

## Panini's Conception of "Syntactic Structures"

E. V. N. Namboodiri \*

### Abstract

"*Syntactic Structures*" is the title of Noam Chomsky's first book published in 1957. It introduces a new model of grammar which we now call "*Transformational Generative Grammar*". The idea of generative grammar is not novel, Chomsky points out in the preface to his very famous book "*Aspects of the theory of syntax*" (1965). The present paper attempts to trace the origin of the standard model of generative grammar of Chomsky far back to Panini.

A new era of Linguistic studies began when some of the old ideas of Indians and Greeks were revived and reconstructed, says Chomsky. It is interesting to examine how Chomsky revived, reconstructed and revised the very basic ideas of Panini in the new model of transformational generative grammar.

**Key Words:** Syntax, Grammar, Transformative Generative Grammar, Syntactic Structures

### 1. Models of Grammar

There are three very important models of grammar prevalent today all over the world – *Traditional grammar* of Europe, *Descriptive grammar* of Leonard Bloomfield, and modern *Generative grammar* of Noam Chomsky. Panini's model of grammar is one of the oldest models. However, in a different point of view, it is a very important model since it is much closer to the transformational generative grammar developed by Chomsky.

Chomsky (1964, 16-17) differentiates the above three models of grammars as follows: Both traditional grammar of Europe and generative grammar of Chomsky provide information to understand and use sentences properly. However, the traditional grammars fail to describe the deep seated regularities of linguistic structure in an explicit way, observes Chomsky. Because, the user of a traditional grammar has to use his intelligence or intuition in understanding a sentence from the examples and hints provided by the grammarian, he (Chomsky) elaborates further. At the same time, a generative grammar describes the structure of sentences explicitly in terms of well-defined rules so that the user of the grammar can generate, that is produce, sentences mechanically by the application of the rules of the grammar in the given order, without using his intelligence or intuition at all, claims Chomsky correctly. A generative grammar is a device that specifies the infinite set of well-defined sentences possible in a language and assigns to each of these possible sentences one or more structural descriptions. At the same time, modern descriptive grammar as developed by Bloomfield merely presents the inventory of elements that can appear in structural descriptions and in their contextual variants.

Chomsky (1964, 11) then distinguishes between two conflicting models of *generative grammar*: "The first – which I will call the *taxonomic model* – is a direct outgrowth of modern structural linguistics. The second – which I will call the *transformational model* – is much closer to traditional grammar".

---

\* Department of Linguistics, University of Kerala

---

Many modern structural linguists regard the traditional linguistics as having no value, only because they know it little. Chomsky who realized the value of traditional linguistics has given a new life to it by reviving, reconstructing, revising and also remodeling many ideas expressed explicitly or implicitly in traditional linguistics. In fact, there is at present no alternative to Chomsky's transformational generative model of grammar.

## 2. Three Hypotheses

We shall put forward the following three hypotheses to start with a discussion in detail:

1. Panini's grammar is one model of generative grammar.
2. Panini's grammar can be interpreted as a transformational generative grammar in the contemporary sense of this term.
3. Panini's grammar can be reconstructed as a standard model of generative grammar from which the contemporary model of transformational generative grammar is developed by introducing new methodology.

A hypothesis will be proved or disproved after sufficient discussion. It will not be acceptable as a theorem until it is proved.

Let us now examine whether the three hypotheses put forward above can be proved or not. To prove the first hypothesis we shall see what the minimum requirements of a generative grammar are and whether or not Panini's grammar meets all of them.

## 3. System of Rules

"By a generative grammar I mean simply a system of rules that in some explicit and well-defined way assigns structural descriptions to sentences", defines Chomsky (1965, 8). No traditional grammar or any modern descriptive grammar is qualified to be a generative grammar in this sense.

Notwithstanding, Panini's grammar is "a system of rules" and therefore worth considering. The grammar of Sanskrit language is described by Panini in terms of nearly 4,000 rules (called *suutras* in Sanskrit) of a well-defined form. When these rules are analyzed, with examples and counter examples, we get interpretations of the forms of the Sanskrit language. The rules can thus be interpreted as describing (or assigning in the way Chomsky specifies) the correct structure of infinite number of Sanskrit sentences in an explicit and well-defined way. This is exactly the characteristic feature of a generative grammar.

There are six types of rules differentiated by Panini (*samjn^aa ca paribhaas'aa ca vidhirniyama eva ca, atides^odhikaaras^ca s'ad'vidham suutralaks'an'am*). (1) *Samjn^aa* rules define the technical terms used in the grammar; (2) *Paribhaas'aa* rules explain how the rules of grammar can be interpreted; (3) *Vidhi* rules describe the structure of linguistic forms in terms of (a) general rules (*utsarga*) and (b) exceptions (*apavaada*); (4) *Niyama* rules impose restrictions in the application of general rules and in their exceptions; (5) *Atides^a* rules expand the sphere of application of the specific rules and (6) *Adhikaara* rules divide the grammar into compartments and sub-compartments.

Panini's grammar is not only a grammar of the Sanskrit language, but also an introduction to a general linguistic theory. The *samjn^a*, *paribhaas'a* and *adhikaara* rules of Panini contribute to the idea of Universal Grammar. The other rules, *vidhi*, *niyama* and *atides^a* rules, which describe the structure of Sanskrit language may be interpreted as language specific.

