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CO-ORDINATION IN SANSKRIT

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ABSTRACT

The description of the coordination, analysis, and representation of the dependencies involving conjuncts and conjunctive particle differ from a linguist to a linguist and also among computational linguists. Indian grammarians have also discussed the meaning of a conjunctive particle 'ca', and provide some clues with regards to the concord of sentences involving such particle. We present a brief survey of various representations of co-ordination in dependency framework by linguists, and computational linguists, followed by the discussion in Indian literature on the conjunctive particle. Finally, we propose a dependency representation for co-ordination in Sanskrit taking clues from these discussions.

Keywords: Co-ordination, Sanskrit, analysis, conjunction

1. Introduction

Since the 1990s, NLP is turning towards dependency analysis and in the past few years' dependency has become hegemony. The computational linguistics finds it more appropriate for the tasks such as machine translation, information retrieval, information extraction, question answering, and so on. Several dependency parsers for various languages in the world are being developed. Universal dependency frameworks are being proposed. The dependency frameworks for language analysis have also been found useful and relevant in psycholinguistics analysis. Eventually, several linguists and computational linguists have contributed to the domain. Guidelines for annotation of dependency structures have emerged. The dependency frameworks with different sets of relations were proposed. Among all these, we noticed that the co-ordinate structures have been central issue both in theoretical as well as computational linguistics. The description of the coordination, analysis, and representation of the dependencies involving conjunct to conjunctive particle differ from a linguist to a linguist and also among computational linguists. Indian grammarians have also discussed the meaning of a conjunctive particle 'ca', and provide some clues with regards to the concord of sentences involving such particle. We look at all these theories, and propose a scheme for dependency representation of Sanskrit sentences involving conjunctive particle 'ca'.

In the next section, we give a brief overview of the description of co-ordination in various dependency theories and also various representations of phrases involving conjunct by computational linguists. Most of the discussion below heavily derives from Mazziotta (2014) and Nivre (2005). In the third section, we look at the discussions in Indian grammar books regarding the treatment of conjunctive particle. In the fourth section, we present a proposal for the dependency analysis of conjunction in Sanskrit justifying our choice.

2. Treatment of conjuncts in western linguistics

There are two issues related to the analysis of a conjunction. The first one is regarding its status as a function word or a content word, and the second one is regarding the dependency

relations involved. Regarding the first one, Jahannessen (1998, p. 105) shows that the linguists agree that the conjunctive particle belongs to the closed lexical class marking it as a functional word rather than a content word. He further also points out that it also lacks any 'descriptive content'. The second issue that involves the dependency relations poses the following questions.

(i) Is the coordinating conjunction the head?
(ii) If it is, then what does it govern and is it governed by anything?
(iii) Is the relation of the conjunction with all the involved conjuncts symmetric?

Below we give a brief outline of different views of western linguists that cover the complete spectrum of divergent representations of sentences involving co-ordinating conjuncts.

2.1 Tesnière

Tesnière, a modern linguist whom the work on modern dependency grammar can be traced back to, models the co-ordination with the concept of "junction" (Osbone & Kahane, 2015). This is a horizontal relation marking the words connected to be hierarchically equivalent as against dependent when they are connected by "vertical" relation. The graphical representation of the relations in the sentence Alfred and Bernard fall (1) is shown in Figure 1 below:

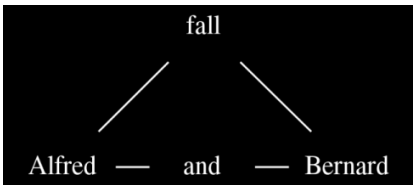

Figure 1: Tesnière

Thus we see that 'Alfred', as well as 'Bernard', depend (are governed by) on the main verb 'fall'. The two conjuncts 'Alfred' and 'Bernard' do not have any dependency relation between them, and the conjunctive particle 'and' joins them. Note that 'and' is not governed!

2.2 Timothy Osborne

In 2008 (Osborne, 2008) proposed a model that deviates a little from that of Tesnière. Osborne does not accept that both the conjuncts are governed by the main verb. According to him, while all other relations are the same as in Tesnière's analysis, only the leftmost conjunct is governed by the main verb. See Figure 2 below:

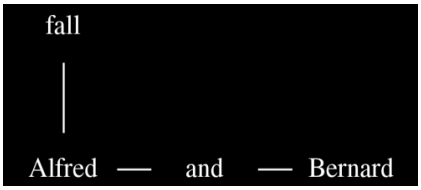

Figure 2: Osborne

With such an analysis, it would be difficult to explain the non-agreement in number of the governee with the governed, unless we compute the number for the conjunct phrase.

