhyāyī was a clever compiler who, while reworking on the different layers of the text has carefully tried to maintain a high degree of consistency as regards technical terminology, the basic pratyāhāra and anubandha systems and the anuvṛtti as assumed by the basic layer, as evidenced by the examples of anuvṛtti conventions in all the sections of the Aṣṭādhyāyī. However, the conventions of anuvṛtti do not work when a rule is inserted in the pre-existing
body of the rules, often such insertions being at the end of pre existing group or between two previous existing rules. Pāṇini's grammatical theory construction can be understood only when such interpolations are purged out with the help of careful reasoning and an open mind.

2.48 ASTĀDHYĀYĪ AS SELF-CONTAINED MODELLING OF GRAMMATICAL KNOWLEDGE AKIN TO MATHEMATICAL MODELLING OF SCIENTIFIC KNOWLEDGE

Pāṇini did not provide illustrations for his rules. Perhaps he intended the rules to be purely representing grammatical knowledge without any redundancy as is done in mathematical modelling of knowledge in science. As he was concerned with perfecting grammatical description and making it a venerable science self-contained in itself, he has avoided recourse to any extraneous definition or factor in other spheres of knowledge. However, this delicate modelling has suffered at the hands of his successors like Patanjali as between Pāṇini and his successors there is not only a time gap, but also a gap of discontinuity of tradition. Pāṇini's skillfully planned out representation has almost completely been lost, under the treatment of Kāśikā. In Pāṇini, the accents were a living reality, but were lost already at a time prior to Patanjali.
2.49 **Pāṇini as Culminating Point in Indian Grammatical Tradition**

Pāṇini stood at the culmination point of a rich grammatical tradition, the main schools of thought being Aindra School which took *pada* to be the unit of meaning, Śākātāyana School which held the extreme view that all non-verbal forms are derived from verbal roots, Apiṣali School to which the principle of economy is ascribed, Sakalya School which is credited with the features of Sandhi in the *Aṣṭādhyāyī*, Gārgya School which held that the prefixes are not mere symbols of meaning but have their own independent meaning and other schools propounded by Kāśakṛtsna, Gālava, Kāśyapa, Senaka, Sphotāyana and Cakravarmaṇa.

2.50 **Pāṇini's Approach Described as Synthetic in His Innovation of Defining Older Terms Not Semantically But in Terms of Structural Behaviour and as Analytic in His Own Description**

In order to continue the older grammatical tradition, even at the cost of non-economy Pāṇini uses longer terms such as *prātīpađika* 'nominal stem', *sarvanāmaasthāna* 'the group of first five declensional suffixes', *sārvadhātuka* 'a class of verbal suffix' and *karmapravacanīya* 'governing preposition', Pāṇini showed his innovation by defining these older terms not in terms of meaning but in terms of their structural behaviour. For example, he defined *Prātīpađika* as non-
verb, non-suffix, meaningful unit in P.1.2.45-46. Panini described the structure of verbal conjugation not in terms of temporal tense because he found overlapping of sense of time. He discarded the four fold classification of words nāma ‘nominal’, ākhyāta ‘verb’, upasarga ‘proverb’ and nipāta ‘indeclinable’ which were prevalent in the tradition and instead introduced a two fold division of words dhātu ‘verb’ and prātipadika ‘non-verb’. Pāṇini’s approach may be described as synthetical in accepting traditional values that analytical in his own description.

2.51 PĀṆINI’S GOAL AS MATHEMATICAL MODELLING OF GRAMMAR TO GENERATE NEW FORMS AND ACCOUNT FOR EXTENT FORMS WITHOUT RECURSIVE TO ILLUSTRATIONS

From the internal evidences in the Aṣṭādhyāyī itself Pāṇini’s goal appears to be to describe the language spoken by a group of priests of vedic tradition, to give variations as a kind of foot-note to the main line of description, to give a functional orientation to the units used in the description in order that the validity of their interrelationship may not have to be sought outside the grammar, by defining either in terms of lists or in terms of their common functional behaviour to present the description in a concise style, to start from syntactic relationship based on meaning and to arrive at the phonemic realisation as a sentence and to present a mathematical model of the grammar which can generate
new forms and account for extent forms without having to take recourse to illustrations.

Pāṇini’s Astādhyāyī consists of fourteen pratyāhāra sūtras, the main body of description, gaṇapātha or the group wise list of non-verbal stems, each group serving a common function in the description and dhātu pātha or the list of verbal stems divided into ten main sub-classes.

2.52 PĀṆINI’S ABSTRACTION AS IN SCIENTIFIC AND NOT PHILOSOPHIC TERMS FOR WHICH HE DEvised ALGEBRAIC NOTATION IN TERMS OF EXTRA LINGUISTIC DEFINITION AND ASSIGNED FUNCTIONS TO THEM

Pāṇini adapted the sūtra style prevalent in his times to compose his grammatical rules. The sūtra style is marked by the absence of verb predicates, avoidance of repetition of the same term in a string, use of technical terms which are defined, use of technical devices which facilitate in making out the sense and abstraction from a series of observations through categorization. However, Pāṇini’s abstraction is in scientific and not philosophical terms unlike the sutra style in other śāstras. He had no obligation to give reasons for his arrangement, his only requirement being representation of pure knowledge. For this purpose, he devised algebraic notation and assigned functions to them. He, therefore, avoids definition of his symbols in terms of extra-linguistic definition.
He sticks to either a distribution of definition or an enumerational definition. For example, he classifies the suffixes addable to the non-verbal stem, namely, the feminine, the declensional, and the secondary derivational suffixes on the basis of their distributional class prātipadīka 'non-verbal stem' by P.4.1.1 Nyap prātipadikāt read with P.4.1.2 and P.4.1.76 or after having defined the verbal stems and affixes by listing he defines the non-verbal stem as the meaningful element which is neither a verbal stem nor an affix in P.1.2.45 read with P.1.2.46.

2.53 **Pāṇini as defining grammatical terms by relational function, enumeration, listing, substitution, elimination or grouping features of substitution, elision or augmentation**

In order to achieve maximum economy, Pāṇini used the devices of sanjña 'definition', paribhāsa 'rules of interpretation', anuvṛtti 'chain technique' and the use of third person singular conjugational form of a verb to indicate a transformational kernal sentence model.

Pāṇini defined the grammatical terms already in use by relational function as in the case of kartṛ in P.1.4.54 read with P.1.4.55 and karma in P.1.4.49 read with P.1.4.50-52 or by enumeration under a single heading as in the case of avyayabhāva 'adverbial compound' as in P.2.1.6-21 as definition of P.2.1.5 or by listing as in the case of dhātu as in P.1.3.1 or by
substitution by an element sharing common function as in the case of secondary verbal stem as in P.2.3.32 and non-verbal stems as in P.1.2.46, or by elimination as in the case of non-verbal stems as in P.1.2.45 or by grouping a common feature of substitution, elision or augmentation under one heading as in the case of guṇa as in P.1.1.2 or lopa as in P.1.1.60-61.

2.54 **Pāṇini as Making Use of Algebraic Notation to Denote Group of Forms by Abstraction of Common Features of Representation**

Pāṇini made use of algebraic notation to denote a group of forms by means of joining the first of the first member which is real and the last of the last member which unreal as in the case of pratyāhāras or to denote a group of forms or functions by the abstraction of common feature of representation as in the case of lopa 'zero' called ṚU applying to three types of zero, namely, śLU, LUK, LUP as in P.1.1.60, 61 and 63 or as in the case of feminine suffix Ṛī standing for ṚīP, ṚīG, ṚīN in P.4.1.1 or to denote a group of forms by the common initial or final morphophoneme as U in P.3.1.125 by the force of P.1.1.72 or to denote a group of forms by the common morphemic classifier or it as in the case of śap, śyāN, śLU, śna, śnu, śa, śnaN as in P.3.1.68 - 83 or to denote a specific element in a group of elements having a definite function but which cannot be statable precisely by a lexical word due to such a function having no relevance in the semantic
area, such as bha 'internal component' as in P.1.4.18-19 or ṭi 'final syllable' as in P.1.1.64 or ghu standing for the verbal stems dā, dhā excluding dāp as in P.1.1.20. For distinguishing the sounds used as algebraic symbols from the real sounds of the language, Panini used either the device of an additional feature of nasalization as in the case of vowel algebraic symbols as in P.1.3.2 or the defined location of these sounds especially when they are consonants or a group of sounds as in P.1.3.3-8. Panini does not apply his own rules of sandhi wherever they can bring ambiguity. This he does in order to make these symbols of his meta-language look unambiguous and transparent. When there is no chance of confusion he applies sandhi rules.

2.55 RULES OF INTERPRETATION AS FOR DETERMINING ORDER AND FORCE OF SUCCESSIVE APPLICATION, ENVIRONMENT AND TARGET OF OPERATION, JURISDICTION OF A CHAIN OF RULES, FOR EXPLAINING USE OF SYMBOLS AND RULES DEFINING STRUCTURE OF ANALYSIS

Rules of interpretation or paribhāṣa rules are of five kinds: (a) rules determining order and successive force or application; for example, P.1.4.2 vipratisēdhe param kāryam, 'the later rule is to be enforced when there is a contradiction of a former rule by a later rule, (b) rules determining the environment and target of operation; for example, P.1.1.66-67, locative singular case ending indicates the following, the ablative singular case ending indicates the
preceding environment, (c) rules determining the jurisdiction of a chain of rules, for example, P.1.3.11, the heading of a description is marked by the boundary of a circumflex accent, (d) rules explaining the use of symbols for example P.1.1.70-72 and (e) rules defining the structure of the analysis, for example, P.1.1.62, even though the affix is realised as zero, the functions assigned its classifiers are to be brought in operation.

Most of these rules were propounded by Katyayana or Patañjali but some more additions were made. Nāgeśa Bhaṭṭa in his Paribhāṣendu śekhara has critically examined these rules of interpretation. However, majority of these rules throw more light on the tradition of the interpretation of Panini than on Pāṇini himself.

2.56 **CHAIN TECHNIQUE AS OPERATING THROUGH A HEADING INDICATED BY A CIRCUMFLEX ACCENT. A COMPLETE CONTINUITY BROUGHT BY PARTICLE CA. PARTIAL RULE WITH PART OF FOLLOWING RULE AND INTERRUPTED**

Anuvṛtti 'chain technique' device is used in order to achieve maximum economy operating through -

(1) **A heading indicated by a circumflex accent which in turn itself can be a sub-heading of a main heading. For example, in P.3.1.1 pratyāvat 'affixes' is**
the main heading which runs through the chapters 3 to 5. But P.3.1.91 dhatoḥ 'after a verbal root' is a sub-heading, of which again P.3.2.84 bhute 'to indicate the past sense' is a sub-sub-heading.

(2) A complete continuity brought by the particle ca. For example, P.1.4.54 svatantraḥ kartā 'the agent is one which is independent' followed by P.1.4.55 tat prayojako hetuṣca 'and that which is the indirect cause of the agent being joined by ca carries the force that 'the indirect cause of the agent' is also 'agent'

(3) A partial continuity brought by taking only part of a preceding rule and joining it with the following rule. For example, only the karmāṇaḥ etc., 'the goal concept' from P.3.1.7 is taken as a continuous in the succeeding rule P.3.1.8 and not the rest dhatoḥ.

(4) An interrupted continuity, mandūkapluti operating after an intervention. For example, P.3.1.8 supa ātmanāḥ kyaC 'after a declensional form kyaC is added to indicate the desired goal of itself', everything continues in the following P.3.1.9 Kāmyacca 'and also Kāmyac 'but in the following P.3.1.10 upamānadhācāre 'to indicate the sense of one's goal functioning like something else', the suffix kyaC and not Kāmyac, is added.

When the oral tradition had been broken the
chain technique became a real problem and the precise boundary of one chain became at times confused.

2.57 **Pāṇini as resorting to transformational kernel sentence model where exact connotation cannot be made clear otherwise**

The use of third person singular conjugational form of a verb to indicate a transformational kernel sentence model, where the exact connotation cannot be made clear otherwise, was resorted to by Pāṇini, for example, P.5.1.16 tadasya tadasmin svād iti 'that may "belong to this" or that may be "in this"' in order to serve as a substitute for these two kernel sentences.

2.58 **Division of rules of the Astadhyayi into various categories**

The rules of the Astadhyayi may be divided broadly under two categories, those that pertain to the technique of description and those that pertain to the description itself. Samjñā, Paribhāṣā which includes anuvṛtti and headings and sub-headings fall under the first category. Both these rules may be further classified as utaarga 'general rule' and apavāda 'exception' which can be either atideśa 'obligatory replacement' or vibhāṣā 'optional replacement'. Again Patanjali has made another classification as antarāṅga 'the inner layer rule' and bahirāṅga 'the outer layer rule' from the point of view of force or order of
operation. This layering is structurally comparable to that of 'constituents' in modern linguistics.