The *samjn^a* rules may be interpreted as (1) a *description*, (2) a *prescription*, or (3) an *instruction*. The descriptive rules describe, or define, technical terms such as *padam* (word), *angam* (stem), *udaattah* (accent) etc. Suutras 1-4-14, *suptin^antam padam*, 1-4-13, *yasmaat pratyayavidhistadaadi pratyayengam*, and 1-2-29, *uccairudaatah*, are examples. The suutras 2-1-1, *samarthah padavidhih* 'combination of words shall have a meaning' and 4-1-1, *n^yaap praatipadikat* 'the case suffixes occur after nominal roots and feminine suffixes' are examples of prescriptive suutras. The instructive suutras give instructions for grammatical processes like *lopa* (deletion), *aagama* (addition), *aades^a* (substitutuin) or *dvitva* (reduplication).

Patanjali, the first and most authoritative commentator of Panini's grammar, points out that Panini has constructed grammatical rules (*suutras*) and not linguistic forms (*nahi paan'ininaa s^abdaah proktaaah. kim tarhi? suutram*). Patanjali compares a grammarian with a potter. The potter creates pots for our use. Like that, the grammarian does not create linguistic forms for our use. Contrarily, he describes the structure of forms which we already use. However, the description of a grammarian will enable a grammar to create, or generate, any number of new forms following the rules given by him. This idea accounts for the 'creative aspect of language use' referred to by Chomsky in the preface to his 'Aspects of the Theory of Syntax'.

The suutras of Panini define all the linguistic forms available in the Sanskrit language. If one says something which is not defined by Panini suutras, one is pronouncing only mere sounds (*naada*), not Sanskrit forms, Patanjali asserts in his commentary *Mahaabhaashya* (2<sup>nd</sup> century B.C.). "The grammar of L will thus be a device that generates all of the grammatical sequences of L and none of the ungrammatical ones", Chomsky (1957, 13) ascertains further.

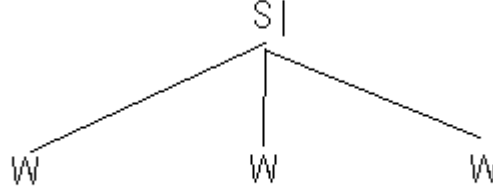
#### 4. Structure of Sentences

We shall now examine how Panini's rules assign structural descriptions to sentences in an explicit manner. A sentence according to Panini's conception is a sequence of words joined together (suutra 1-4-109, *parah samnikars'ah samhitaah*) and ending in a pause (suutra 1-4-110, *viraamovasaanam*). It conveys a meaning (suutra 2-1-1, *samarthah padavidhih*).

Panini does not specify whether the meaning of a sentence will be complete or incomplete, significant or insignificant, sensible or nonsensical. "I like music", "I like classical music" and "I like Western classical music" are sentences in English though they are still expandable adding further information. None of these sentences expresses a complete meaning since any of them can be expanded further infinitely. However, even the shortest of them is complete in linguistic structure and therefore is qualified to be a sentence. Chomsky's examples "Colorless green ideas sleep furiously" and "Revolutionary new ideas appear infrequently" are sentences having meaning interpretable by grammatical rules. Both of them are therefore qualified to be sentences, though one of them expresses only nonsensical meaning. The meaning of a sentence may be sensible or nonsensical, but the grammatical rules shall be able to interpret it. Both Panini and Chomsky have achieved this.

The last syllable of a Sanskrit sentence (*vaakya*) will be lengthened and accented (suutra 8-2-82, *vaakyasya t'e pluta udaattah*), Panini specifies. Suppose the symbol "l" denotes a longer and

accented syllable. A sentence (S) according to Panini's suutras can then be represented as a sequence of words (W) as shown in Diagram 1:



**Diagram 1**

A word (*pada*) for Panini is a linguistic form ending in either *sup* or *tin`*. (*suptin`antam padam* – suutra 1-4-14). The *sup* is a set of 21 suffixes indicating 'number' and 'case' added to the nominal roots, called *praatipadika* in Sanskrit. Similarly, the *tin`* is a set of 18 suffixes denoting 'tense', 'mood' and 'aspect' added to the verb roots called *dhaatu*. The structure of a word can be represented, according to Panini, as either *praatipadika + sup* (Nominal root + Case suffix) or *dhaatu + tin`* (Verbal root + Personal ending). There are only two word-classes, noun and verb, in the underlying structure of Sanskrit sentences. Other parts of speech are identified in Sanskrit syntactically by deleting gender, number and case suffixes (suutra 2-4-82, *avyayaad aap supah(luk)*).

Each noun in a simple sentence is related to a verb. The relation between a noun and a verb is called *kaaraka*. Panini has defined six *kaarakas* as shown below:

1. *Kartaa*: Suutra 1-4-54 *svatantrah kartaa* 'The constituent which stands independently as the actor of the verb' (Subject).
2. *Karma*: Suutra 1-4-49 *kartr`riipsitatamam karma* 'The constituent which expresses what the actor wants chiefly' (Direct object).
3. *Karan`a*: Suutra 1-4-42 *saadhakatamam karan`am* 'The thing which is absolutely necessary for the accomplishment of the action indicated by the verb' (Instrument).
4. *Adhikaran`a*: Suutra 1-4-45 *aadhaarodhikaran`am* 'The place or time where or when an action is performed' (Place and Time).
5. *Saampradaana*: Suutra 1-4-32 *karman`aa yam abhipraiti sa sampradaanam* 'The person to whom an object is given for benefit' (Indirect object)
6. *Apaadaana*: Suutra 1-4-24 *dhravamapaayepaadaanam* 'A fixed point from which an action takes part (Source).