2.3 Mel'čuk

Mel'čuk (1988), in his Meaning-Text Theory (MTT), uses syntactic, morphological as well as the semantic criterion to identify the governor. In the case of dependency representation of conjunction, he uses both syntax as well as semantics. He claims that the co-ordination symmetry is only at the semantic level. He privileges the first conjunct as the head of the co-ordination. That is according to him the conjuncts in a co-ordinate construct, are independent semantically but there is a syntactic dependency of the second conjunct on the first one.

The dependency structure for (1), following MTT is as shown in Figure 3:

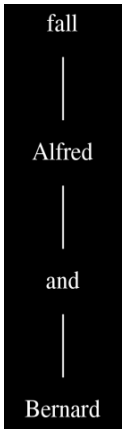

Figure 3: Mel'čuk

Note here that the conjuncts are no more independent of each other as was the case in Tesnière or Osborne. The second conjunct depends on the first one, and therefore also on the verb indirectly. But according to Tesnière, the dependence of each of the conjuncts on the verb is direct. Such a representation cannot represent the two readings of 'old men and women' to mean a) (old men) and (old women) and b) (old men) and women, faithfully. Because the only possible representation in this scheme is the dependency shown in Figure 4:

Figure 4: Mel'čuk

There is no way to know whether ‘old’ is distributed over ‘and’ or not. Similarly, there is no known way to describe the co-ordination where the verb in shared between the two conjuncts or where the subject is shared between two verb phrases, as shown below:

John loves Mary and Peter, or as in,
John gets a letter from Mary and roses from Ann.

2.4 Hudson’s Word Grammar

Hudson (1988) recognizes the fact that in dependency structures words have unequal status whereas in coordination they have equal status. This feature is captured by Hudson by marking the dependency relations with each conjunct as in Tesnière. However, he deviates from Tesnière in the representation and relation of conjunction with the conjuncts. Hudson unlike Tesnière, marks the conjuncts to be dependent on the conjunction, thereby showing that they have equal status. Thus the sentence

He saw Arthur and Bill (2)

is represented as in Figure 5 below:

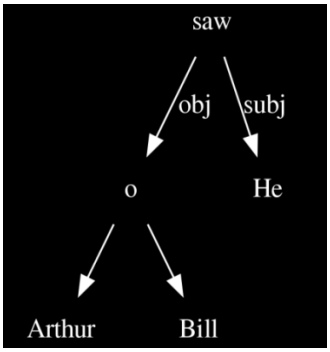

Figure 5: Hudson’s Word Grammar

2.5 Rosta

Rosta (2006) marks it clear further that while the conjuncts relate to the head by dependency relation, they also relate to the conjunctive particle ‘and’ by part-whole relations. Instead of marking the dependency relations with each of the conjuncts, he proposes to mark it with the conjunction treating it as a proxy of its dependents. Thus the sentence (2) is represented as in Figure 6:

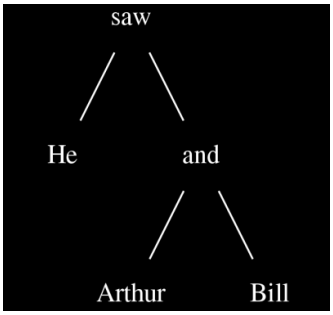

Figure 6: Rosta’s representation of (2)

A sentence such as

She will give Sophy roses and Edagar tulips, (3)

is analysed as in Figure 7 below:

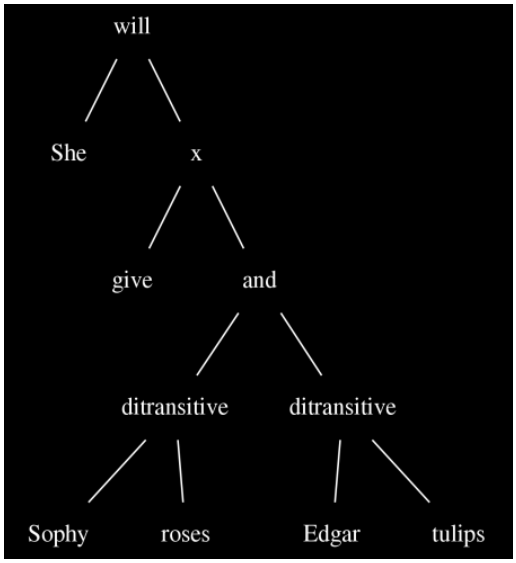

Figure 7: Rosta's representation of (3)

Note the subtle difference between Hudson's representation and that of Rosta's. Rosta posits the co-ordination as a proxy and the relation between the verb and the conjuncts is through the proxy. But Hudson does not bring in the lexical unit 'and'. He posits an empty circle through which the relation is marked. This empty circle corresponds to the set represented by the conjuncts conjoined by the conjunction.