2.59 **EVERY RULE AS BEING CLOSELY RELATED WITH THE ENTIRE FRAMEWORK OF DESCRIPTION, WHICH FACT HAS PRESERVED THE ASTADHYAYI INTACT TO A GREAT EXTENT AND HELPS IDENTIFY INTERPOLATION**

The rules operate in a string in the Astādhyāyī so that one has to go on and on till one reaches the end of Astādhyāyī. One has to operate through the entire corpus of description before reaching the final level of the actual utterance. In this process one has to refer back to general technical rules and refer forward to particular rules, exceptions which may over rule the force of the rule, concerned and in addition one has to reconstruct the full rule adding the components implicit from continuity and context. In other words every rule is closely related with the entire framework of the description and cannot be isolated from it. This interdependence of the rules has presented much difficulty in application when one does not have the complete grammar in his active memory. However, this inter dependence has kept the Astādhyāyī preserved in tact.
2.6 **PANINI’S GRAMMAR AS ONE INDIVISIBLE STRUC...**
**INTERDEPENDENT RULES EXPRESSED IN EQUATIONAL FORM TO DESCRIBE HIS OWN SYNCHRONIC ANALYSIS**

Pañini uses regularly a sentence having a non-verb predicate except for the rules where a finite verb is needed to illustrate the substitutive transformational model in the third person singular. Everywhere in Pañini’s rule the verb form ‘is’ is implicit because the rules referring either to technique or to the main description are in terms of his own synchronic analysis and not in terms of what the form was or what it should be. Thus, the framework of his sentence is precisely mathematical in character, every rule is one step, sometimes an independent step or the beginning of another set of step, but in general it is dependent on the step preceding and following it. Because of this, Panini’s whole grammar has become one indivisible statement. The order of every word in the rule and the inflectional ending of every word is important.

2.61 **SOME ASPECTS OF PĂNINI’S RULE CONSTRUCTS WHOSE COMPONENTS ARE CLEARLY DEFINED IN TERMS OF THEIR POSITION SPECIFIC STRUCTURAL BEHAVIOUR**

The concordant predicate of the term under definition or description is placed first. This concordant predicate is replaced by words implying option वा, vibhāsā or exception, ना wherever required. It is also substitutable by its expansion into a non-
verbal phrase as well as by a non-concordant non-verbal phrase.

The second in order comes the term or feature under definition or description. The third in order comes the conditioning factor for the definition or description and the last in order is either a connective ca, vā anyatarasyām if required usually one or many of these items are implicit in the context and need to be linked up with the statement in the rule concerned.

Nominal singular ending indicates the term or feature under definition or description. A plural ending indicates either a group of heterogeneous term or features or an unlimited number of similar item. Ablative singular ending marks the feature concerned to be the preceding environment. Genitive ending after the word functioning as the head of the predicate indicates that the feature concerned is the one that is stated as 'to be replaced by'.

Locative ending has four definite functions to perform -

(1) When it is added to a word signifying some broad heading or area of description and indicates in the situation or in the occasion, visayasaptam.

(2) When it is added to a word signifying environment in operation and indicates the following one, P.1.1.66.
(3) When it is added to a word indicating some condition, *nimittasaptami*, which belongs to the stratum different from that under description.

(4) When it is added to a preceding element in the primary suffix formation, P.3.1.92.

Instrumental ending indicates that the other member is a compound.

The symbols of the meta-language are also inflected though they do not follow the following descriptive rule in order not to look ambiguous:

(a) the final phoneme even though in a word final does not alternate as required by P.8.2.30.

(b) The forms though indeclinable in the actual language, when used as a citation form get declensional suffixes as they do not behave like an indeclinable.

(c) Similarly the verbal stems also are inflected as non-verbal stem when treated as a citation form either in the abstract shape in which it is read in the *dhatupatha* or in the realizable form or in the third person singular form of the present indicative.

(d) Some monosyllabic abstract suffix forms like *a, ka* are not inflected for nominative singular so that they might not be confused for forms like *as* and *kas* (P.3.3.102 and P.3.3.83).
It is thus evident that the various components of a Pāṇinian rule are clearly defined in terms of their position and specific structural behaviour in contrast with the common language.
The technical rules of Panini fall into two broad categories: (1) those rules that apply equally all sections of the Aṣṭādhyāyī, (a) without being overruled by the following rules in case there is contradiction and (b) those which are overruled and (2) those that apply to a particular section. The first category of the rules is put together in the first two chapters and the second category is spread over in the concerned section. The category (1)(a) and (b) are separated by the rule P.1.4.1. After this rule, whenever the same form gets more than one definitional designation, it is the later that is, applicable and not the former. For example, p.1.4.59 overrules the preceding rule 58 to indicate that when the term upasarga 'preverb' applies to the form pra, etc., the previous designation nipāta 'enclitic' does not apply but the term pre-verb does not apply to ca etc., designated nipāta in P.1.4.57 since P.1.4.59 contradicts only P.1.4.58 the immediately preceding rule.

The rules put together in P.8.2.4 till the end of the book form a group in themselves. In that (a) whenever they seem to contradict a rule in the preceding portions of the book they are in capacitated in overruling the earlier one. (b) within this portion itself a later rule does not overrule a former rule
except when it is an exception to that general rule.

(c) though the definitional rules of the first three sections of the first chapter do apply to this portion neither the descriptive rules of the remaining chapters apply to this portion nor such definitional rules which have a specific purpose in relation to a rule belonging to the portion between P.1.4.1 and P.8.2.1. The purpose of the *tripādi* is to provide a layer which is not colinear to the rest, so that, the operations of the rest of this book take into effect as though *tripādi* had not been in existence, but not vice versa. Panini used this device in order to take care of those exceptions which when put in the circle of earlier operations, would have disturbed the circular rotation and would have made statement clumsy and to take care of the exclusive features of external *sandhi*, such as, *sandhi* or phrase *sandhi*.

2.63 *Śīva Sūtras Grouped on the Basis of Structural Behaviour of Language*

The *śīva sūtras* are the first group-formers. Though the traditional grammarians call the last consonant in each of the fourteen *śīva sūtras anubandhas*, Panini calls them *iṭa* in P.1.3.2 by virtue of their occurring as the form-final marker consonant. The *iṭa* are notational symbols which though unreal and therefore, disappear when the actual utterance is to be realised by applying P.1.3.9 read with P.1.1.60 serve to signal either a group of forms or their functions.
The arrangement of śīva sūtras is more in tune with the structural framework of the whole grammar than with phonetic criteria. śīva sūtras are sets of real members and as such do not account for the unreal aspects of these real members. For example, jh of jh-I does not include 'JH' of 'JH'i where JH is unreal as jh and is a cover symbol for ant- or at (P.7.1.3 - 8). The śīva sūtras are grouped on the basis of their total structural behaviour in the language and not on mere phonological similarity. These sūtras follow the order of varṇa samāmnāya or traditional alphabet so long as the order is not interfered by the overall structural behaviour. The important feature of the śīva sūtras is that they are formed on the basis of strict economy so that the order may take care of the indusiveness of a bigger set and also of the exclusiveness of one or more members. However, the order of the notational symbols in the śīva sūtras has eluded conclusive explanation.

2.64 Pāṇini's Technique of Signalling a Group

Pāṇini signals a group in four ways:

(1) the final segment of the group, together with the first member of the group, may represent the entire group, or the final segment itself be a group-marker of a class of which the segment preceding is the first member, or one of the segments, namely, initial, medial or final, may be a notational symbol for operations and sometimes distribution shared by all the members of the class.
(2) the first member of a group followed by a word like adi 'etc.'; this grouping being based on lists of verbal roots 'dhātupātha' or non-verbal stems 'ganapātha'. This is a list type of grouping (gana).

(3) the group may be denoted by a definite term applying to all members, though belonging to none individually (sanjñā).

(4) the group may be shared by the highest common factor shared by all the members.

The śīva-sūtra pratyāhāra groups come under (1) above. Also come under (1) above the following groups of suffixes formed by a similar device as applied in śīva-sūtras:

(a) sU-P : all declensional endings.
(b) sU-T : the first five declensional endings, namely, nominal singular, dual and plural and accusative singular and dual.
(c) ti-N : all the conjugational endings
(d) ta-N : all the middle endings

Also come under (1) above, the five groups of consonants classified according to place of articulation, namely, the velar -kU, the palatal cU, the retroflex ṭU, the dental ṭU and the labial pU signalled by U.
Groups indicated by enumeration in the main body of the description are:

1. **kāraka** 'verbal relation' P.1.4.24-55
2. **nipāta** 'enclitic' P.1.4.57-97
3. **karmapravacaniya** 'governing preposition' P.1.4.84-97
4. **samāsa** 'compound' P.2.1.4 - P.2.3.73
5. **avvayibhāva** 'adverbial compound' P.2.1.5 - P.2.1.21
6. **tatpurusa** 'determinative' P.2.1.24 - P.2.2.22
7. **bahuvihi** 'possessive' P.2.2.24 - P.2.2.28
8. **pratyaya** 'suffix' P.3 and 5 chapters
9. **pratyaya** 'suffix' addable to verbal stem only P.3.1.96 - P.3.4.117
10. **krtya** 'suffixes of class 9' P.3.1.96 - P.3.1.132
11. **strī pratyaya** 'suffix addable to non-verbal stem to make it a feminine stem P.4.1.4 - 81
12. **taddhita** 'secondary suffixes' P.4.1.77 - P.5.4.160

The purpose of the above type grouping is to avoid a definition in any other term than its members of the classes defined by each enumeration block. To group the class of distinct members, Panini makes use of the common denominator of a common phonemic sequence giving it an abstract name. For example, L serves as a symbol for conjugational ending and is sub classified into two groups, T and ŉ on the basis of allomorphy of the conjugational suffixes. It is again sub grouped on the basis of the sememic concepts into ten sub groups
marked by the intervening vowels as LΆN, LΆT, LΙΝ, LΙΤ, 
LΥΝ, LΥΤ, LΡΝ, LΡΤ, LET and LOT.

2.66 *EXPLANATORY TRANSPARENCY OF SYMBOLS USED*

In this grammatical theory construction, Panini has chosen such symbols as to be explanatorily transparent in most cases. For example, -N and -P as finals of ti-Ň and sU-P serve the purpose of designating these classes and have no other function, as by definition a group can be designated by the first member coupled by the last notational symbol. N as the final verbal stem iN distinguishes it from the verbal stem iN which invariably takes the middle ending. -I as final of ṇasĩ (ablative singular) serves to distinguish it from Nas (genitive singular). Both I and U as penultimate or final serve a protective purpose, so that the element preceding it by becoming final does not become by the force of definition (every final consonant of an abstract form is notational symbol; P.1.3.3 and subsequently zero, P.1.3.9) and that the notational symbol following it is kept apart for the set of functions assignable to it. For example in ṇinI, I protects -n from being mistaken for a notational symbol and in GHiṇUN, U stands between n and ṇ for the protection of both. U has reserved for a consonantal augment or substitute class, differing in positional function as well as phonemic shape. For example, tUK, sUT, num stand for -t after s- before and -n- intervening. ṇ is the initial of a feminizer
suffix-group serves as a common denominator for three kinds of \( i \), having different types of accent shifts denoted by the final \( N, P \) and \( S \).

2.67 **DIFFERENTIATION OF SYNTAXIC STRUCTURE OF DEFINITIONAL RULES BY PLACING TERMS IN APPOSITION IN NOMINATIVE CASE**

The syntactic structure of definitional rules (\( \text{samj} \n \)) is differentiated by two terms placed in case in apposition in the nominative case while in applicational rules (\( \text{paribh} \n \)) even where the two terms used in the rule are in the nominative, as in \( \text{samarthah padavidhi} \n \) P.2.1.1, where one is merely a modifier of the other. The usual order is the definitional term followed by the defined term, though this order is reversed in P.1.1.1 where the auspicious word \( \text{vrdh} \n \) is placed before definition. The \( \text{paribh} \n \) rules are interspersed with the \( \text{samj} \n \) rules, firstly, to effect economy of terms by connecting the same term to definition as well as application. For example, the application rules regarding realization of a suffix as zero follow immediately the definition of a zero realization (P.1.1.60 - P.1.1.63). Secondly, the order of rules is pertinent for operation in a circle, so that, if a particular definition is to apply to a term and is not to be affected by a rule of application delimiting its application, that definition will be taken out of the jurisdiction of the particular rule of application. For example, the adjectival compound
karmadhāravya is defined in P.1.2.42 while the other components are defined in P.2.1.2 for the simple reason that the definitions given in P.2.1.2 are governed by the rule of application in P.1.4.1, so that a term defined therein cannot have two definitions simultaneously. Thus an adjectival compound cannot remain in terms of structure a determinative tatpurūṣa compound at the same time. The easy way out of this problem is to take out that definition from the range of the application rule P.1.4.1.

2.68 **FIVE CHARACTERISTICS OF PĀÑINIAN DEFINITIONAL RULE**

The general characteristics of Painian definition rule are that (1) it is given in structural terms to avoid extra-linguistic criteria to define a particular term. Only the structural relation or position or membership or distribution should be the criteria; (2) it is not ambiguous and clearly contrastive; (3) it is limited by rules of application in order and mode of operation, (4) it is an abstraction valid only to the description of the relationship between the analyzable units of utterance in a particular language; (5) wherever it is not explicit, it is implicit by elimination, enumeration or juxtaposition.