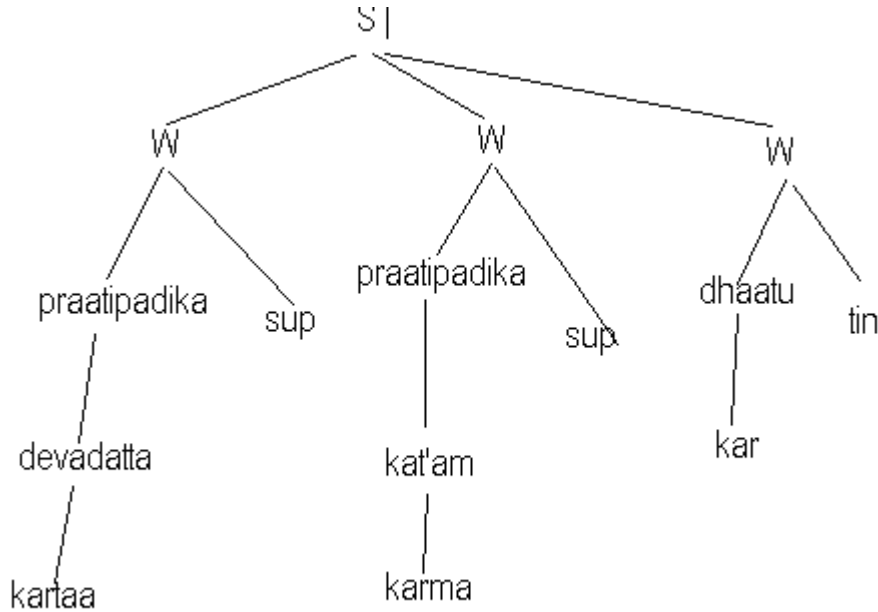
Any *kaaraka* not defined will be considered as an 'Object' (*karma*) by Panini (sutra 1-4-51, *akathitam ca*). This will explain how a pronoun takes accusative case form in English sentences like "John is older than me".

The structure of the sentence *devadattah kat'am karoti* 'Devadatta makes mat' can be shown in Diagram 2 adopting Chomsky's methodology. This Diagram 2 is highly redundant. The *kartaa* (Subject) and *karma* (Object) are always words having the structure *praatipadika* + *sup*. Therefore, Diagram 2 can be simplified as Diagram 3 without losing any relevant information. The case formation rules along with others given by Panini will derive the sentence *devadattah kat'am karoti* from the structure shown in Diagram 3.

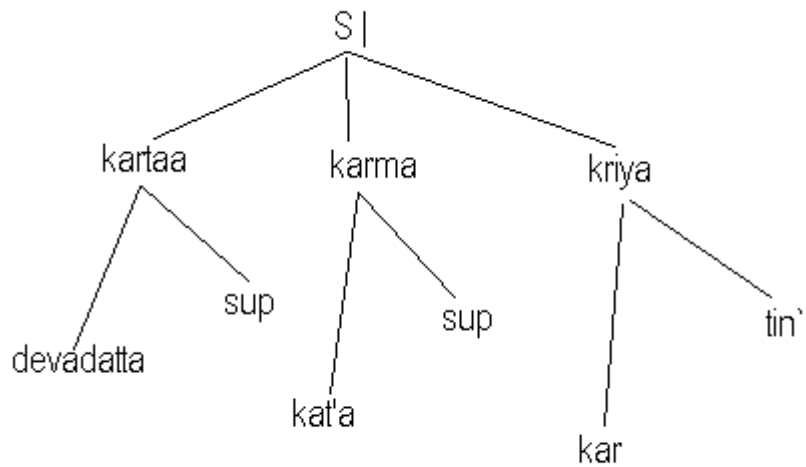
The structural descriptions Panini provides are in some way different from those of Chomsky. For a comparison, see the Diagrams 3 and 4. One important difference between Chomsky and Panini is that while the former prefers always division of a constitute into two immediate constituents the latter does not have this idea.

We thus find that Panini's grammar is "a system of rules" that assigns structural descriptions to sentences" in an "explicit and well defined way". It can therefore be considered as one model, the first model, of generative grammar meeting the minimum requirements as per the formulation of Chomsky.

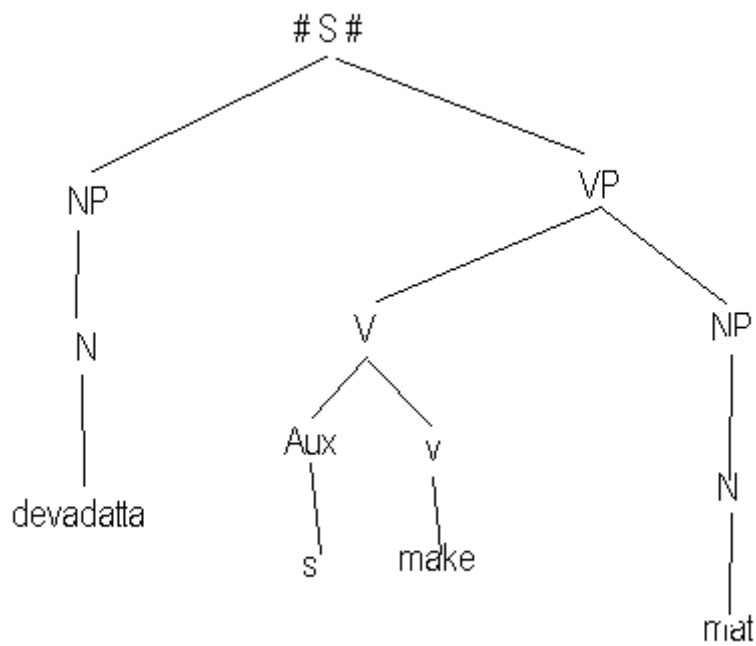
**The hypothesis 1 can therefore be approved as a theorem.**



**Diagram 2**



**Diagram 3**



**Diagram 4**

Furthermore, the following discussion will show that Panini and Chomsky share many crucial ideas that are characteristic to the contemporary model of generative grammar. It is therefore worth examining our hypotheses 2 and 3 elaborately. The nature of grammatical rules, the basic

---

idea of Deep structure, Surface structure, Transformation and Semantic interpretation are some of the most important ideas Chomsky has characterized in his generative model. It can be found that these are ideas reconstructed and revived by Noam Chomsky from Panini's grammar. Of course, it is also a fact that Chomsky has introduced many crucial new ideas also in developing Panini's grammar into the contemporary model of generative grammar.