3. Treatment of Conjuncts in Computational Linguistics

Having seen treatments of conjuncts by major western linguists, let us see how computational linguists treat it. Popel et al. (2013) have noted that there are many variations in the treatment of conjuncts across various dependency tree banks. They give a systematic survey of solutions adopted in various treebanks. We produce here two samples for English and one for Hindi.

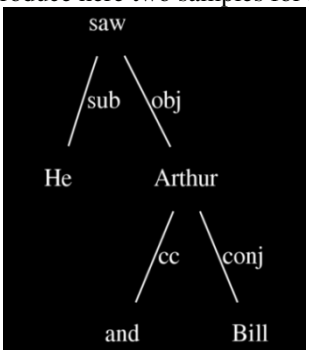

Figure 8: Stanford Dependency

In the Standford dependency parser, the coordination is represented as a dependency structure in which the first conjunct is normally the head of the dependency. Thus the analysis of (2) is represented as in Figure 8:

Like Mel'čuk, this analysis also treats the left most conjunct the head and the conjunction dependent on it. But it differs from Mel'čuk in that the other conjunct is marked to be dependent on the head and not on the conjunction.

The Prague dependency tree bank on the other hand marks both the conjuncts dependent on the conjunction, which acts as the head of the co-ordination structure. Thus the representation of (2) according to Prague Dependency Treebank guidelines would be same as the Rosta's representation shown in Figure 6.

The Hyderabad Dependency Treebank for Hindi marks the conjunction as the head and the two conjuncts depend on this node by the relation of *ccof*.

Thus the sentence,

Hindi: rāma aura śyāma skula jāte haiṁ (3)
English: Rama and Syama go to school.

is analysed as shown in Figure 9 below:

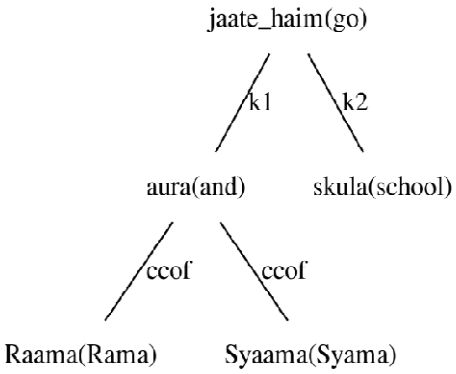

Figure 9: Hindi Treebank

In summary, we notice that there is no unanimity regarding the analysis of sentences involving co-ordinating conjuncts. The relation between the coordinating conjunction and conjuncts may be symmetric or asymmetric. Tesnère, Hudson, Rosta, Prague Tree bank and Hindi Tree bank consider it to be symmetric. However, they differ with regards to the dependency relation involving the conjunctions.

Except for Tesnière, everybody who considers the relation to be symmetric marks the conjuncts depended on the conjunction. However, as far as the governee of the conjunction is concerned they have different stands. Tesnière and Hudson do not consider the conjunctive particle to be governed while Rosta and the Hindi Treebank and Prague Treebank developers consider it to be either governed by the verb or to be the root of the sentence. Those who consider the relation to by asymmetric either consider the particle 'and' to be independent (Osborn) or consider it to be governed by the first conjunct and governs the following conjunct.

These various positions are summarised in the following table:

	Governee	Governed by	Symmetric
Tesnière	-	-	Yes
Hudson	Both conjuncts	-	Yes
Rosta	Both conjuncts	verb	Yes
Prague Dependency			
Hindi Tree Bank			
Osborne	-	-	No
Mel'čuk	following conjunct	first conjunct	No
Universal Dependency	following conjunct	first conjunct	No

4. Indian grammatical tradition on the coordination conjunction

Having seen various western theories regarding the dependency analysis of the sentences involving the coordinating conjunctions, let us see what the Indian theories have to offer in this regard. In Sanskrit, the conjunctive co-ordination is expressed by the word 'ca', which is an indeclinable. Indian grammarians have discussed the following issues with regards to 'ca':

(i) Expressive power of the particle 'ca',
(ii) Different meanings of the particle 'ca', and
(iii) Concord in sentences with 'ca'.