2.69 **FOUR FOLD CLASSIFICATION OF DEFINITIONAL RULES**

The definitional rules can be broadly classified under: (1) classes defined in terms of
membership. Under this category, fall (a) stems, namely dhātu and prātipadika, (b) suffixes pratyaya and suffix sub groups and (c) phoneme groups pratvāhāra. (2) combinations defined in terms of their components. Under this fall (a) sentence (b) word inflected (c) word compound, (d) word derived (e) combination of classifiers (f) combination of phoneme. (3) Units defined in terms of their representation at a lower strata. Under this fall (a) supra morphemic units represented as a morpheme (b) morpheme represented as a morphophonemic entity (c) morphophoneme represented as phoneme (d) phoneme represented as phonetic entity. (4) relating in terms of relative position or function under this fall (a) cases (b) bustitutable component in a compound (c) substitutable component in primary derivation (d) substitutable component in secondary derivation (e) classifiers.

2.70 FIVE FOLD PURPOSE OF PĀṇINIAN APPLICATION RULE

The rules of application or paribhāṣā in Pāṇini have a four-fold purpose of (1) relating the definition rule to the main description rule as also one description rule with the other (2) limiting the scope of a designation sāṃśāna or a rule (3) assigning precise mathematical significance to the notational symbols and terms used (4) ordaining the successive order of operation and determine the relative force of more than one conflicting rule and (5) serving as a meta-theorem or meta-theory in logical terms.
Joshi and Kiparsky claim that the ordering of rules in Pāṇini's grammar is governed by the principle that all rules are *siddha* with respect to all rules, unless a specific statement to the contrary is contained in the grammar.

According to Kātyāyana, making a rule *asiddha* has two functions: *asiddhavacanam ādaśalaksanapratisedhārtham* utṣarga laksanabhāvārtham (P.6.1.86 Varttika 1), *utṣarga* here meaning sthānīn, the element which undergoes substitution in a rule.

Suppose we have a process

(1) A ---> B

and processes P and Q applying in the environments A and B respectively:

(2) P in the environment A
(3) Q in the environment B

Then to say that the rule (1) is *asiddha* with respect to rule (2), is to say that P is applicable in the environment A even if A should become B by rule (1) *-utṣarga laksanā bhāvārtham*. And to say that rule (1) is *asiddha* with respect to rule (3), is to say that Q is not applicable to A even if it should become B by rule (1) *-ādeśā- laksanā pratīṣedhārtham*. 
To use terms of modern linguistics, *asiddhatva* blocks bleeding and feeding between rules. Thus, to say that rule (1) is *asiddha* with respect to rule (2) means that it does not bleed rule (2), that is, rule (1) does not deprive rule (2) of A's to which rule (2) can apply, and to say that rule (1) is *asiddha* with respect to rule (3) means that rule (1) does not feed (3), that is, does not provide rule (3) with B's to which rule (3) is allowed to apply.

For example, P.8.2.7 *nalopaḥ* prātipadikāntasya is *asiddha* by virtue of P.8.2.1 pūrvatrāsiddham with respect to P.6.4.8 sarvanāmaasthāne cāsambuddham. This blocks the deletion of n by P.8.2.1 from bleeding the lengthening of the vowel before stem-final n in the strong cases by P.6.4.8 so that we derive correctly nominative, singular (rājan + sū) ---rāajan ---rājan (P.6.4.8) rajan ---rājan (P.8.2.7) rāja (utsargalakṣaṇaṇabhāvārtham).

Rule P.8.2.1 also makes P.8.2.7 *asiddha* with respect to P.7.1.9 *ato bhisa ais*, as a result of which the deletion of n by P.8.2.7 in rājan + bhis ---rāja + bhis is not allowed to feed the replacement of bhis by ais after a short a by P.7.1.9 so that we do not wrongly derive rāja + bhis ---*rāja + ais* as in the correct derivation vrksa + bhis ---vrksa + ais ---vrksaih, with an original -a stem. This case illustrates the ādēsalakṣaṇa-pratisedhārtha function of *asiddhatva* in Pāṇini's system.
Kātyāyana’s observation can be generalized to every ordering restriction stated in the Astādhyāyī, not only asiddha in P.8.2.1 pūrvarāsiddham and P.6.1.8 satvakor asiddhah and asiddhavat in P.6.4.22 asiddhavat atrā bhāt, but also sthānivadbhāva in P.1.1.56 sthānivad ādeso’nalvidhau, P.1.1.57 acaḥ parasmin pūravidhau and P.1.1.59 dvirvacane’ci. All these serve the function of blocking one or both of these two ways that rules can affect each other’s application, bleeding and feeding and their use in the grammatical system can be justified exclusively as ādesalaksanā pratisedhārtham and / or utsargalaksanā bhāvartham.

2.72 SIDDHA RELATIONS OF FEEDING AND BLEEDING AS GIVEN FREE AND ASIDDHA AS A SPECIAL STATEMENT OF RESTRICTION

Asiddha and other devices are restrictions (nivamae) on a general paribhāṣā that determines how rules interact when no special statement about their ordering is made in the grammar. Though this paribhāṣā is not stated in the grammar itself, it is presupposed by the correct operation of rules in it and implied by the various restrictions on it that are stated in the grammar. Kiparsky has suggested the formulation of this paribhāṣā as :

(4) sarvatra siddham

and calls it siddha-principle. The siddha-principle
says that in the general case, we have ādeśa laksāna bhāva and utsargalaksāna pratisedha. Reverting to our schematic example, if we have a form A and the above rules (1), (2) and (3) are in the grammar, then rule (2) will ordinarily not apply to that form because it will be bled by rule (1) - utsargalaksānapratisedha- and rule (3) will ordinarily apply to that form because it will be fed by rule (1) - ādeśa- laksanabhāva. In other words, the siddha relations of feeding and bleeding are given free by the underlying theory of the Aṣṭādhyāyī and if we lack them in some particular case, then only something must be said in the grammar itself.

2.73 PāṇINIAN NON-LINEAR ORDERING O RULES EXCEPTING TRIPADI AS CONTRASTING WITH LINEAR RULE ORDERING OF MODERN GENERATIVE LINGUISTICS

As far as feeding is concerned, this really goes without saying. In almost any derivation, the application of one rule creates scope for another rule to apply, that rule applies creating scope for a third rule and so on. It is taken for granted in tradition that all rules in such a chain of rules are to be applied. It is only the generative linguists who are used to a strict linear ordering of rules in Tripādi style, that are likely to consider this a noteworthy feature of Pāṇini's grammar.
2.74 THE PRINCIPLE OF BLEEDING ORDER AS EQUIVALENT TO NITYA-PRINCIPLE

Coming to the bleeding (utsargalakṣaṇa pratisedha) case, let us see some examples to see what it means to say that we have bleeding order or rules unless otherwise specified:

In the form śvapitvā ‘having swelled’, the underlying śvi + ktva is subject to two rules. P.7.2.35 ārdhadhātukasved valādeḥ inserts the augment īt at the beginning of the gerund suffix ktvā. The other applicable rule is P.6.1.15 vacisvapiyaṭadīnām kiti, which effects samprasāraṇa replacement (V → U) in the root. Now the question is which rule takes precedence. While samprasāraṇa replacement would have no effect on the applicability of the īt- augment rule, the īt- augment rule causes samprasāraṇa to become inapplicable. This is because of P.1.2.18 na ktva set which says that ktva is not kit and therefore, does not cause samprasāraṇa, if it has the augment īt. The siddha- principle tells us to insert the īt- augment first, bleeding samprasāraṇa replacement and deriving correctly by P.7.3.84 sārvadhātukāradha- dhātukayoh the correct form śvayitvā considering tad (neuter nominative singular of tad ‘that’), we find that in tad + su, a rule is applicable which deletes the case suffix su by luk deletion in neuters according to P.7.1.23 svamor napumsakāt. This rule bleeds and therefore, is applied before any process which depends
on the suffix sU, in this case the rule which replaces
the final sound of the pronoun by a before a case-
suffix (P.7.2.102 tyadādīnāṃ ah) so that we derive tād
+ sU ----> (P.7.1.23) tād and not tād + sU ---->
(7.2.102) taa + s ----> (P.6.1.97 ato guṇe) tā + sU ---->
(P.7.1.23) *.
Considering asmai 'to this', we find that in ida + e [(from idam + e ---→ (P.7.2.102) idaa + e ---→ (P.6.1.97) ida + e)] a rule which replaces the suffix e by asmai after a pronoun ending in a (P.7.1.14 sarvanamnah asmai, ida + e ---→ ida + asmai, eventually asmai) bleeds a rule replacing id in the stem by ana before e (P.7.2.112 anāpy aha), lest we derive incorrectly ida + e ---→ ana + e ---→ * anasmai.

Thus the principle of bleeding order (utsarga laksanapratisedha) is equivalent to the nitya-principle formulated in the traditional inventory of paribhāṣās.

2.75 THE NITYA-PRINCIPLE AS ENBEDDED IN THE SIDDHA

To say that rules are applied in bleeding order amounts to the same thing as saying that nitya rules are applied first. Kiparsky claims that the nitya-principle is not necessary as an independent paribhāṣā because it is already subsumed by the more general principle sarvatra siddham, it being the one half of the siddha-principle, namely the utsarga laksana pratisedha half. He is justified in his claim that this is not merely a modern port-facto generalization, but that Pāṇini himself actually organized his grammar on the basis of such an inclusive siddha-principle.

2.76 SIDDHA-PRINCIPLE AS FIXING TRANSPARENT OR
ORDERING

utra- _laksāna bhāva_ and _ādeśa_ _laksāna_ pratīṣedha are more comprehensive and appropriate characterizations of _asiddhatva_ than those using concepts of feeding and bleeding. Suppose we consider how the rule (1) \( A \longrightarrow B \) relates to a rule that differs from (2) \( P \) in environment \( A \) and (3) \( Q \) in environment \( B \), in that it is applicable to both \( A \) and \( B \), but with different results as given below:

(5) \( R \) in environment \( A, B \); where the application of \( R \) to \( A \) and \( B \) yield different outputs.

In this case, the _siddha_- principle tells us that rule (5) is to be applied to the output of rule (1), that is, to \( B \) rather than to \( A \). Conversely, if rule (1) is _asiddha_ with respect to rule (5), rule (5) is not to be applied to the output of rule (1). Yet the concepts of 'feeding' and 'bleeding' do not apply here in any obvious sense. In order to extend them to such cases we have to resort to the artifice of dividing the applications of rule (5) in the environment \( A, B \) into as many sub rules '\( R \) in environment \( A \)', '\( R \) in environment \( B \)' etc., which gives the derived _siddha_ order as that in which rule (1) feeds and bleeds these individual sub rules.
For example, consider the interaction of a root-changing process such as *samprasārana* with reduplication, which copies a portion of the root. In the derivation of *susyūsati* 'wants to sew', the underlying *siv + sa + ti* is subject to both replacement of *v* by *u* (P.6.4.19) *chvoh śūd anunāsike ca* and reduplication (P.6.1.9 *sanyānoḥ*). The *Siddha-principle* says that the change in the root precedes the copying of the root, giving *siv + sa + ti* --> *sīu + sa + ti* and then (P.6.1.77 *iko yan aci*) *syū + sa + ti*. Only at this point does reduplication apply to give *syū + syū + sa + ti* (--> *susyūsati*). Had it applied at any earlier stage in the derivation, contrary to the *siddha-principle*, then the wrong form *sisyusati* would have been derived. The correct derivation here is a case of both *utsarga laksana pratisedha* and *adesa laksana pratisedha* together in a straightforward way, but, on the other hand, we can speak of feeding and bleeding only if we decompose reduplication into sub-rules including *siv* --> *siv + siv* (bled by *v* --> *u*), *sīu* --> *sīu + sīu* (bled by *i* --> *u*) and *syu* --> *syu + syu* (fed by both).

2.77 **EXPRESSION OF SIDDHA NOTION IN SYMBOLIC TERMS**

*Utsarga laksana pratisedha* and *adesa laksana bhāva* are also complementary relations from a formal point of view, which can be brought under a single over-riding concept which provides the explication of the term *siddha*. *Siddha* literally meaning 'effected',
the idea of sarvatra siddham is that when any rule is applied, the rules pertinent to its application should have been 'effected', i.e., applied. In other words, environment changing rules are applied first. The environments of P, Q, R in rules (2), (3) and (5) are A and / or B and the siddha-principle says that you first apply the rules that effect A and B (either by creating or eliminating them) and then only apply the rules that are applicable in the context of A and B. The idea of siddha can be expressed more precisely in a symbolic way as follows:

Let A(X) denote the result of applying rule A to form X. Then B(A(X)) denotes the result of applying A and B in that order to X, and A, B(X) denotes the result of simultaneously applying A and B to X. Then siddha can be defined as:

(6) A is siddha with respect B = for all X such that B(A(X)) is different from A, B(X), A is applied before B to X and the siddha principle may be expressed as (8). All rules are siddha with respect to all rules.