### 5. Rewriting Rules

Panini has identified four processes of grammatical operations – *lopa* (deletion), *aagama* (addition), *aades^a* (substitution) and *dvitva* (reduplication). The process of substitution is the most important among these four. If "A" can be substituted by "Z", then, the Indian grammarians will consider it as Z occupying the place of A, which is equivalent to Chomsky's rewriting rule  $A \rightarrow Z$ . For a concrete example, Panini's suutra 8-2-30, *coh kuh* is interpreted as "cu" (palatal stop) is replaced by "ku" (velar stop) as in *vaac*  $\rightarrow$  *vaak* 'word'. See that this is equivalent to Chomsky's model of rewriting rule  $cu \rightarrow ku$ .

The possible place of occurrences in a rule of replacement is called *sthaana* (place) and the form which undergoes the substitution is called *sthaanin* (the 'place-holder') and the form which replaces it is called the *aades^a* ('instruction' or the 'instructed element') in Panini's terminology. The *sthaani* and *aades^a* have equal privilege of occurrences, Panini observes (*sthaanivad aades^ah*). This means, if  $A \rightarrow Z$ , then Z is an A. If **Sentence**  $\rightarrow$  **NP + VP**, then, **NP + VP** is a **Sentence** in Chomsky's examples.

What is 'substitution' for Panini is 'rewriting' for Chomsky. If A is substituted by Z, then A is rewritten as Z. That is,  $A \rightarrow Z$ . "All rewriting rules", says Chomsky (1965, 112), "are of the form  $A \rightarrow Z / X - W$ " (Where the symbol A is rewritten as Z in the context 'X - W'). This form of rules can be considered obviously as a revision of Panini's rules of substitution. For another typical example, the suutra 6-1-77, *iko yan'aci* can be considered as equivalent to:

$$ik \rightarrow yan' / - ac$$

that is, 'ik is replaced by yan' before ac' (Panini's interpretation), or 'ik is rewritten as yan' before ac' (Chomsky's interpretation).

### 6. Sequential Application of Rules

Chomsky has insisted that the rules of a grammar shall be ordered in such a way that they shall be applied in the given order. This is a very important principle. If the rules are not given in a linear order and not applied in the given order, then, the derivation of sentences will not be automatic or mechanical. Hence, the first rule shall apply first, the second rule next, and so on until the last rule applies. Each rule shall be applied on the string generated by the previous rules. After the application of one rule, no rule preceding it can apply unless the whole set of rules apply cyclically. This is a natural and essential requirement of any grammar to enable the users to generate sentences by the application of the rules without using his intelligence or intuition. Chomsky has therefore maintained this principle throughout his works.

Panini has proposed this principle explicitly in his Suutra 8-2-1, *puurvatra asidddham*, which says that a suutra will be considered as not applicable (*asidddham*) before its term comes (*puurvatra*). To take a concrete example, suutra 6-1-78, *ecoyavaayaavah*, derives *harayuttis'th'a*, *guravuttis'tha*, *tasmaayapi* and *vaagarthaaviva* from *hare + uttis'th'a*, *guro + uttis'tha*, *tasmai + api* and *vaagarthau + iva*, respectively. Later, from these strings the suutra

8-3-19, *lopah s^aakalayasya*, derives correctly *hara uttis'th'a*, *gura uttis'tha*, *tasmaa api* and *vaagarthaa iva* by deleting the glides *y* and *v*. Now, if suutra 6-1-87 which precedes 8-3-19 applies to these strings, the ungrammatical forms *\*harottis'th'a*, *\*gurottis'tha*, *\*tasmopi* and *\*vaagarthaiva* will be derived. Hence, it is proposed that the suutra 6-1-87 cannot be applied to the results of the suutra 8-3-19 which follows it. See the following:

Suutra 6-1-78      suutra 8-3-19      suutra 6-1-87

*hare uttisth'a* → *harayuttisth'a* → *hara uttisth'a* → *\*harottisth'a*

See that suutra 6-1-87, if applied, derives ungrammatical forms from the strings derived by the suutra 8-3-19. To say generally, after the application of a suutra no previous suutra will be applied to the result of it. Thus the rules are applied one after another in the given order.

The derivation of *tacchivah* from *tat + s^iva* can be illustrated as another example here. Several suutras are operative in this derivation as shown below:

*tat + s^ivah* > *tad + s^ivah* (suutra 8-2-29) > *taj + s^ivah* (suutra 8-4-40) *tac + s^ivah* (suutra 8-4-55) > *tac + chivah* (suutra 8-4-63) > *tacchivah*.

What is important to note here is that when a suutra is applied to a string it will be followed by the application of the rules which follow it, and not the rules which precede it.

However, the commentators of Panini's grammar say that this linear order of rules is maintained in Panini's grammar only in a small part of it called *tripaadi*. That means, Panini has not maintained this essential principle throughout a large portion of his grammar.