We provide below the gist of these discussions followed by our proposal for dependency representation of sentences involving 'ca'.

4.1 'ca': illuminates the meaning or expresses it?

Bhratṛhari in his Vākyapadīyam in the second canto discusses the meaning of particles in the following kārikā:

nipātā dyotakāḥ kecit pṛthagarthābhidhāyinaḥ
āgamā iva ke'pi syuḥ sambhūyārthasya vācakāḥ (2.192)

(Particles are found to be of three types: those which illuminate the meaning (dyotaka), those which express (vācaka) their meaning independently, and those that convey the meaning, like grammatical arguments, while in union with other words which govern them.)

Bhartṛhari further states that

cādayo na prayujyante padatve sati kevalāḥ
pratyayo vācakatve'pi kevalo na prayujyate (2.194)

(Just as the suffixes which have their own meanings cannot be used by themselves, the conjunction 'ca' and other similar words, also in spite of being words, cannot be used by themselves.)

This implies words such as 'ca' do not have their own meaning. In other words, 'ca' only illuminates the meaning.

4.2 Different meanings of 'ca'

In the Mahābhāṣya Patañjali has given four different meanings the word 'ca' illuminates, under the commentary of Pāṇini's sūtra '*cārthe dvandvaḥ*' (2.2.29). These four meaning are:

(i) Samuccaya (collection),
(ii) Anvācaya (secondary importance),
(iii) Itaretarayoga (mutual connection), and
(iv) Samāhāra (collection).

4.2.1 Samuccaya

Samuccaya is defined as "*parasparanirapekṣasya anekasya ekasmin anvayaḥ*". Thus it is the grouping together of two or more words of equal importance/status, which have no mutual expectancy. For instance, in the following sentence

Sanskrit: *gāṃ aśvaṃ ca nayati*
Eng: He takes a cow and a horse

The conjunctive particle 'ca' groups two substantive terms 'go' and 'aśva', which have equal importance as far as the underlying action is concerned. Further the two substantives involved do not have any expectancy for each other, as far as the underlying action is concerned. Since there is no mutual expectancy, joint involvement of items in the underlying action is not implied.

4.2.2 Anvācaya

As against Samuccaya, anvācaya is defined as '*anyatarasya ānuṣaṅgikatve anvācaya*' a grouping of items that are not of equal importance. The example of anvācaya is '*bhikṣāṃ aṭa gāṃ ca ānaya*' (Oh! Boy, go for alms and bring a cow). Here the 'ca' connects two sentences, not nouns. There are two different actions involved, of which one (to go for alms) is the main action, which is under focus, and the other one (to bring cow) is of secondary importance.

4.2.3 Itaretarayoga

It is defined as '*parasparāpekṣāṇāṃ avayavabhedānugataḥ*'. This is a grouping together of items that have mutual expectancy wherein the individuality of the constituent items is also maintained. For example, suppose a task requires a skill of two persons, Rama and Krishna. Then the usage will be *rāmakṛṣṇābhyāṃ idaṃ kāryaṃ kartavyam* (this work is to be done jointly by Rama and Krishna). If any one of them is absent, the work would not be done since for the completion of the activity, their joint participation is necessary.

Note here that the words Rama and Krishna together form a compound *rāmakṛṣṇa* and this compounded form is used in the above sentence. If we use the uncompounded version such as *rāmeṇa kṛṣṇena ca idaṃ kāryaṃ kartavyam* (this work is to be done by Rama and Krishna), then the togetherness is not implied. It would just mean the work is to be completed by both Rama and Krishna individually. In order to specify the joint role of the individuals in a task, one needs to use the compounded version.[1]

4.2.4 Samāhāra

It is defined as '*parasparāpekṣāṇāṃ eva tirohitāvayavabhedaḥ*'. This is grouping together of items that have mutual expectancy. In such a grouping, only the collection has an identity and not

the individuals. The example discussed under this category is *chatropāhnam* (umbrella and sandals), which together form an identity of a person and not each separately. Thus we see that both it aretarayoga and samāhāra are special cases of Samuccaya. In both these cases, the collective effort, or collection is highlighted. When the joint action is involved, then mandatorily compound formation is advocated by the above sūtra by Pāṇini. Since this compound is regular (nitya), i.e., there is no paraphrase that can be used to convey the meaning of such compounds, it follows that when there is a joint action, then it must be expressed through a compound formation. We find supportive statements in the Mahābhāśa, where it is stated that the individual reference is known by the use of sentence, while the compounds indicate the composite/joint action.[2]

Since itaretarayoga and samāhāra are the types of compounds, and in compounded form, the conjunctive particle 'ca' is not used in what follows we will be mainly dealing with only two cases - that of samuccaya and anvācaya. In the case of samuccaya, the collection is devoid of joint action, and in the case of anvācaya, two or more actions are involved, of which one action is of primary importance and the other one is of secondary importance.