Siddha-principle fixes what has been the transparent or unmarked ordering in generative grammar.
2.78 **THE ROLE OF ANTARANGA-PRINCIPLE AS NOT JUSTIFIED IN THE WORD DOMAIN**

Kiparsky claims that when the force of the siddha-principle is correctly appreciated, the antaranga-paribhāṣā can be seen to play no role within a word. The ordering of rules in the derivation of a word is regulated exclusively by the siddha-principle and utsarga / apavāda principle. The bahiranga rules may very well be siddha with respect to antaranga rules contrary to paribhāṣā No.50. asiddham bahirangam antarange provided only that the siddha-principle requires it. The irrelevance of the antaranga-paribhāṣa is demonstrated by the following examples where it comes in conflict with the siddha-principle, and the correct ordering is always obtained by the siddha-principle, in violation of the antaranga-paribhāṣa.

In prati+ac+as 'turned towards (genitive singular), the rule deleting the vowel of the derivational suffix ac before certain case suffixes, such as genitive singular as (P.6.4.138 acaḥ) bleeds the replacement of i by y before vowels (P.6.1.77 iko van aci). Thus prati+ac+as --->(P.6.4.138) prati+c+as, and then --->(P.6.3.138) praticas. But P.6.4.138 is supposedly bahiranga with respect to P.6.1.77 so that the antaranga paribhāṣa predicts the incorrect result *pratycas. Thus the correct form is dictated by the siddha-principle.
In **praśṭhāva** 'having departed', the base form **pra+sthā+ktvā** can undergo either replacement of root-final a by i before the following **kiṭ** suffix in च (P.7.4.40 **dvatisvatimāsthāṁ it ti kitī**) or replacement of the suffix **katvā** by **LyaP** in compounds, as hereafter the prefix **pra** (P.7.1.37 **samāse'naḥpurve ktvō lyp**). If supposedly 'antaranga' process a ---> i is applied first, the incorrect form is derived (**pra+sthā+tva** ---> **pra+sthi+tvā** ---> **pra+sthi+ya** ---> * **pra+sthitva**). Transparency predicts that **ktva** ---> **LyaP** should apply first, since it bleeds a ---> i. This yields the desired form **praśṭhāva**.

A special adhoc condition is introduced by the tradition, to take care of the above case with **katvā** ---> **LyaP**, to the effect that a replacement by **LyaP** takes precedence even over **antaranga** rules (Paribhāṣā 55 : **antarangān api vidhim bahirango lyp bādhate**). This condition is not needed since the correct ordering is guaranteed by the general **siddha-principle**.

In **yūnas** (accusative plural of yuvan 'young'), yuvan + as ---> (P.6.4.133 **svayuvamaghonām ataddhite**) yuvan + as ---> (P.6.1.108) yuun + as ---> (P.6.1.101 **akaḥ savarṇe dirghah**) yun + as. Here the process of **samprasāraṇa**, which is supposedly **bahiranga** relative to contraction because it is conditioned by
the case suffix, must nevertheless feed it. The antaranga-paribhāṣā does not derive the correct form, but the siddha-principle does.

2.79 PROCESSES APPLICABLE TO COMBINATION OF WORD AS ASIDDHA WITH RESPECT TO WORD INTERNAL PROCESSES

Thus the antaranga-paribhāṣā has no justification in the word domain, though the processes which apply across word boundaries cannot either feed or bleed processes which apply within words. Kiparsky calls this the principle of word-integrity. It is stated follows:

(8) Processes which apply to combination of words are asiddha with respect to word-internal processes.

For example, the ordering of the two contraction rules P.6.1.87 ād gunah and P.6.1.101 akah savarne ḍīghah is determined by the principle of word-integrity, as demonstrated by the contrasting derivations of a + yaj + a + i indram and atra i + ij + atus : a + yaj + a + i indram ---> (P.6.1.87) ayaje indram ---> ayaja indram, atra i + ij + atus (P.6.1.101) atra ij + atus ---> (P.6.1.87) atrejatus.

The two rules p.6.1.87 and P.6.1.101 must be applied in the opposite order, the rule to be applied first always being the one which is applicable within the domain of a word. In general, the word integrity principle implies that words will be subjected to processes of sentence phonology only when all processes applicable at the word level have been applied.
2.80 **EFFECT OF 'SIDDHAVAT' AS EQUIVALENT TO SIMULTANEOUS APPLICATION OF RULES**

Bronkhorst raises the question why Panini uses different terms, *asiddhavat* in P.6.4.22 *asiddhavad atra bhāt* and *asiddha* in P.8.2.1 *purvatrā siddham* and P.6.1.86 *satvatu-kor asiddham*. The tradition equates *asiddha* and *asiddhavat* as both meaning 'regarded as not having taken effect' and thus gives no satisfactory explanation for the difference. Bronkhorst claims that the relation between the rules in the section headed by p.6.4.22 *asiddhavad atra bhāt* is special in that any two rules A and B in that section must be applied in such a way that each is 'regarded as not having applied' when the other is to be applied. For instance, in *śās + hi* (2nd person singular imperative of 'teach'), two rules, both governed by the heading p.6.4.22 are applicable. By P.6.4.101 *hujhal bhvohar dhiḥ*, *hi* is replaced by *dhi* after a *jhal* consonant, in particular after *g*. By P.6.4.35 *śā hau*, *śās* is replaced by *śā* before *hi*. To derive correctly *śās + hi* ---*> *śā + dhi* both rules must apply. But if *hi* ---*> dhi* is applied first, then the condition for *śās* ---*> *śā* is no longer met, and if *śās* ---*> *śā* is applied first, the condition for *hi* ---*> dhi* is no longer met. In this situation of *vipratīgedha* or 'mutual bleeding', Panini has ensured that both rules will apply by stipulating that every rule in the section governed by P.6.4.22 is *asiddhavat* 'as if not having taken effect' with respect to every other rule.
With this provision, we may apply this rule in either order. Whichever rule we apply first, when we apply the second rule, we pretend that the first rule has not been applied, though in actual fact it has been. In other words, the effect is equivalent to that which would be obtained by applying all the rules in this section simultaneously. Kiparsky explains the -vat in P.6.4.22 as follows:

2.81 THE USE OF ASIDDHAYAT AS JUSTIFIED UNLESS ORDINARY FORMULATIONS FAIL

Assuming that Pāṇini allows only sequential application of rules, given rules A and B, either A must apply before B or B must apply before A and they cannot apply simultaneously. Then it follows that A is siddha with respect to B if and only if B is asiddha with respect to A. Since simultaneous application is excluded, mutual asiddhatva is now a logical impossibility. But Pāṇini needed to get the effect of mutual asiddhatva in the rules of section beginning with P.6.4.22. This has been achieved by the atidēśa device indicated by the suffix -vat. Though the formulation * asiddham atrā bhāt ‘the rules upto bha are asiddha with respect to these rules’ would have been impossible on this assumption, it was still possible to say asiddhayad atrā bhāt ‘the rules upto bha are as if asiddha with respect to these rules’. Though the rules are still to be applied in sequence
this tells us to apply A as if B had not yet applied, for any rules A and B in this section. Kiparsky claims that the reason Panini has formulated P.8.2.1 as purvaträsiddham and not as * purvaträsiddhavat is that he never resorts to the atidēsa device 'A is treated like B' unless the straightforward formulation 'A is B' gives wrong results. For example, instead of P.1.4.43 divah karma ca 'the most effective means (instrument, sadhaka-taman P.1.4.42) is also karman 'goal' with div 'gamble' he could equivalently have said, divah karmavac ca 'is also treated like a karman', but he has not done so because it would be unnecessarily cumbersome. But in P.3.1.87 karmavat karmanā tulyakriyavah 'an agent which functions like a goal is treated like a goal' (for example bhidyate kāstham svAYam eva 'the stick is splitting by itself' with passive morphology). Pāṇini had to employ the atidēsa because simply to have said that kāstham is a goal would incorrectly deny in the agent status which it must have, for example, in order to permit sentences like ucchusya bhidyate kāstham svAYam eva 'having dried out, the stick is splitting by itself', where the gerund ucchusya must have the same agent as the main verb bhidyate, namely, kāstham (samāna kartṛkayoh pūrvakāle). As vat is only used if ordinary formulations fail, there was no reason to use asiddhavat instead of the straight forward asiddha in P.8.2.1.
2.82 THE PURPOSE OF TRIPĀDI SECTION AS FOR OVERCOMING UNDESIRED CONSEQUENCES OF SIDDHA-PRINCIPLE

Kiparsky has claimed that the inclusion of rules in the Tripādi section is invariably motivated by the need to cancel the siddha- principle and that rules have never been put into the Tripādi solely in order to guarantee an order of application which would be provided in any case by the siddha-principle. In other words, the only function of the Tripādi- section is to overcome the undesired consequences of the siddha-principle.

The cases discussed so far were asymmetrical ordering relations where A feeds or bleeds B but B does not feed or bleed A. It was concluded that Panini has assumed a general principle of siddha ordering and taken care of such cases of asiddha ordering as arise in his rule system by formulating special restrictions of asiddha (vat) tva, sthāniyadbhāva and pratvayalakṣanatva.

Now, as regards symmetrical ordering relations between rules, theoretically, they may be of two types, namely, where A and B either feed each other or bleed each other. However, in Astādhyāyī mutual feeding between rules is not noticed, though the relation of mutual bleeding is very common and is traditionally discussed under the name of vipratisadha ‘mutual conflict’. An observation about vipratisadha or mutual bleeding relation is that Panini has never
resorted to the \textit{asiddha} device to resolve the indeterminacy of ordering. Given \textit{vipratisedha} between rules A and B, Panini could have resolved it in favour of either A or B, as desired, by making the other rule \textit{asiddha} with respect to it. Thus, if A is in the \textit{saagdi} and B is in \textit{Tripädi}, then A automatically takes precedence over B. Still, there is no rule whose placement in the \textit{Tripädi} (P.8.2.1 following) or in the \textit{Abhīya} section (P.6.4.22 following) is motivated by the desire to resolve a \textit{vipratisedha} situation in favour of one or the other rule. The inclusion of rules in those sections is always motivated by the need to countervail the \textit{siddha}-principle in cases where it over-applies, which all involve the asymmetrical ordering relations of one-sided feeding or bleeding.

2.83 \textbf{BLOCKING RELATION AS HOLDING NOT ONLY BETWEEN A SPECIAL RULE S AND A GENERAL RULE A BUT ALSO WHEN THE ENVIRONMENTS OF S ARE PART OF COMBINED ENVIRONMENT OF RULES IN G}

Thus, we have to assume either that Panini used some other means of indicating which of two mutually bleeding rules is to be applied or that Panini did not systematically resolve \textit{vipratisedha} in his grammar. The tradition holds that the ordering is determined by assigning validity through the whole grammar to P.1.4.2 \textit{vipratisedha param kāryam 'in case of conflict, apply the last rule'.} However, this stand cannot be correct since there are as many cases that go
against this principle, requiring precedence of earlier rules, as there are supporting it. It was pointed out by Faddegon significatively that P.1.4.2 follows P.1.4.1 akārād eka samjña 'upto kadāra (P.2.2.38), only one technical term is to be assigned to any given item'.

His suggestion that the validity of P.1.45.2 also, like that of P.1.4.1 extends just to P.2.2.38, the end of the section in which technical terms are introduced, is supported by others. Kiparsky suggests that a number of apparent cases of vipratigedha are really governed by a generalized form of the utṣarga- apavāda relation. The correct ordering of rules is obtained in them by the principle that special rules (apavāda) take precedence over general rules (utṣarga). This is achieved by the bādhyasamānyacintā interpretation that blocking relation holds not only between a special rule S and a single rule G (Fig-1) but also between a special rule S and a set of rules G = G1, G2, .... Gn such that the environments of S are included in the combined environments of the rules in G (Fig-2, 3).

FIG.1

FIG.2

FIG.3
This can be illustrated by the three basic vowel *sandhi* rules P.6.1.77 *iko van aci*, P.6.1.87 *ādgunāḥ*, P.6.1.101 *akah savarne dīrghaḥ*. Considered pair wise, the environments of the *savarṇa dīrgha* overlap with *van-ādeśa* and like wise with *guna*. From this point of view, we have two mutually bleeding pairs of rules and no precedence is definable on either pair.

\[
\begin{align*}
\text{yan (P.6.1.77)} & & \text{savarṇa dīrgha (P.6.1.101)} & & \text{guna (P.6.1.87)} \\
i + a & \rightarrow ya & a + a & \rightarrow \bar{a} & * a + a & \rightarrow a \\
* i + i & \rightarrow yi & i + i & \rightarrow \bar{i} & a + i & \rightarrow e \\
i + u & \rightarrow yu & u + u & \rightarrow \bar{u} & a + u & \rightarrow o \\
u + a & \rightarrow va & \text{etc.} & & \text{etc.} \\
u + i & \rightarrow vi & \text{etc.} & & \\
* u + u & \rightarrow vu & \\
\end{align*}
\]

However, when all three rules are taken together, we have a proper subject relation between one of the rules and the other two. The input of *savarṇa dīrgha* is wholly included in that of *yan* and *guna* taken together (Fig. 4).