A note on the interpretation of the suutra 8-2-1, *puurvatra asiddham*, is relevant here. The commentators of Panini interpret this suutra as an *adhikaara* suutra which divides Panini's grammar into two major sections, (1) *puurvatra siddham* which includes the first seven chapters and the first quarter of the eighth chapter (*sapaada saptaadhyayi*), and (2) *puurvatra asiddham* which includes the last three quarters (*tripaadi*) only. This is done on the assumption that the sequential application of suutras is valid in Panini's grammar only to the last three quarters of the last chapter. This is probably a false interpretation. The present author believes that the *puurvatra asiddha* principle is valid for all the rules except *samjn^aa* and *paribhaas'a* rules which have to be considered as universal. The suutra 8-2-1 *puurvatra asiddham* shall be considered as a *paribhaas'a* rule (Namboodiri, 2016, 170-73) we can claim.

## 7. Levels of Structure

"A language is an enormously involved system, and it is quite obvious that any attempt to present directly the set of grammatical phoneme sequences would lead to a grammar so complex that it would be practically useless", Chomsky, (1957, 18) continues: "For this reason, linguistic description proceeds in terms of a system of "levels of representations". Instead of stating the phonemic structure of sentences directly, the linguist sets up such 'higher level' elements as morphemes, and states separately the morphemic structure of sentences and the phonemic structure of morphemes. It can easily be seen that the joint description of these two levels will be much simpler than a direct description of the phonemic structure of sentences".

Panini has identified a system of three (against the above described two) units in addition to *vaakya* (sentence). Just like a sentence for Panini is a sequence of one or more words (*padas*), a



word is a sequence of one or more morphemes ( $s^{\wedge}abd$ as), and a morpheme is a sequence of one or more phonemes ( $varn'$ as).

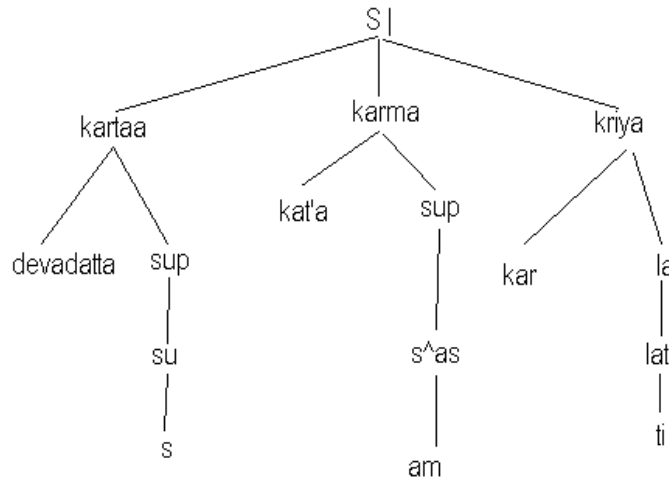
### 8. Kaarakas and Vibhaktis

In addition to what is said above, Panini has identified two important levels of syntactic structure – the *kaaraka* level and the *vibhakti* level. The underlying structure of a simple sentence in Sanskrit language consists of a Verb (*tin`anta*) and one or more Nouns (*subantas*) in Panini's conception.

Each noun is related to the verb in a particular way. The relation between a noun and a verb is called *kaaraka*. Panini has defined six *karakas* listed earlier in this paper.

The verb of a sentence in Sanskrit will be inflected for tense, mood, aspect and voice. Panini generates all the suffixes attached to the verb stems from an arbitrary basic underlying form "*la*". The form *path'ati* '(he) learns' will be thus generated from *path' + la* (root + suffix). The root *path'* changes to *path'a* by a process of stem formation. The suffix *la* is replaced by *lat'* to denote 'present tense' (sutra 3-2-123 *varttamaane lat'*). Again, *lat'* changes to *ti* by another rule to indicate 'third person singular'.  $path' + la = path'a + la = path'a + lat' = path'a + ti = path'ati$ .

Similarly, the nouns are inflected for *kaarakas*. "*sup*" is a set of 21 suffixes attached to nouns to denote three 'numbers' (singular, dual and plural) and seven 'cases' (first to seventh). Other grammatical categories, such as negative, question, conjunction etc. will be denoted in Sanskrit by particles, *na*, *kim*, *ca* respectively. The structure of the sentence *devadattah kat'am karoti* 'Devadatta makes mat' already shown in Diagram (3) is repeated below (Diagram 5) adding more details:

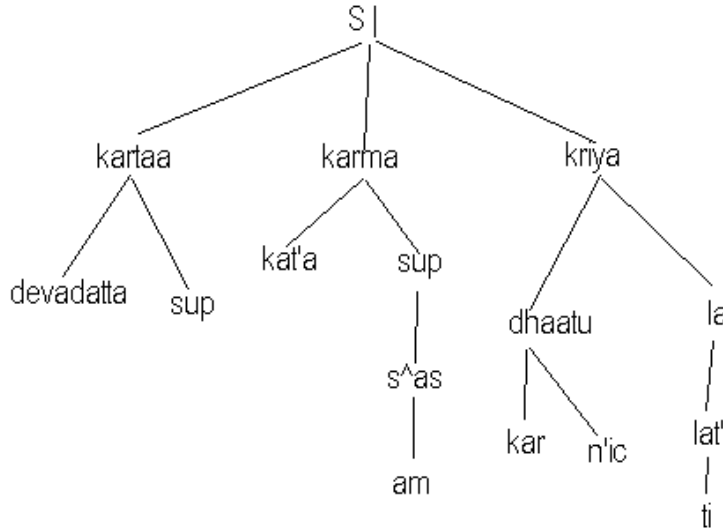


**Diagram 5**

The actual form of sentence, *devadattah kat'am karoti* is derived from the Diagram 5 by morphophonemic rules. The subject *devadattah* in this sentence is in the 'nominative case' (first

case – *prathama vibhakti*) and the object *kat'am* in the 'accusative case' (second case – *dvitiiya vibhakti*). The verb is in the 'present tense third person singular' indicated by *lat'* and *ti*.