4.3 Concord

We first describe the stylistic variations in the use of 'ca'. Two different styles of use of 'ca' in the case of conjunctions of noun groups are found.

(a) 'ca' is used after each conjunct. Here is an example.

Sanskrit: *rāmaḥ ca tvam ca grāmam gacchati*.
English: Rama and you go to a village.

(b) Another usage is 'ca' is it is used only at the end of the last conjunct, as in

Sanskrit: *rāmaḥ sītā ca grāmam gacchati*.
English: Rama and Sita go to a village.

In the case of conjunct of verbs,

(c) If all the arguments of the second verb are shared, then the conjunctive particle 'ca' is used after the verb, as in

Sanskrit: *rāmaḥ śālām gacchati paṭati ca*.
English: Rama goes to school and studies.

(d) If the arguments of the second verb are expressed, then the conjunctive particle is placed immediately after the first argument of the second verb, as in

Sanskrit: *rāmaḥ śālām gacchati pāṭham ca paṭati*.
English: Rama goes to school and reads a lesson.

Now we look at the concord with sentences involving conjunctive particle. If the kartā (karma) has more than one item grouped together with 'ca' in the kartari (karmaṇi) prayogaḥ, then irrespective of whether there is only one 'ca' or 'ca' with each item, following agreement rules were observed.

(1) Hierarchy among the person:

When a group of substantives have nouns / pronouns referring to different persons, then the person of the group of substantives for the purpose of agreement with a verb is defined with the

max function with the hierarchy of the first person second person third person. If the group contains a term with the first person, then the verb shows agreement with the first person, if it does not have first person pronoun but has a second person pronoun then the verb agrees with the second person, and in all other cases, the verb agrees with the third person.[3] Here are a few examples:

rāmaḥ ca aham ca gacchāmi.
Rama and I go. (agreement with first person)

tvam ca aham ca gacchāmi.
You and me go. (agreement with first person)

rāmaḥ ca tvam ca gacchasi.
You and Rama go. (agreement with second person)

rāmaḥ ca tvam ca aham ca gacchāmi.
Rama, You and I go. (agreement with first person)

Sometimes, we also come across agreement with the whole group. And the rule for determining the person for agreement is the same as above, but the number corresponds to the number of the collective group. Here are some examples.

rāmaḥ ca aham ca gacchāvaḥ.
Rama and I go. (agreement with first person)

tvam ca aham ca gacchāvaḥ.
You and me go. (agreement with first person)

rāmaḥ ca tvam ca gacchathaḥ.
You and Rama go. (agreement with second person)

rāmaḥ ca tvam ca aham ca gacchāmaḥ.
Rama, You and I go. (agreement with first person)

(2) Verb agrees with the number and person of the substantive which is close to the verb.

The verb agrees in number and gender (in case of non-finite verbal endings such as kta and ktavatu) of the substantitive that is close to the verb. Here is an example from the Mahābhāṣya in support.

iha devadattaḥ iti ukte kartā nirdiṣṭaḥ karma kriyāguṇau ca anirdiṣṭau.
(Mahābhāṣya under 1.2.45)

(Here, by Devadatta kartā is indicated; a karma and, an action and an adjective are not indicated.)

Here we notice that the non-finite verbal form nirdiṣṭaḥ agrees with the substantitive kartā, similarly, in the second sentence, the non-finite verbal form anirdiṣṭau, agrees with the compounded substantive kriyāguṇau (an action and an adjective). Further, in the same commentary, Patañjali states

abhyāja iti ukte kriyā nirdiṣṭā kartṛkarmaṇī guṇaḥ ca anirdiṣṭaḥ.

Here the form anirdiṣṭaḥ agrees in gender and number with the closest substantive guṇaḥ, and not with the compounded form kartṛkarmaṇī, which is in dual. And finally, in the sentence

śuklām iti ukte guṇaḥ nirdiṣṭaḥ kartṛkarmaṇī kriyā ca anirdiṣṭā

the non-finite verbal form anirdiṣṭā agrees with the closest substantitive kriyā in both gender and number, and not with the compound kartṛkarmaṇī.