![Figure-4](image-url)
Thus *savarṇa dīrga* takes precedence over both *vāṇa* and *guna* by the *bādhya sāmanvayacintā* understanding of disjunctive ordering. However, there remain a number of cases which do not yield to this understanding of disjunctivity. For example, suppose we have rules A and B in mutually bleeding relationship and suppose now that preference is to be given to whichever rule bleeds or feeds another rule C. An example of this type is found in conflict between *luk* and *lopa* deletion that arises in certain derivations.

2.84 THE KINDS OF DELETION RULES IN PĀṇINI

Pāṇini’s grammar has two kinds of deletion rules. In one type, whole suffixes are replaced by *luk, lup* or *ālu* which are phonologically null, but which have different morphological consequences, under various morphological circumstances. For instance, P.2.4.71 *supo dhātu prātipadikavoh* states that case endings are replaced by *luk* inside roots or nominal stems. The rule is applied when inflected nouns are subjected to some derivational process such as formation of denominal verbs or of compounds. Thus by the rule P.3.1.8 *supa ātmanah kyac*, the suffix *kyac* is placed after a noun inflected for case to denote wanting for oneself (putra + am + KyaC + *sāP + tiP*) ‘he desires a son’. Here the accusative ending *-am* is deleted by P.2.4.71 since it is inside a root P.3.1.32 *sanādyantā dhātavah*. The final result is *putrīvati*. 
A second kind of deletion in Šaṅini is replacement by lopa. This is in principle deletion of phonological rather than morphological elements, although it can involve the disappearance of entire suffixes. For instance, P.6.1.68 haliniḥabhyo dirghat sutisy aprktam hal provides for the deletion of a single consonant under certain conditions including, as in this case, after consonants if this single consonant is the second or third person singular ending -s, -t or the nominative singular ending -s. For example, in rājan + su 'king' or gomat + su 'possessing cows' the final -s drops, the ultimate output being rāja, gomān.

2.85 DISTINCTION BETWEEN LUK, LUP, SLU AND LOPA

DELETION RULES

One way in which the two kinds of deletions differ is that stem-changes conditioned by a suffix take place even if the suffix has been deleted by lopa (P.11.62 pratvaya lope pratvaya lakṣanam) but not if the suffix has been deleted by luk, slu or lup (P.1.1.63 na lumatāṅgasya). For instance, even though -su is dropped by lopa in rājan + su, gomat + su, the morphophonemic changes conditioned by the suffix -su still operate to yield rāja, gomān. But in dvismāh, from dvīs + sap + mas where sap has been dropped by luk by P.2.4.72 adiprabhṛtibhyah sapah, the deleted sap does not condition gūṇa fo i or e in the stem by P.7.3.86 pugantalaghupadhasya ca so that the wrong form * dvismah is not derived.
Thus, given the difference between \( \text{luk} \), \( \text{sU} \), \( \text{lup} \) deletion and \( \text{lopa} \) deletion, it becomes important to determine, in forms where both deletion processes are potentially applicable, which one should take effect. For example, in a compound with \( \text{gomat} \) and \( \text{priya} \), the underlying \( (\text{gomat} + \text{sU}) + (\text{priya} + \text{sU}) + \text{sU} \), the individual parts of the compound are required to have a case suffix (P.2.1.4 [sup] saha supā) and the whole compound, itself being a nominal stem (by P.1.2.46 \( \text{kr̥yatāddhita samāsāsca} \)) receives a case suffix of its own. The first member of the compound, \( \text{gomat} + \text{sU} \), is now going to lose its case suffix \(-\text{sU}\) by one of the two rules. The morphological rule which provides \( \text{luk} \) of case suffixes inside nominal stems (P.2.4.71), or the morphophonemic rule which provides \( \text{luk} \) of case suffixes inside nominal stem (P.2.4.71), or the morphophonemic rule which provides \( \text{lopa} \) of certain consonants after consonants (P.6.1.68). If \( \text{luk} \) deletion takes place, the stem will not be touched by morphophonemic changes and will emerge as \( \text{gomat-} \). If \( \text{lopa} \) deletion takes place, the stem will be affected and will develop into \( \text{goman-} \) (by P.7.1.70 \( \text{ugidacām sarvanāma sthāne dhātōḥ} \)).

The principle of \( \text{vipratisedha} \) is resolved in favour of that rule which bleeds or feeds another rule predicts that \( \text{luk} \) deletion should be applied, for that will bleed the other processes potentially triggered by the case ending, because of the fact that elements
deleted by luk do not possess pratyayalaksanatva (P.1.1.63 na lumataṅgsya). This is actually correct, as the derived form is gomat priyah.

On the traditional understanding, the priority should be decided by the antaranga-paribhāṣā. But this would incorrectly entail lopa deletion, which is applicable to the first member of the compound by itself, should take precedence over luk deletion, which does not become applicable until the whole compound is reached in the derivation. This would predict the incorrect form * gomānpriyah. To get the correct gomatpriyah, the tradition, beginning with Patañjali, sets up still another exception to the antaranga-paribhāṣā namely, paribhāṣā No.52 anantarangān api vidhin bahirango lug bādhata 'a bahiranga deletion by luk supersedes even anantaranga rules'. This principle can be dispensed with on the assumption that the ordering of rules is determined by this extended form of the siddha-principle.
2.86 **DISTINCTION BETWEEN CONTEXT-SENSITIVE AND CONTEXT-FREE RULES**

In the grammatical description, many rules are valid only within specific contexts. As an instance, the rule that \( i \) is replaced by \( y \) is valid in Sanskrit only when a vowel follows. One way of expressing this rule formally would be \([i \rightarrow y]\) vowel, where the context is marked by brackets. It may also be expressed as \( i \rightarrow y \) in the context: -vowel. In general, a rule which states that \( b \) is replaced by \( c \) in the context of preceding \( a \) and following \( d \) is represented as \( a[b \rightarrow c]d \) so that \( abd \rightarrow acd \). This may also be expressed as \( b \rightarrow c \) in the context \( a-d \). If \( a \) and \( d \) are null, the rule is called context-free and if \( a \) and \( d \) are non-null, the rule is called context-sensitive provided \( b \) is assumed to be a single element.

2.87 **INADEQUACY OF CONTEXT-FREE RULES IN GRAMMATICAL DESCRIPTION OF NATURAL LANGUAGE**

Even though context-sensitive grammars are found to be essentially richer than context-free grammars, yet context-sensitive grammars also are unlikely to account for all the features of natural languages. In contrast, it has been found that even context-free rules are sufficient for the grammatical description of programming languages such as ALGOL. Since Pāṇini has used context-sensitive rules in describing the Sanskrit language, it is clear that for
Panini context-free rules were inadequate for his purposes. Also the use of context-sensitive rules by Panini, unlike the context-free rules used in modern linguistics where rules are treated as statements independent of one another, has attracted the attention of modern theorists and inspired them to study the formal properties of context-sensitive grammar in greater detail than before. It is now held that context-sensitive grammars are needed for the description of most features of natural languages.

2.88 Panini's context-sensitive rules as free from order of elements as compared to modern linguistic formulas

Context-sensitive rules are found in Panini's grammar mainly in the following three meta-rules or paribhasas, which clarify how other rules have to be interpreted and used: P.1.1.49 sasthi sthanevogā 'the sixth, that is, genitive case ending is used for that in the place of which something is substituted namely, for the substituend, denoted by b. P.1.1.66 'tasmin iti nirdiṣṭe pūrvasya' 'when something is referred to with the locative ending, the substitute appears in the place of the preceding element, namely, the preceding element denoted by d.
P.1.1.67 tasmad ity uttarasya 'when something is referred with the ablative ending, the substitute appears in the place of the following element, namely, the following element denoted by a.

The main function of a grammatical rule is presumed to be for the expression of a substitution. Panini always indicates the substitute as the subject of the rule, which occurs in the nominative case. The substitute corresponds with c in a [ b ---> c ] d, though the substituendem b is not always a single element, in which case the rule will not qualify as either context-sensitive or context-free. Pāṇini's method of referring to context-sensitive rules is by means of expressions of the form : a + ablative ending, b + genitive ending, c + nominative ending and d + locative ending in a [b ---> c] d. It is also read as : 'after a, in the place of b ( b + genitive ending sthāne), c, when d follows (d + locative ending pare). Though Pāṇini’s expression corresponds to a [b ---> c]d the order of elements in Panini’s expression is not fixed since their function is fully circumscribed by the case endings. On the other hand, in the expression a[b ---> c]d, the order is fixed since the function of the elements depends only on the position in the formula. The difference between the modern linguistic method of expression a[b ---> c]d and that of Pāṇini’s
is that in Pāṇini’s method which makes use of the inflected language to advantage, the word order being immaterial while the order of elements is as important in modern linguistic formula as word order in modern uninflected languages.

2.89

One of the devices used by Panini from the viewpoint of conciseness and simplicity if anuvṛtti ‘recurrence’ in accordance of which the repetition of a recurrent element or string should be avoided. However, anuvṛtti demands that the rules be ordered in a definite manner. In the modern linguistic method of representing the context-sensitive rules with anuvṛtti, the recurrent element will be supplied in parantheses whenever necessary since anuvṛtti is extended over numerous rules which do not occur consecutively. In place of the modern formulae\textsuperscript{76} $a_1[b_1\rightarrow c_1]d_1$ and $a_1[b_2\rightarrow c_2]d_2$, Pāṇini chooses to express $a_1[b_1\rightarrow c_1]d_1[b_2\rightarrow c_2]d_2$,

\[ [b_2\rightarrow c_2]d_2, \]

We are expected to expand the above rules by supplying anuvṛtti of $a_1$ in the second rule whenever necessary by writing $(a_1)[B_2\rightarrow c_2]d_2$. As the use of anuvṛtti is extended over many rules which need not all occur consecutively, ambiguity is not avoidable always.
2.90 **Listing Elements and Referring to These Elements in Their Respective Order in the Context-Sensitive Rules**

Pāṇini makes use of a simplification obtainable by listing elements and referring to these elements in their respective order in the list, instead of enumerating the set of context-sensitive rules:

\[
\begin{align*}
& a_1[b_1 \rightarrow c_1]d_1, \\
& a_1[b_2 \rightarrow c_2]d_1, \\
& \vdots \\
& a_1[b_n \rightarrow c_n]d_1,
\end{align*}
\]

Pāṇini formulates a single rule for this as:

\[
\begin{align*}
& a_1[b_1 \ldots b_n \rightarrow c_1 \ldots c_n]d_1 \text{ which may be written more conveniently as:}
\end{align*}
\]

\[
\begin{align*}
& a_1 \\
& b_1 \\
& \cdots \\
& b_n \\
& / \quad / \\
& b_1 \quad c_1 \\
& \cdots \\
& b_n \quad c_n
\end{align*}
\]
2.91 USE OF ARTIFICIAL METALINGUISTIC EXPRESSIONS TO REFER TO PARTICULAR ELEMENTS OF OBJECT LANGUAGE IN THE CONTEXT-SENSITIVE RULES

Pāṇini achieves great simplicity and brevity by making use of artificial meta linguistic expressions to refer to particular elements of the object language or pratvāhāra 'condensation' in the context-sensitive rules, such as 'ac' for all vowels, 'ik' for 'i, u, ṭ, ṭ', 'yan' for 'y, v, r, l', and so on. He also uses other metalinguistic elements where indicatory letters perform various functions such as 'tuk' for a certain infix 't', 'pit' for an element marked 'p', 'kṛt' for a certain a class of suffixes including 'kvip' and 'lyap' and so on. He further made use of the metalinguistic expressions which have merged into natural Sanskrit such as 'hṛṣva' 'short', 'dīrga' 'long' 'sāmītī' 'continuous (speech)', pratvāya 'suffix' and so on.

Pāṇini also considers rules of the form [p₁ + p₂ --- e] which are introduced by the rule P.6.1.84 ekāḥ pūrvaparayoh, which is actually a meta-rule. The next rule P.6.1.85 antādiyac ca states that the new substitute is both final element of the preceding word and the initial element of the following word, that is, a [p₁ + p₂ --- e] b generates a e b. Rules of this kind, however, are neither context-sensitive nor context-free, because the substitutendum is not a single element. However, this problem can be overcome, if a
whether with or without context restriction $a - b$, can be replaced by two context-sensitive rules and one context-free rule as $\ [p_1 \longrightarrow e^* \] \ p_2$

$$e^*[p_2 \longrightarrow \emptyset]$$

$$e^* \longrightarrow e$$

or as $\ p_1[p_2 \longrightarrow e^*]$

$$[p_1 \longrightarrow \emptyset]e^*$$

$$e^* \longrightarrow e$$

$e^*$ is introduced to prevent the application of $e[p_2 \longrightarrow \emptyset]$ to cases where $e p_2$ does not result from the application of $[p_1 \longrightarrow e]p_2$ and similarly to prevent the application of $[p_1 \longrightarrow \emptyset]e$ to cases where $p_1 e$ does not result from the application of $p_1[p_2 \longrightarrow e]$. Rules of the form $a \ [ c ] \ d$ can be brought into the required context-sensitive pattern by writing

$$a \ [ \emptyset \longrightarrow c ] \ d$$
2.92 RENDERING OF PĀNINI'S SŪTRAS INTO MODERN
LINGUISTIC FORMULAE

It is clear that Pāṇini did not use meta-linguistic devices just for achieving brevity for its own make, but he only made use of the basic structures available in ordinary Sanskrit to his advantage to serve the needs of precision and simplicity in his grammatical description. The rendering of the Pāṇinian sūtras into modern linguistic formulae suggested by Staal is given below to demonstrate how Pāṇini has achieved simplicity and brevity by meta-linguistic devices afore mentioned:

P.6.1.71: hrasvasya piti kṛti tuk

(root ending with) short [tUK] piti kṛ
t

The elements within the parenthesis are recurrent elements from the earlier rules. Since LvaP is a kṛt suffix realized as ya and marked with a p, this rule is exemplified by prakṛ-ya—-> prakṛtya.