The verb in the above diagram (5) can take a 'causative' suffix *n'ic* deriving Diagram 6. In that case, the subject takes the 'third case' by case formation rule *sutra 2-3-18*, *kartr`karan`ayostr`tiyaa*, deriving the sentence *devadattena kat'am kaarayati* 'the mat is made by Devadatta'.



**Diagram 6**

*devadattena kat'am kaarayati* 'the mat is made by Devadatta'.

1. Devadatta-sup + kat'a-sup + kar-lat' →
2. Devadattah kat'am karoti
3. Devadatta-sup + kat'a-sup + kar-n'ic-lat' →
4. Devadattena kat'am kaarayati

### 9. Deep Structure, Transformation and Surface Structure

The central idea of Chomsky's transformational grammar is that every sentence has a deep structure from which its surface structure is derived by transformations. For a simple example, the sentence "*Sincerity was admired by John*" is generated in Chomsky's conception from its abstract structure "*John – past – admire – sincerity – by passive*" (disregarding details irrelevant for the present discussion) by a 'passive transformation', an 'auxiliary transformation' and morphophonemic changes as shown below:

*5. John – past – admire – sincerity – by passive →*

6. *sincerity – past – be + en – admire – by + John* →  
7. *sincerity – be – past – admire – en – by + John* →  
8. *Sincerity was admired by John*

Here, 5 is the deep structure and 7 the surface structure of sentence 8. The string 6 is derived from 5 by 'Passive transformation', and 7 from 6 by 'Auxiliary transformation'. The sentence 8 is derived from the surface structure 7 by morphophonemic rules, according to the formulation of Chomsky.

"It is worth mentioning that with this formulation of the theory of transformational grammar", Chomsky (1965, 137) points out, "we have returned to a conception of linguistic structure that marked the origin of modern syntactic theory, namely that presented in the *Grammaire générale et raisonnée*". In fact, this new conception can be traced back not only to the *Grammaire générale et raisonnée* (Lancelot *et al*, 1660), but also to Panini (5<sup>th</sup> century B.C.), we can claim and also substantiate.

In the previous section, we found that sentence 4 is derived from the structural string 3 by a case formation rule (and of course by some morphophonemic rules). The string 3 can be considered as the deep structure from which the sentence 4 is derived by a transformation in Chomsky's conception.

The transformational structure of languages, though described in clear terms only recently, is a natural inheritance. Therefore, it is not surprising that the ancient Indian grammarian Panini has not left undescribed many of the important transformations in Sanskrit (Namboodiri 2016, 146-56).

Panini has identified several types of transformations in his grammar. One important type is concerned with the change of case relations (*kaaraka*). The subject (*kartaa*) of a sentence becoming the object (*karma*) of another sentence is one of the several examples of transformations described by Panini. If the *kartaa* of a sentence causes an action performed by another *kartaa*, the former *kartaa* is called *prayojaka kartaa* or *hetu kartaa*, (Causative Agent) (*tat prayojako hetus^ca – suutra 1-4-55*).

The agent of a verb becomes the object of its corresponding causative verb in the presence of a *prayojaka kartaa*. See the following sentences.

9. *devadattah kat'am karoti* 'Devadatta makes mat'  
10. *sah devadattam kat'am kaarayati* 'He causes Devadatta to make mat'  
11. *maan'avakah bhaaram harati* 'The boy takes the load'  
12. *sah maan'avakam bhaaram haarayati* 'He causes the boy to take load'

Here, *devadattah*, and *maan'avakah* are the subjects of the verbs *karoti* and *harati* in 9 and 11 sentences respectively. They become objects of the causative verbs *kaarayati* and *haarayati* by taking the objective case (*dvitiiya*) in the sentences 10 and 12.

## 10. Semantic Interpretation

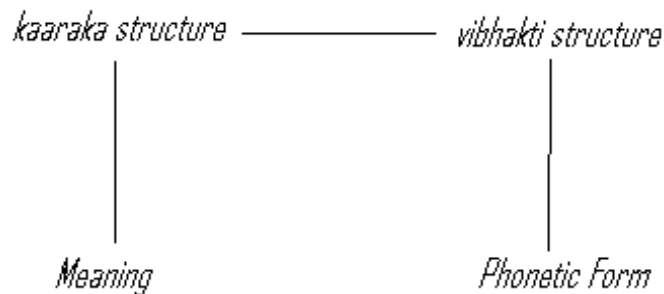
---

Chomsky has a ‘Semantic Component’ to interpret the meaning of sentences. Panini does not have a separate component for semantics. However, this does not mean that he is not interested in the interpretation of the meaning of sentences.

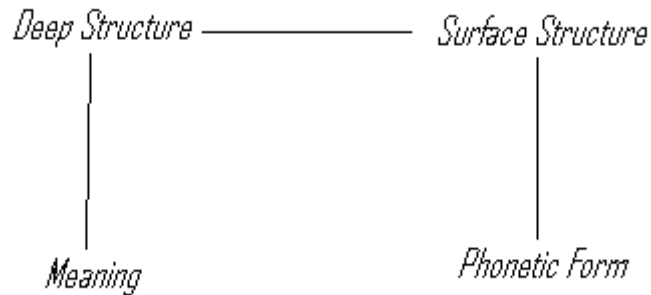
The ultimate aim of Panini’s grammar is to relate the linguistic forms with their meanings (*s^abdartha sambandha*), observe the commentators of Panini’s grammar. The generative grammar as developed by Chomsky also aims at the same goal. “Thus the grammar assigns semantic interpretations to signals, this association mediated by the recursive rules of the syntactic component” Chomsky (1965, 141) says.