(3) The concord with adjectives involves gender and number.

The rule for number is same as the one for verb. Regarding the gender, the hierarchy goes like this:

neuter masculine feminine

If the group contains a neuter gender word, then the adjective common to the whole group will be neuter in gender, and if there are only masculine and feminine words involved then the gender is masculine. For example

rājā rājñī ca stutyacaritau staḥ.

(The King and his queen are of laudable conduct). [Kale 789]

We notice that the adjective stutyacarita is in masculine.

In another sentence,

dharmaḥ kāmaḥ ca darpaḥ ca harṣaḥ krodhaḥ sukhaṃ vayaḥ arthādetāni sarvāṇi pravartante na saṃśayaḥ. [Kale 789]

(Fulfillment of duty, satisfaction of desires, pride, anger, happiness, and long life, all these proceed undoubtedly form wealth.)

We notice that the adjective sarva (all) is in neuter gender.

Thus, to conclude,

- The co-ordinating conjunct, in spite of having a status of a word, does not have its own meaning, but illuminates the meaning.
- The conjuncts do not have any mutual expectancy with regards to the action involved, and they may or may not have equal importance with regards to the underlying action.
- Sometimes, there is an asymmetry involved with respect to the concord with the verb. The verb shows concord with the substantive close to the verb.
- We also come across sentences where the conjuncts joined by a co-ordinating conjunct are treated as one unit and the verb agrees with the gender and number of the collection and not with the closest substantive.

5. Governance

Since ‘ca’ is a dyotaka, it just illuminates the meaning and hence it acts as a means to mark the relation of conjuncts with other words and among themselves. It is not governed by any word in a sentence, and nor does it govern the conjuncts it conjoins. The concord provides us a clue for establishing relations. We now propose the dependency structure for sentences having a coordinate conjunct that conjoins words with different parts of speech.

5.1 Conjoining nouns

There are two cases: Either there is an asymmetry with verb showing agreement with the conjunct close to the verb, or verb shows agreement with the whole group of substantives joined by the conjunctive particle. Accordingly, we propose the following dependency representations for the two cases.

- The verb shows concord with the substantitive close to it.

Here is an example.

Sanskrit: *rāmaḥ bharataśatrughnau ca grāmam gacchataḥ*.
English: Rama, and Bharat-(and)-Shtrughna go to a village.

The dependency structure proposed is shown in Figure 10:

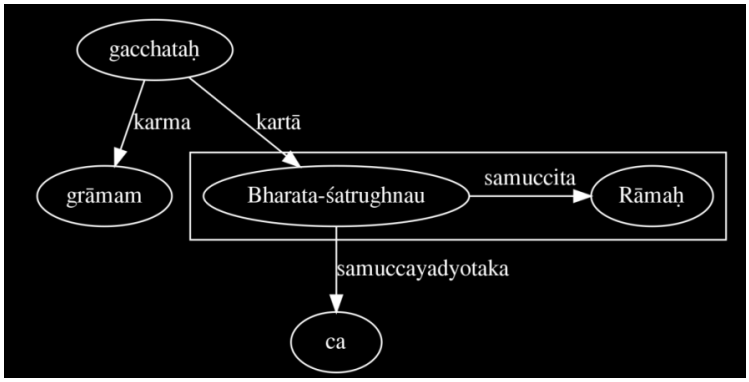

Figure 10: rāmaḥ bharataśatrughnau ca gacchataḥ

Here the relation between 'ca' and Bharataśatrughnau is marked as samuccayadyotaka (conjoining marker), and that between rāma and bharataśatrughnau is marked as samuccita (conjoined). Since the verb, which is in kartari prayoga (active voice), shows agreement with bharataśatrughnau, it is marked as kartā (agent).