P.6.1.72: samhitāvām

in continuous speech (this rule continues through anuvṛtti in the following rules). This rule remains valid until P.6.1.157.

P.6.1.73 che ca

(root ending with short vowel) [tUK] ch

For example, ga-chati ——> * gatchati, This is replaced by gacchati in accordance with P.8.4.40.
\[.,6.1.77: \text{iko yan aci}\]

\[
\begin{array}{c}
i \\ u \\ \text{r} \\ l
\end{array} \rightarrow \begin{array}{c}y \\ v \\ \text{r} \\ l
\end{array}
\]

Vowel

For example, \text{dadhi atra} \rightarrow \text{dadhy atra}

\text{madhu atra} \rightarrow \text{madhy atra}

\[P.6.1.78: \text{ecdyavāyāvah}\]

\[
\begin{array}{c}
e \\ o \\ ai \\ au
\end{array} \rightarrow \begin{array}{c}a \\ v \\ ay \\ av
\end{array}
\]

Vowel

For example, \text{ce-ana} \rightarrow \text{cayana}

\text{lau-ana} \rightarrow \text{lāvana}
This rule refers to ay and ay in the previous rule by singling out the common element v. For example, nau-ya ---> navya.

P.6.1.84 : ekah pūryaparavoh

[preceding + following ---> one] (this rule continues through anuvṛtti in the following rules). This rule remains valid upto P.6.1.111.

P.6.1.85 : antādivac ca

( a [ p₁ + p₂ ---> e ] β ) generates a e β

This rule remains valid upto P.6.1.111

P.6.1.87 : ādgunah
This rule is formulated for all vowels (ac) though in fact it does not hold for e, o, ai, au (ac). However, for these vowels the next rule is especially formulated and hence, they are excluded from the present rule by an application of the well-known meta rule *vipratisedhe param* 'in case of contradiction, the following rule prevails. By means of this, Pāṇini is able to use the *anuvṛtti* of ac from P.6.1.77. a, i ..... stand for the long and short vowels a, a, i, i, ..... . Examples are tava idam ---> tavedam. tava udakam ---> tavodakam.

```
  \e\ | \ai\
  o   \an\ \\
(a) + \ai\ ---> \ai\ \\
  \an\ \an\ \\
```

Examples are: brahma eti ---> brahmaiti brahma odana ---> brahmaudana.

P.6.1.94 : eñi pararpum

(preverb ending a) +

```
  e   o
  o   o
```

There is *anuvṛtti* of a (denoting a and a) from P.6.1.87 and of 'preverb' from p.6.1.91. The expression 'following' indicates that [p₁ + p₂ ---> p₂]. This can be replaced by a context sensitive rule by means of: [p₁ ---> Ø ] p₂.
P.6.1.96: usy apadānāt

[non-final (-a-) + us (-----> us)]

Example is bhindya-us ----> bhindus

P.6.1.97: ato qune

Here the short a is expressly mentioned (referred to by at in accordance with P.1.1.70) and there is anuvṛtti of 'non-final' from P.6.1.96 and of 'following' from P.6.1.94.

P.6.1.101: akaḥ savarne dīrghah

a, i etc., stand for the long and short vowels. Examples are danda agram ----> dandāgram, adhi itva ----> adhītya
The expression 'preceding' indicates that 

\[ p_1 + p_2 \rightarrow p_1 \]. This can be replaced by a context-sensitive rule by means of: \( p_1[p_2 \rightarrow \emptyset] \).

Examples are \( vrkṣa\ am \rightarrow vrkṣam \).

\( agni\ am \rightarrow agnim, \ vayu\ am \rightarrow vayum. \)

This rule would be superfluous should \( am \) be replaced by \( m \). However, this would lead to difficulties in other parts of the grammar.

There is \textit{anuvṛtti} of 'preceding' from the preceding rule. The short \( a \) is again expressly mentioned. Example is \( agne\ atra \rightarrow agne'\tra \) (the \textit{avagraha}) is introduced by another rule.
The structure of Pāṇini’s grammar makes it difficult to isolate a set of rules without referring to many other rules, which in turn refer to other rules and so on, and therefore, it is clear that rules can be isolated only at the expense of introducing some measure of artificiality. This is so because Pāṇini has chosen a structure which may be termed single context or ekavākyatā, the whole description of grammar being represented as a single rule or sentence. However, a complete analysis of context-sensitive rules in Pāṇini, though a difficult task, would be very useful in providing a consistent and unified picture of the bases on which Pāṇini built his grammatical theory.
2.93 **Aṣṭādhyāyī as a Potential Source for Developing Advancement**

The tasks of processing knowledge and representation of knowledge with different emphasis has parallels in many ancient disciplines. The grammarians have long considered the questions of mapping facts of physical and cognitive worlds into linguistic expressions. So have logicians developed formal structures modeling relationships among events and draw inferences from such models. This is seen best in the work of ancient Indian grammarians and logicians. It is claimed that many contemporary developments in formal logic, linguistics and computer science are a rediscovery of the work of these ancient masters. This claim has raised new hopes for cognitive and computer scientists that there might still be other rules in Indian grammar and Indian logic that may be of use in making further advances in cognitive and computer sciences. Nineteenth century Western linguists could not see the significance of the context-sensitive rules of Pāṇini’s grammar of fifth century B.C. It was only 30 years ago that the importance of Paninian style structures were first introduced by Western linguists such as Noam Chomsky. J.F.Staal asserts that it is difficult to detect something that we have not already discovered ourselves, to explain this fact.
Computationally, grammars of natural languages are considered to be as powerful as any computing machine, though this fact is often obscured since the setting of a grammar is very different from that of a computer. Nevertheless, the formal structure of a grammar can be easily adapted to perform numerical processing.

In fact, Pāṇini’s Astādhyāyī, due to its algebraic formulation and its comprehensiveness of structure, has been described as a machine generating words and sentences in Sanskrit. He is often called a computer scientist par excellence albeit without a computer. As in any formal system, we find in Astādhyāyī definitions or axioms, linguistic facts or theorems, rules regarding rules or meta-theorems. Pāṇini’s śūtras are of different kinds; some are universal and context-sensitive transformations. Others operate sequentially or recursively. These śūtras, in general, are expressed in three groups (i) rules of interpretation or meta-rules comprising samjñā and paribhāṣā rules (ii) rules of affixation or rules prescribing affixes after two kinds of basic dhātu and dratipadika roots and (iii) rules of transformation for the stems and the suffixes or morphophonemic rules. A computer program also has the same general features of context-sensitive rules, recursion and sequential rule
application. Thus, the sūtras of Astādhyāyī may well be compared to a computer program. Just like a computer which can process any number of outputs by manipulating input data, so also Pāṇini’s Astādhyāyī, due to its algebraic structure, can generate an infinite number of words and sentences from a finite set of elements. Cognitive scientists are interested in Pāṇini’s grammar for the principle of economy, an Occam’s razor. It is also interesting to observe that grammar has been the source of ideas for the emergence of logic in India. Grammatical categories serve as a means for the expression of knowledge about the world. Pāṇini’s system of knowledge representation is based in his kāraka theory. The kārakas are deep structure relations that mediate mappings from semantic relations, such as agent, goal, location, to phonological representations in terms of case endings that may express voices, via surface structures in terms of morphological categories such as nominal cases, prepositions and verbal voices. The kāraka theory appears to provide the break-through long awaited in natural language processing.

2.94 KNOWLEDGE REPRESENTATION IN THE ASTĀDHYĀYĪ AS A MODEL FOR THAT OF COMPUTER SCIENCE

The Astādhyāyī must be studied from linguistics, structural and algorithmic aspects to capture the ideas of knowledge representation in it so that similar ideas may be developed in computer science.
for knowledge representation. The computer scientist would be particularly interested in the arrangement of rules in the Astādhyāyī and the smallest set of rules that would be equivalent to the Astādhyāyī. This necessitates one to describe Pāṇini’s rules in a form convenient for analysis by computer. The works of Staal as well as Saroja Bhat and Subhash Kak contribute in this direction significantly.

2.95 PANINIAN SUTRA AS RESEMBLING A COMPUTER PROGRAM

Words and sentences constitute the data as well as the rules for grammar. Thus language is both a means and an end. The end language or the object language is distinctly different from the means language or meta language in Pāṇini’s grammatical system. His metalanguage has its own vocabulary, syntax and grammar although it is basically Sanskrit which is the object language. An extensive use of abbreviated expressions and other devices has given it an appearance of a code language and this feature has inspired its comparisons with a computer program. He has used several algebraic devices which help in achieving precision and non-redundancy. The economy achieved in Pāṇini’s grammatical theory construction is not for its own sake but to prevent any confusion that may arise due to redundancy. Even in modern mathematical and logical systems, we do not permit redundancy for the same reason. Thus Pāṇini uses his own technical terms in place of lengthy technical expressions, just as any modern scientist would do in
the exposition of his theory. In addition to use of symbols like \(ti\), \(ghu\), \(gha\), \(bha\) etc., he makes use of a code representation technically known as \(praty\ah\) to make his expression precise.
2.96 **LOGICAL REPRESENTATION OF PĀśniNIAN SŪTRAS FOR CAPTURING AND MAKING TRANSPARENT PĀśniNIAN NOTIONS FOR APPLICATIONS IN COMPUTER SCIENCE**

A Pāṇinian sūtra is a single clause proposition consisting of a subject, a predicate, and an environment. It is a statement about grammatical features such as a suffix, an augment, a substitute, accent, reduplication, elision and compounding. Usually, it is in the form 'A is B in the environment C'. This can be written in the following formula:

\[ \text{Pāṇinian Sūtra: } A \rightarrow B \left( C \right) \]

where the arrow stands for 'is' or 'becomes' and the parenthesis stands for 'when'. A stands for the subject, B represents predicate and C stands for environment. While A and B are the necessary components of a sūtra, C is optional. The absence of a finite verb predicate is a unique feature of Pāṇini's sūtra, though the finite verb asti 'is' or bhavati 'becomes' is taken to be present in each rule. Thus, a Pāṇinian rule is a statement about something being or becoming something else. Pāṇini's marked predilection for nominalization is conspicuous in his attempt to reduce all statements to those on being or becoming. For example, instead of saying tat lupyate 'that code letter is dropped', Pāṇini says 'tasva lopah' (P.1.3.9) 'Its, i.e., the code letter's elision takes place.'
Unlike the other sūtra works like Nyaya sūtra and the brahma sūtra which often contain, in addition to A, B and C, a cause (hetu) and an illustration (dṛṣṭānta), paninian proposition is conspicuous for its total absence of syllogization or any other kind of argumentation. In short, he describes facts of language without accounting for them. Thus the language of Pāṇinian sutra comprises three types A, B and C as shown above. Though there are exceptions to such a structure, these exceptions do not define the general structure of the rules.

2.97 **FORMULAIC REPRESENTATION OF PANINIAN RULE**

The relation between A and B, and the relation of C with A and B are expressed by Panini by the use of certain cases. The predicate item is always expressed in the nominative though the case of the subject item is determined by its specific relation with the predicate. If the predicate is a substitute (adesa), the subject is used in the genitive as stated by Pāṇini in the rule P.1.1.49. On the other hand, if the predicate is a suffix (pratyaya), the subject is put in the ablative according to the rule P.1.1.67. Environment is expressed in the locative if it follows the subject according to P.1.1.66. These statements can be put in the following formule:

For substitute:

A (genitive) --> B (nominative) (C(locative))
For suffix:

A (ablative) --> B (nominative) (C(locative))

An example for the first formula is P.6.1.74 iko vanaci.

van is substituted in place of ik when ac follows. The mutual relation among the three items is conveyed by the case endings.