It is important to examine how Panini and Chomsky assign meanings to phonetic forms. Panini identifies two different levels of ‘syntactic structures’ – the *kaaraka* level and the *vibhakti* level. The *kaarakas* define grammatical relations that are interpreted semantically. They are then mapped into *vibhakti* forms that are represented by phonemic sequences. The meaning of a sentence is thus interpreted from the underlying *kaaraka* structure and the phonetic form from the surface *vibhakti* structure. The meaning and phonetic form of a sentence are in this way related through the syntax which consists of two different levels, *kaaraka* level and *vibhakti* level. See the diagram (7).

Chomsky, in the same manner, generates a deep structure corresponding to Panini’s *kaaraka* structure, and a surface structure corresponding to Panini’s *vibhakti* structure. The deep structures and surface structures are two different structures derived in the processes of the derivation of sentences. In the Standard theory of Generative Grammar the deep structure contains all the elements necessary for understanding the meaning of the sentence. The surface structure, the actual form of a sentence, is obtained from the deep structure after the application of all the transformational, morphophonemic, and the phonological interpretation rules on it. Compare the Diagram 7 with the Diagram 8 which represents Chomsky’s model of generative grammar.



**Diagram 7.**



**Diagram 8.**

### 11. Phrase Structure Component

We shall not conclude from the above discussions that Chomsky was merely reviving Panini's grammar. It is true that Chomsky has revised, reconstructed and remodeled many ideas from Panini's grammar. In addition to this, he has also introduced several ideas of other ancient and modern grammarians as well as of his own.

One important difference between Chomsky and Panini is that the former has introduced a 'Phrase structure level' while the latter has no such a level. It was Bloomfield who first defined and described phrases in terms of 'immediate constituents'. Chomsky's innovation of Phrase Structure as a part of the Base Component of generative grammar enabled it to generate infinite number of sentences automatically and mechanically, and this is a unique feature of Chomsky's generative grammar. According to this theory, a grammar contains an initial string "S" and a finite set of instructions called 'branching rules' of the form  $X \rightarrow Y$ , interpreted "rewrite X as Y".

Chomsky generates the deep structure of sentences by 'branching rules' which divide each sentence into two constituents – subject and predicate. This is shown by a rule of the form (20):

$$13. S \rightarrow NP + VP$$

This rule indicates that a sentence is rewritten as a noun phrase plus a verb phrase in this order. The noun phrase of a sentence is defined as its Subject and the verb phrase as its Predicate. Suppose the rule (13) is followed by other rules as given below:

- 13a.  $NP \rightarrow Art + N$
- 13b.  $VP \rightarrow V + NP$
- 13c.  $N \rightarrow man, mango$
- 13d.  $Art \rightarrow The, a$
- 13e.  $V \rightarrow eats$

This sample grammar (13) can generate the sentence 14 "The man eats a mango" by the application of the rules one by one in the given order rewriting each time the symbol on the left hand side of the arrow ( $\rightarrow$ ) by the symbols on the right hand side. See the following derivation (14):

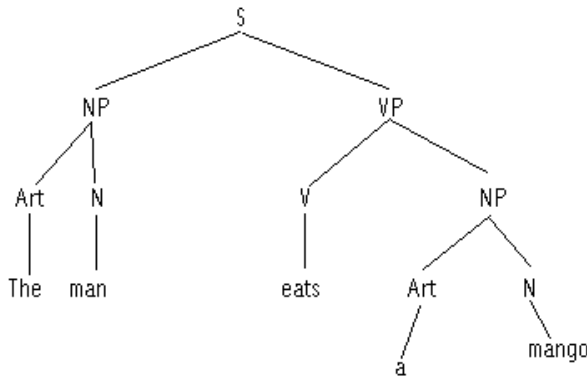
- |     |   |                     |
|-----|---|---------------------|
| 14. | S   | (initial symbol)    |
|     | NP + VP   | (rule 13)           |
|     | Art + N + VP  | (rule 13a)          |
|     | Art + N + V + NP  | (rule 13b)          |
|     | Art + <i>man</i> + V + NP                                       | (rule 13c)          |
|     | <i>The</i> + <i>man</i> + V + NP                                | (rule 13d)          |
|     | <i>The</i> + <i>man</i> + <i>eats</i> + NP                      | (rule 13e)          |
|     | <i>The</i> + <i>man</i> + <i>eats</i> + Art + N                 | (rule 13a repeated) |
|     | <i>The</i> + <i>man</i> + <i>eats</i> + Art + <i>mango</i>      | (rule 13c repeated) |
|     | <i>The</i> + <i>man</i> + <i>eats</i> + <i>a</i> + <i>mango</i> | (rule 13d repeated) |

Observe that the rules are applied in the given order, but repeated after the application of all the rules in one cycle. The rewriting rules of Chomsky are thus applied cyclically.

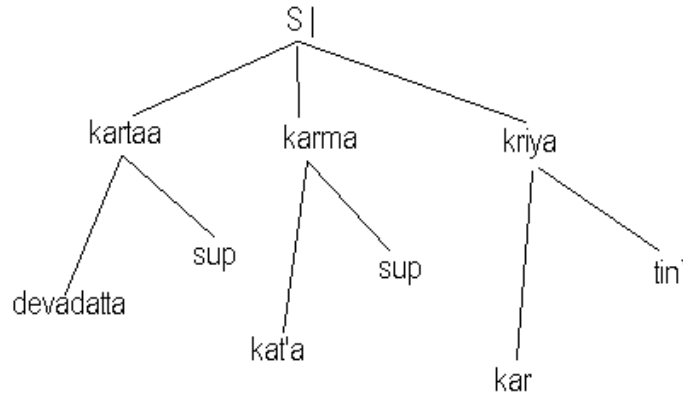
The above rules (13) are called ‘Base-rules’. They are of two types. The first three rules (13, 13a and 13b) are called ‘Constituent structure rules’; and the rest three, ‘Lexical rules’. The constituent structure rules are branching rules generating an abstract level of deep structure of sentences. The lexical rules insert lexical items into the proper nodes in these deep structures. The branching rules together with the lexical rules constitute the Base Component of a Generative Grammar.