Similarly, for the sentence

Sanskrit: *rāmaḥ ca tvaṃ ca grāmaṃ gacchasi*
English: Rama and you go to village

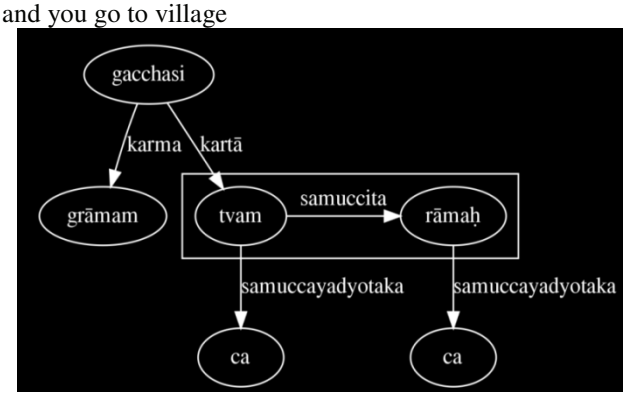

Figure 11: rāmaḥ ca tvaṃ ca grāmaṃ gacchasi

The dependency analysis is as shown in Figure 11, where the verb agrees with the closest substantive tvam (you). In this sentence, there are two 'ca's. And these are connected with the closest conjuncts.

The verb shows concord with the whole group involving the conjuncts. When the verb shows concord with the group of words conjoined through 'ca', then the kartṛtva (agenthood) is in the whole group and not in the individual items.

Hence in such cases, the relation is marked with the complete group as shown in the annotation of following sentence in Figure 12:

Sanskrit: *rāmaḥ ca tvaṃ ca grāmaṃ gacchathaḥ*
English: Rama and you go to a village.

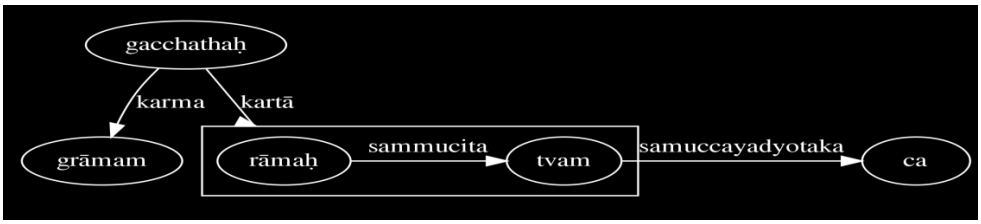

Figure 12 : rāmaḥ ca tvaṃ ca grāmaṃ gacchathaḥ

Here the group of conjuncts is marked as a kartā (agent) and not any one individual. The relations of samuccayadyotaka (conjoining marker) as well as samuccita (conjoined) are same as in the earlier examples.

Here is one more example with verb showing concord with the group.

Sanskrit: *rāmaḥ śyāmaḥ bhīmaḥ ca grāmaṃ gacchanti*
Eng: Rama, Syama and Bhīma go to a village.

The dependency relations and the annotation are shown in Figure 13:

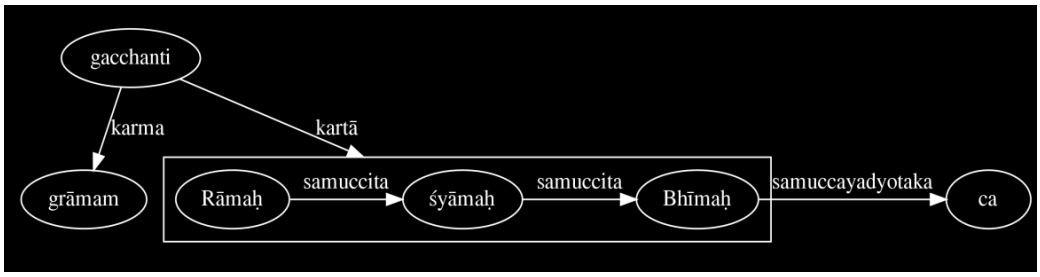

Figure 13: rāmaḥ śyāmaḥ bhīmaḥ ca grāmaṃ gacchanti

When the nouns are in 'case' other than nominative, there is no question of concord with the verb. In such cases as well, we mark the substantive closest to the verb by the appropriate semantic relation, and other substantives are conjoined with this substantive by the relation of conjoined. For example, consider the following sentence:

Sanskrit: *rāmaḥ dugdham jalam ca pibati*.
English: Rama drinks water and milk.