Just as science is modelled by generalizations followed by statements of exception when required, so also Paṇinian science of grammar consists of a set of general rules followed by exceptions. Thus a Paṇinian śūtra can be either a generalized statement or a specific statement which stands as an exception to a generalization. In either case, the subject or the predicate can be a multi-layered category. A single predicate may be shared by many or all subjects. For instance, P.3.2.1 (dhātoḥ) karmanyaḥ ‘the suffix an is added to a root in the sense of object.’ dhātoḥ is the subject and an is the predicate. Here dhātu stands for any root in general. The statement of the suffix an is then applicable to all roots in general. The predicate an is thus shared by all subjects. Here the subject, which is a multi-member category, is represented by a class term dhātu.
2.98 **FORMULAIC REPRESENTATION OF RELATION AMONG SUBJECT PREDICATE AND ENVIRONMENT COMPONENTS OF A PANINIAN RULE FOR VARIOUS MULTIPLE-MEMBER CASES**

This type of Paninian *sūtra* is represented as:

\[ A^{1-n} \rightarrow B \ (C) \]

On the other hand, sometimes many predicates are linked with one subject. For instance, P.5.2.32 *nerbidac bīrīsacau* and p.5.3.33 (*ner*) *inacpiṭaccaika ca*. The suffixes *bidac, bīrīsac, inac* and *piṭac* are added to *ni* (in the sense of flat nose) and in the case of latter two suffixes *ni* is replaced by *cica* and *ci* respectively. In this case four predicates are shared by one single subject, *ni*. This statement can be represented as:

\[ A \rightarrow B^{1-n} \ (C) \]

Occasionally, we have A and B which are both simultaneously multi member categories. For example, P.3.1.133 (*dhātoḥ*) *nyultrīcau* 'the suffixes *nyul* and *trī* are added to any root. This statement is represented by:

\[ A^{1-n} \rightarrow B^{1-n} \ (C) \]

Just like A and B, C also can be a multi-member category. For example P.1.3.13 : *dhātoḥ bhāva karmanoḥ* (*ātmanepadam*) 'ātmanapada endings are added to a root in the sense of *bhāva* (state) or *karman* (object).
Bhāvakarmanop expresses the environment in terms of meaning. The two meanings bhāva and karman are mentioned here. This can be represented as:

\[ A \rightarrow B \ (C^{1-n}) \]

The combination of all the three multi-layer categories is also encountered in some sūtras. For example, p.3.4.70 (dhatoh) tayoreva kṛtyakta khalarthāḥ 'the suffixes kṛtya, kta and those conveying the same meaning as that of khal are added to any root in the sense of bhāva (state) or karman (object). The term tavoh is to be interpreted as bhāvakarmanop. Thus the statement may be represented as:

\[ A^{1-n} \rightarrow B^{1-n} \ (C^{1-n}) \]

In short, the three categories A, B and C may be either single-member or multi-member categories and they may appear in all combinations in Pāñinian sūtras.

2.99 DISJUNCTIVE AND CONJUNCTIVE LINKING WITHIN MULTI-MEMBER CATEGORIES

Two questions arise when a statement contains multi-member categories, namely, (1) whether the members in a category are linked to each other disjunctively or conjunctively and (2) what the mutual relations between the members of two multi-member categories are.
As regards question (1), Pāṇini has employed three linking devices in the Astādhyāyī, namely, juxtaposition, dvandva compound and the particle ca. These link either items or statements and these devices work in terms of disjunction or conjunction. Disjunction implies application of all the items separately whereas conjunction implies their application together. Items put together in a dvandva compound are disjunctively connected. For example in 3.1.133 (dhātoḥ) ṅyultṛcau 'the suffixes ṅvul and trc are added to any root', the compound ṅvul trc is a multi-member predicate and the items ṅvul and trc are disjunctively connected to each other. Hence, they are separately and not simultaneously added to a root. Thus it is possible to derive two separate forms such as pācaka and pakṛć from root pac.

On the contrary, if the items are put in juxtaposition, they are conjunctively connected with each other and hence, simultaneously applicable. For example, in P.7.4.49 saḥ svārdха dhātuke (taḥ) 'ś is replaced by ṭ when an ārdha dhātuka ending beginning with ś follows. Here two items śi and ārdha-dhātuke which belong to the category C are not put together in a compound, but are mentioned in juxtaposition separately. They are, therefore, conjunctively connected. In other words, śi and ārdha dhātuke are coreferential. Items belonging to one category put in juxtaposition in a rule, hold a head-modifier or
adjective–substantive relationship. Items belonging to the same category but not connected by a head-modifier relation never occur in juxtaposition in a single sūtra. Juxtaposed occurrence of two heads or modifiers always indicates the existence of separate sūtras. The particle ca is never used to link two or more items as it does in ordinary speech, as for example: rāmaśca kṛṣṇaśca gacchatāḥ where ca links two items disjunctively. Items belonging to the same category in a rule are either put in a compound or are juxtaposed according to their relation with each other.

2.100 MUTUAL RELATIONS BETWEEN MULTI-MEMBER CATEGORIES

As regards the second question of what the mutual relations between the members of two multi-member categories, Panini accepts the principle of numerical correspondence for linking items in two multi-layered categories according to the rule P.1.3.10 vathā saṃkhyanudeśah samānām 'items in two categories having the same number are connected with each other in their respective number i.e., order'. For example, in P.4.3.94 tūḍīśalāturavarmmatikṛścaārāddhachandhanyakah, the suffixes dhak, chan, dhan, yak are respectively added to the stems tudi, salatura, varmmati and kricavara in the sense 'it is the place where his ancestors lived'. In this case both A and B consist of four members each and the members of A are connected with the members of B in the same order in which they are put in the compound.
All the three elements A, B and C (optional) are not always explicitly present in a sutra and the missing element has to be borrowed or continued from the preceding rule. This process is technically called anuvṛtti. The sutras in the Astādhyāyī are arranged in a manner suitable for borrowing an item or items from the preceding context. Though Pāṇini has arranged rules in his grammar principally on thematic basis, the arrangement of rule within different sections is governed by the needs of anuvṛtti. An item is carried forward in the subsequent rules until it is blocked by an incompatible items. Two items are incompatible if they belong to the same category, that is, subject, predicate, or environment. For example, the item nit which is continued in P.1.2.4 sārva-dhātukampit 'a sarvadhatuka suffix, other than the one which is pit is nit' is not further continued in P.1.2.5 asamyogallit kit (apit) 'a lit suffix other than the one which is pit added to a root not ending in a conjunct consonant is a kit', because it contains the item kit which is incompatible with nit. But the items sārvadhātuka and lit are incompatible with each other and therefore, the former is not continued in P.1.2.5 as it is blocked by the latter.
2.102 **BLOCKING DUE TO A HEAD ITEM AND MODIFIER ITEM INCOMPATIBILITY**

Though items which are incompatible with each other usually appear in the same case ending, this is not the only identification mark of incompatible items and their relative syntactic position has also to be taken into account. For example, in the example given above, the two items सार्वधातुकम and अपित together form subject category in P.1.2.4, the former being the head item and the latter its modifier (adjective). The fact that there is no incompatibility between a head and a modifier is true not only when they belong to one and the same rule but also when they are mentioned in two different rules. Thus, the modifier item अपित mentioned in P.1.2.4 is compatible with the head item in the subsequent rule. Thus, although the head item लित in P.1.2.5 blocks the incompatible item सार्वधातुकम in the preceding rule, it does not block the modifier item अपित which is therefore, continued in P.1.2.5. On the basis of this observation, another rule has been laid down as follows.

A head item blocks an incompatible head item, but it does not block a modifier if it is not incompatible.

A modifier blocks an incompatible modifier, but it does not block a head item if it is not incompatible but there are cases when a head modifier...
is not continued since it is incompatible not on syntactic but on semantic grounds. In the Astādhyāyī, within a thematic group, the sūtras are arranged on the basis of the principles of anuvṛtti. Though, a generalization is followed by specific or individual rules, this order is often violated due to exigencies of anuvṛtti. Thus anuvṛtti is a key-word in the arrangement of Pāṇinian sūtras.

2.103 **INDICATION OF GRAMMATICAL FUNCTION BY ANUBANDHA**

One of the many powerful devices used by Pāṇini is the anubandha which is a code letter that indicates a grammatical function like elision and reduplication. Anubandhas are added to various grammatical units such as suffix, an augment and a root.

2.104 **EXCEPTIONAL RULE AS MORE POWERFUL THAN GENERAL RULE**

A major aspect of Pāṇini's descriptive technique is the law of utsarga and apavāda which states that an apavāda 'exception' is more powerful than an utsarga 'general rule'. Thus, utsarga has to be applied only after checking for its apavādas. Once an utsarga is barred from entering into the area of its exception, it can never enter that area again. However, in cases where the application of utsarga even in the domain of apavāda is derived, Pāṇini makes the operation of apavāda optional. For example, the
optionality marker vā in P.4.1.118 pilaya vā (an strīyah) 'the suffix an is added optionally to pila in the sense of 'his offspring'.' suggests that the exceptional suffix an operates optionally. Therefore, the utsarga suffix dhak taught by P.4.1.121 dvyaçaḥ (dhak strīyah) 'the suffix dhak is added to a feminine noun consisting of two vowels in the sense 'his offspring' is also applied and two alternate forms, pileya (pila + dhak) pailaya (pila + an) are derived.

2.105 SIDDHA-PRINCIPLE AS IMPLYING FREE-MOVEMENT OF RULES IN ALL DIRECTIONS

A very important principle of Pāṇini's theory is the siddha-principle though it is not directly mentioned by him. His statement of the asiddha-principle (P.8.2.1) implies the siddha-principle. The entire Astādhyāyī is divided into two parts, namely, siddhakāṇḍa (P.1.1.1 to the end of the first section of chapter eight) and asiddhakāṇḍa or tripādi (P.8.2.1 to the end of the fourth section of the eighth chapter). Tripādi begins with the adhikāra 'chapter heading', P.8.2.1 pūrvatra siddham 'from now on every rule is regarded as not having taken effect with reference to preceding ones'. Any rule in the siddhakāṇḍa is siddha 'having taken effect' for any other rule in the whole of the Astādhyāyī. In other words, before being effective a rule takes into effect consideration possibility of application of other rules. The sequence of the rules in the book does not matter in
the derivational process. What matters is the siddha-principle. According to tradition, this arbitrary application of rules within sections 1.1 to 8.1 is restricted somewhat by a category of rules that are ordered pairs. In each pair, the rule that is first applied is called antaranga and the rule that is applied next is called bahiranga. Kiparsky argues that the correct explication of Pāṇini’s siddha-principle makes this antaranga-principle redundant.

2.106 SEQUENTIAL OPERATION OF RULES IN ASIDDHAKANDA

In contrast, the rules in the asiddhakāṇḍa are operative only in one direction. P.8.2.1 pūrvatrāṃ siddham states that all the rules stated subsequently are asiddha, not effective for the rules stated earlier, that is, for the rules in the siddhakāṇḍa. Likewise, for each rule in the asiddhakāṇḍa, all subsequent rules are asiddha. In short, rules in the asiddhakāṇḍa operate in the same order in which they are arranged.

2.107 NOTION OF DISTINCT LANGUAGES

Some formal features of the Astādhyāyī which have been rediscovered in computer science, have raised the hope that there must be yet other features in it which have direct parallels in computer science. The very success of the Astādhyāyī as a grammatical knowledge representation formalism suggests that its
structure will have implications for further advancement in the knowledge representation discipline of computer science. Also, by capturing the essentials of the Panini's approach, equally good grammars for other languages can be attempted. Further, study of Panini's approaches can help in tackling the problems of natural language processing and machine translation disciplines of computer science. The specific issues of immediate interest to the computer scientist include analysis of arrangement of the rules and search for other arrangements that are equivalent in terms of their generative power. The formal aspects of these arrangements and their relationships is likely to help define the notion of distance between grammars of different languages which is of particular relevance in machine translation. For example, translation across languages with grammars that are close in structure, as in the Indo-Aryan or Dravidian family of languages, one would expect the translation across the languages to be comparatively easy. A formalization of such a notion of closeness is likely to give a direction towards progress in automatic translation.
The greatest virtue perhaps of the Pāṇinian approach is that it operates at the lowest level of word-elements of roots and suffixes facilitating a far deeper level of analysis than afforded by recent Western approaches like generalized phrase structure grammars that have inspired the development of computer parsing techniques. Pāṇini's speciality is that he does not treat lexicon as a separate entity as his grammatical theory allows one to include parts of the lexicon in the definition of the grammatical structure. Thus the degree closeness between languages that share a great deal of lexicon will thus be much higher than otherwise and will be better represented using Pāṇinian structure. It will be interesting to study the closeness of Indo-Aryan and Dravidian family specific members pair wise, since most of the Dravidian languages like Kannada, Telugu and Malayalam share rich common Sanskrit lexicon in addition to their own lexicons and syntactically they are Dravidian in character. The powerful tool of Paninian grammatical theory will thus bridge with intra-family and inter-family language barriers in the representation of knowledge and Sanskritic Departments will fruitfully collaborate with computer science departments in the universities.
Pāṇini is the author of grammar known as Astādhyāyī, a treaty of grammar describing Sanskrit convention in his time and place, that is, approximately 500 B.C. in the north-west of the Indian sub-continent. Pāṇini could assume his audience who were native speakers of Sanskrit and a knowledge of conventions of use known to him and all other native speakers from their own use. The core of Pāṇini’s grammar is made up of statements called sūtra. The sūtrapātha is known as the Aṣṭādhyāyī proper. This text is accompanied by three ancillary texts, namely, Pāṇini’s aksara-samamnaya, dhātupātha and gaṇapātha, the first of these being an ordered set of sounds (akṣara), the second being a catalogue of verbs (dhātu) and the last being sets (gaṇa) of other items pertinent to provisions made in particular sūtras. He takes dialect features in the usages particular to Northerners (udicam) and Easterners (prācam). He also mentions observations of ten teachers (ācāryāṇāṃ) by name as Apisāli, Kāśyapa, Gārgya, Galava, Cakravarmana, Bhāradvāja, Śākatāyana, Sākalya, Senaka and Sphoṭāyana. He also accounts for features of vedic language.