The derivation of the sentence (14) “*The man eats a mango*” can be shown in a different way also by the application of the same set of rules. This different representation shown below is called a “Tree Diagram”.

Panini also provides structural descriptions that can be presented as tree-diagrams of the same sort (9). For example, see the Tree-diagram (10) which shows the structure of the sentence *devadattah kat'am karoti* ‘Devadatta makes mat’



**Tree-Diagram 9**



**Tree diagram 10**

Yet another difference, more important than those described above, between Panini and Chomsky is that the former does not give any branching rule of constituents to generate the deep structure of Sanskrit sentences. The branching rules of a generative grammar “carry out two quite separate functions”, Chomsky (1965, 123) points out: “they define the system of grammatical relations, and they determine the ordering of elements in the deep structures”. The second function of the base rules is not relevant as far as the Sanskrit language is concerned, because, unlike English there is no fixed word order in Sanskrit. Panini has therefore defined “the system of grammatical relations” (*kaaraka*) by a set of suutras, as shown earlier in this paper, and avoided the use of branching rules from his grammar, since there is no need to “determine the ordering of elements in the deep structures” of Sanskrit sentences. On the other hand, English has a fixed word-order in sentences and so Chomsky has to insist a fixed order of elements in the deep structure of sentences.

It may also be noted that another main difference between Panini and Chomsky is that while Panini defines *kartaa* (Subject) and *karma* (Object) directly, Chomsky (1965, 71) introduces the categorial symbol NP first and then defines these notions indirectly by the following rules (24).

- (15) Subject-of: [NP, S]  
 Direct-Object-of [NP, VP]

### **Conclusion**

We have put forward the following three hypotheses at the outset of this paper:

1. Panini's grammar is one model of *generative grammar*.
  2. Panini's grammar can be interpreted as a *transformational generative grammar* in the contemporary sense of this term.
  3. Panini's grammar can be reconstructed as a standard model of *generative grammar* from which the contemporary model of *transformational generative grammar* is developed by introducing new methodology.
-

Our discussion found that Panini's grammar is a set of well-defined rules that assigns structural descriptions to Sanskrit sentences in an explicit manner. Hence, it meets the minimum requirements of a generative grammar formulated by Chomsky, and therefore, our hypothesis 1 can be considered as a theorem.

However, the second hypothesis cannot be substantiated because Chomsky has incorporated not only Panini's ideas but also several new ideas in the formation of contemporary model of generative grammar. The introduction of branching rules in the base component enabled generative grammar to generate infinite number of sentences automatically and mechanically. This is a unique feature of Chomsky's generative grammar. This alone will prove that hypothesis 2 cannot be proved as a theorem. There are also many other new developments which differentiate substantially Chomsky's model from Panini's model.

The third hypothesis can be considered in the light of close similarities between Panini's grammar and the contemporary model of generative grammar. Our discussion shows that Chomsky has revived, reconstructed, revised and remodeled many ideas from Panini. The nature of grammatical rules, the idea of Deep structure, Surface structure, Transformation and Semantic interpretation are some of the very important topics Chomsky has reconstructed and revived from Panini's grammar. Therefore, Panini's grammar can be reconstructed as a standard model of *generative grammar* from which the contemporary model of *transformational generative grammar* is developed by Chomsky introducing new methodology. Further research (Namboodiri E.V.N, 2016, pp 206) has proved beyond doubt that modern generative grammar developed by Noam Chomsky during the 20<sup>th</sup> century is not an outgrowth of traditional European linguistics, but a revision of Panini's grammar written in India in the 5<sup>th</sup> century B.C.

#### References

- Bloomfield, Leonard. 1933. *Language*. New York: Henry Holt and Company.
- Chomsky, N.1975. *Logical Structure of Linguistic Theory*. Plenum Publishing Corp.
- Chomsky, N.1957. *Syntactic Structures*. The Hague: Mouton and Co.
- Chomsky, N.1964. *Current Issues in Linguistic Theory*. The Hague: Mouton.
- Chomsky, N.1965. *Aspects of the Theory of Syntax*. Cambridge: MIT Press.
- Chomsky, N.1972. *Semantics in Generative Grammar*. The Hague: Mouton & Co.
- Harris Z. S. 1957. Co-occurrence and Transformation in Linguistic Structure. *Language* 33, pp 283-340.
- Joshi, S. D. and J.A.F. Roodbergen. 1973 – 1986. *Patanjali's vyaakaran'a mahaabhaas'ya* (Introduction, Text, Translation and Notes). Poona: University of Poona.
- Namboodiri, E.V.N. 2016. *Origin and Development of Modern Linguistics*. New Delhi: Crescent Publishing Corporation,.
- Joshi, B. S. (ed.). *Patanjali, Mahabhashya*, with Commentaries. Delhi: Motilal Banarsidas.
- Vasu, S.C. 1891, 2009. *The Ashtaddhyaayi of Panini*. Delhi: Motilal Banarsidas.
- Vasu, S.C.1905-07, 1982. *The Siddhanta Kaumudi of Bhattojiksita*. Delhi: Motilal Banarsidas.