The Aṣṭādhyāyī contains nearly four thousand sūtras distributed among light chapters (adhyāyas), each of which is subdivided into four quarter-chapters (padas).
Sūtras serve different purposes and there is a major distinction between operational rules (vidhi sūtras) and other ancillary sūtras, the former being directly concerned with operations in respect of elements, the latter, on the other hand, serving to allow the required interpretation and application of other rules. Ancillary sūtras are of basically three types samiṇāsūtras which introduce class names and establish conventions regarding the use of terms, meta rules (paribhāṣa) and headings (adhiṃkāra). Further, there are extension rules (atidēśa sūtra) to extend operations which would otherwise not pertain to given elements. There are restrictive rules (niyama sūtra) which serve to restrict what would otherwise obtain too broadly. There are also rules of negation (pratisedhasūtra, niśedhasūtra) whereby something that would otherwise apply is disallowed. Also, the sūtras regularly do not contain verb forms as integral components. For example, P.1.1.1 vrddhirādaic contains only nominative singular forms at, aic and vrddhiṃ. However, one supplies the verb meaning 'be, occur' which is to be understood.
2.111 DERIVATIONAL SYSTEM USED FOR DESCRIBING SANSKRIT

To describe Sanskrit, Pāṇini uses a derivational system in which affixes are introduced to given items, augments are added to elements, one element replaces another, one of a group of elements is allowed to occur as a single remainder, instead of the whole group, an element is doubled and items are combined to form compounds.

P.3.1.1 *pratyayah* assigns the class name *pratyaya* 'affix' to elements introduced by subsequent rules. As most Sanskrit affixes are suffixes he provides P.3.1.2 *paraśca* so that it can occur after the unit to which it is introduced. For example, the affix kalpa follows patu 'sharp' in *patukalpa* 'almost sharp'. However, in accordance with the structure of sanskrit, Pāṇini also recognises prefixes and infixes so that P.3.1.2 is only the general rule. For example -na- of *yunakti* 'joins' occurs within the base *yuj* : *yu-na-kti*, na being one of a group of elements occupying this particular position with respect to other items. This position is shown by appending the marker (it) *m* to such elements. According to P.1.1.47 mid aco'ntyat parah, an element with the marker *m* (mit) occurs after *parah*, the last vowel (aco'ntyat) of the unit to which it is introduced. The affix of *yunakti* is marked as *ŚnaM*. 
Augments are introduced as parts of other elements. Some augments occur within grammatical units. This augment is marked with m. Augments are also added as initial and final segments of items. The positions of such augments are shown by the markers; f for initial augments, k for final augments, according to P.1.1.46 advantage.takitak.

A substitution rule provides that one element occurs in place of another. The procedure of letting a replacement (Adeśa) occur instead of a substituend (sthānā) accounts for the distribution of related complementary elements. For example y and v are substituted for i, i and u, u before other vowels as in dadhi, dadhy, and madhu, madhv.

2.112 POSITING IN DERIVATIONAL SYSTEM OF ABSTRACT ITEM WHICH ARE NEVER USED IN ACTUAL UTTERANCE

Panini also operates with abstract elements, items which he points in his derivational system but which are never found in actual utterances so that they are necessarily subject to replacement. Some abstract elements are replaced by items that occur in normal usage. For example, L-suffixes are replaced by verb endings and participle suffixes. In Panini’s system, a substituend is regularly denoted by a genitive form. The element subject to replacement can be a sound or a larger grammatical unit. As a general rule, the last sound of a grammatical element is replaced, but its initial sound is replaced if substitution applies in a
left context. Certain substitutes replace whole grammatical units, these replacements either consisting of more than one sound or being marked with a.

2.113 PÂÑINI’S TECHNIQUES OF EKÂŞEṢA DOUBLING OF ELEMENTS AND COMBINING OF ITEMS IN RULES

There are sūtras which provide for a single substitute in place of two contiguous elements (P.6.1.84). Pâñini states that if a single vowel replaces two vowels, one with a high pitch and the other with another pitch, the result is a high pitch vowel (P.8.2.5), and not a vowel with the properties of both the substituends. In the absence of this stipulation, the grammar could allow such an undesired result. A method of avoiding such undesired results is to account for the such derivates not by means of substitution but by some other means. Thus, Pâñini provides that only one of a group of items taken together be the single remainder (ekâśeṣa) to be used (P.1.2.64-73).

Certain sūtras of the Astādhyāyī provide that the given elements are doubled so that one gets two of them under particular conditions.

Composition rules provide that two or more items generally the ones that termination in nominal endings, combine to form a compound (samāsa).
All the three major kinds of Ancillary rules namely samjñasūtras, paribhāsā and adhikāra sūtras have in common one feature which is to serve to interpret other sūtras, though they may still differ in the precise purpose they serve. Thus there are samjñasūtras that serve only to establish general conventions regarding the use of the terms in the grammar. Other samjna-sutras serve as classificatory rules providing that certain class names apply to given items. Some such sutras concern in particular sounds classed as markers (it). Some samjña sūtras deal with terms for zeroes. Similarly, some paribhāsas serve to restrict the choice of substitutes or substituends that are involved in particular operations. Some other paribhāsas serve as extension rules.

Pāṇini recognises classes of grammatical elements connected with particular operations. Some such items are given in ordered sets as in the dhātupātha and ganapātha. Pāṇini refers to these ordered sets by means of compounds in which the first member is the first item of a set or group. For example, bhuvādayah (P.1.3.1) referring to verbs of the dhātupātha the initial (adi) element of which is bhu 'to become'. Items that cannot be included in ordered sets may bear common markers to show that they
constitute a glory in respect of certain operations. In still other cases, Pāṇini uses particular class names to refer to sets of elements.

2.116 **INTRODUCTION OF AFFIXES AFTER ITEMS TO FORM COMPLEXES OF PARTICULAR TYPES IN PĀΝINIAN DERIVATIONAL SYSTEM**

In Pāṇini’s derivational system, affixes are introduced after given items to form complexes of the types B-A, B-A₂-A₁. In the former, a simple affix A follows B, but in the latter, there are two affixes introduced after the same base element in a particular order as A₁ follow B, then A₂ is introduced after B on condition that this already occurs with A₁. B and B-A₂ are referred to as presuffixal bases. Pāṇini’s class name is *anga*, according to P.1.4.13 *vasmāt pratyavavidhiḥ* tadadi pratvayangam ‘a unit that begins with an item B (tadadi) after which (vasmāt) an affix A is introduced (Pratyavavidhiḥ) and is followed by A (Pratyaye) is called *anga* in respect of this affix B-A has a single *anga*, B relative to A, while B-A₂-A₁, with two affixes introduced in the order noted, contains two *angas*; B-A₂ in respect of A₁ and B relative to A₂. The item B of which an affix is introduced can be verbal base (*dhātu* P.1.3.1, P.3.1.32), a nominal base (*prātipadika* P.1.2.44-46), an item with a feminine affix *i*, a or an element with al nominal or verbal ending (*pada* : P.1.4.14).
2.117 **GRAMMATICAL OPERATIONS INVOLVING CLASSES WHOSE MEMBERS ARE NOT LINGUISTIC ITEMS**

Pāṇini also operates with classes whose members are not linguistic items. To describe major aspects of syntax, Pāṇini recognises six categories to which are assigned direct participants in acts (kāraka), under conditions that are both syntactic and semantic. For the derivation of nominal bases meaning 'child, offspring, descendent of' Pāṇini operates with three categories of descendents. He operates with zero and recognises particular zero replacements that have different effects. Zero in general is called *lopa*. Terms like *luk*, *šlu* and *lup* designate in particular zero replacements for whole affixes. Pāṇini recognised the need to use markers for various purposes, but as he could not use visual devices since the grammar transmitted orally, he used special markers which he called *it* which are recited as parts of linguistic units. Though sounds classed as markers are then recited as parts of items when such items are first introduced, the elements actually used in the language described do not contain any such markers. Thus the markers are unconditionally dropped leaving the items-alone. Some markers serve to show that items belong to certain classes. Markers serve to show that items are connected with particular operations including assignment of elements to classes. A marker may also be attached to an element in order to allow referring a series of items by means of what they have in common.
In some case, a marker is appended to an item so that such a common term of reference is not eliminated. A marker may also be appended to an element to distinguish it from a homophonous element (vīseṣaṇārtham). Markers also serve to form abbreviations that refer to members of ordered groups. An abbreviatory item iM denotes the item i and all items that follow, up to the marker M.

2.118 **TECHNICAL TERMS AS NOT SELF-REFERRING**

According to P.1.1.68, an item that is not a technical term of grammar refers to itself. The vowels listed in Pāṇini's sound catalog are class names so that they are not self-referencing. In order to refer to short and long vowels, Pāṇini uses special terms of the type Vt in which a given vowel V, short or long, is followed by t, t (tatparāḥ) being a name of any vowel with the duration V (tatkālasya).

2.119 **FUNCTIONS OF META-RULES**

Metarules (paribhāṣas) serve to interpret other rules in the Aṣṭādhvāyī. Some paribhāṣas come into play to interpret case forms in such contexts that a Sanskrit speaker could not be expected to arrive at a single interpretation based on his knowledge of Sanskrit language. In such cases, the metarules specify what one is understand. A metarule also serves to relate items referred to in sūtras in a particular order. Some other paribhāṣas specify that certain
elements out of a group of possible replacements substitute for particular items or that certain substituends are above subject to particular replacements. Still other metarules provide for extending to certain elements operations and properties which could not otherwise pertain to them.

2.120 FUNCTIONS OF HEADINGS

Headings theoretically divide the Aṣṭādhyāyī into sections. Headings also give elements with respect to which operations are stated in subsequent sutras. A heading may also give conditions under which operations take place. A heading may also be a metarule. Some sutras are restrictive. Negative rules provide that under given conditions what would otherwise obtain does not. The sutras of the Aṣṭādhyāyī cohere. As there are networks of rules related to each other, often one will have to take other rules into consideration to understand a rule.

2.121 MARKERS ATTACHED TO VERBS

One reason why Pāṇini attaches markers to verbs is to state the distribution of parasmaipada and ātmanepada affixes (P.1.4.99-100).
Pāṇinī's derivative systems as based on two broad principles siddatva / asiddhatva and sthānivadbhāva

Joshi rightly observes that the adhoc traditional interpretative principles which have come down to us are too generalized and too complex in their character to have ever been accepted by Panini himself. Thus, the most immediate task of modern Paninian research is to reconstruct, Pāṇinian theory of meta rules (paribhāṣās). Pāṇini has a definite view about the domain of the grammatical theory. Pāṇini's derivative system is based on two broad principles, namely, the principle of siddhatva / asiddhatva and the principle of sthānivadbhāva.

The importance of the asiddha relation stated in P.6.4.22 and P.8.2.1 lies in the fact that it provides a basis for other types of relations which figure nd are assumed in the text of the Astādhvāyī and their working as intended by the basic layer of the Astādhvāyī are as follows:

(1) The asiddha principle blocks feeding (ādesa laksanā pratisedha) and bleeding (utsarga laksanā bhāva)

(2) The siddha-principle deduced from the asiddha allows feeding (ādesalaksanābhāva) and bleeding (utsargalaksanāpratisedha)
(3) The principle of the **sthānivadbhāva** (P.1.1.57) and the **pratyaya laksana** (P.1.1.62) blocks bleeding (**utsargalaksana-pratisedha**) allowed by the **siddha** principle. It does not block feeding allowed by the output (**ādeśalaksanabhāva**). The principle of **sthānivadbhāva** and the **pratyayalaksana** are valid word internally only.

(4) The **antaranga / bahiranga** principle which operates across word-boundaries is not stated in the main body of the text, but it is implicit in Panini’s meta theory. Like the **asiddha** principle, this principle also blocks feeding **ādeśalaksana pratisedha** and **utsargalaksanabhāva**.

The **vipratisedha** principle stated in P.1.4.2 is restricted to the **eka samīnā** section only, though tradition incorrectly extends this principle to the whole of the **Aṣṭādhyāyī** stating that in the case of conflict the later rule in the **Aṣṭādhyāyī** prevails over the earlier rule. Paninian research today is stuck up to find out a precise solution to the cases of conflict (**vipratisedha**). That is, though the general idea of **vipratisedha** is clear, we do not know precise working of this relation.