The dependency analysis for this sentence is shown in Figure 14:

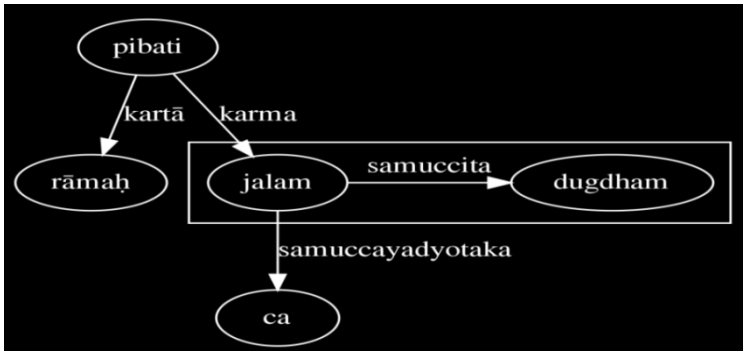

Figure 14: rāmaḥ dugdham jalam ca pibati

5.2 Concord of adjective with substantives

Here also we have two cases

Sanskrit: *rājā rājñī ca stutyacaritau staḥ.*
English: The King and his queen are of laudable conduct. [Kale 789]

Here 'stutyacaritau' is the predicative adjective (kartṛsamānādhikaraṇa) of the group. Hence the representation is as shown in Figure 15:

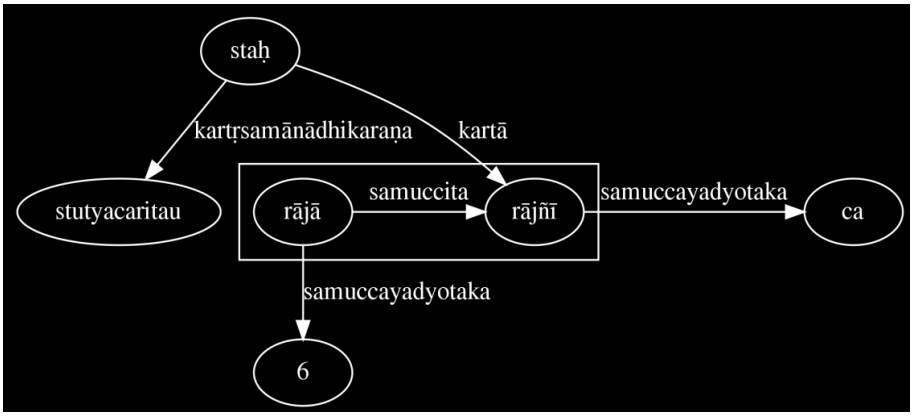

Figure 15: rājā rājñī ca stutyacaritau staḥ

5.3 Conjoining verbs

When the two verbs are conjoined by the conjoining particle, then as we saw earlier, the two verbs are not at the same plane. One verb denotes the primary action while the second verb denotes the action of secondary importance. The dependency analysis of the sentence

Sanskrit: *bhikṣām ata gām ca ānaya* (4)
English: Go for alms and bring a cow.

is shown in Figure 16:

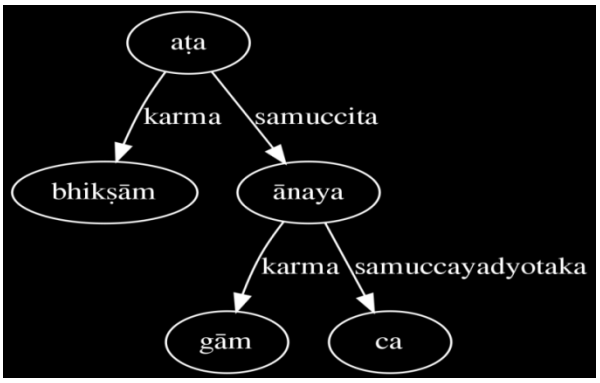

Figure 16: Bhikṣām ata gām ca ānaya

Note here that the main verb governs the secondary verb.

When there is an ellipsis of verb in the presence of a conjunctive particle, the ellipsis indicates that there are two instances of the action with different arguments. Again we have two different situations here. The first one is where only one argument is different, as in

Sanskrit: *rāmaḥ gṛham gacchati sītā ca*.
English: Rama goes home Sita too.

We do not distinguish this sentence from

Sanskrit: *rāmaḥ sītā ca gṛham gacchati*.
English: Rama, and Sita, goes home.

The reason for non-distinction is, the word order in Sanskrit being free, essentially, we do not notice any semantic difference between the two constructions. Hence the dependency representations for both these sentences are the same. When a dependency is shared with multiple dependents, as in the sentence

Sanskrit: *rāmaḥ gṛham gacchati Sītā ca śālām*,
English: Rama goes home and Sita to the school,

We duplicate the verb that is shared between two agents and two goals as shown in Figure 17. In Indian tradition, the repetition of an ellipsis is called 'adhyāhāra'. Two types of adhyāhāra's are discussed in the Indian literature - śabda-adhyāhāra and artha-adhyāhāra.

In the artha-adhyāhāra, during the process of cognition, the meaning of the missing word is supplied, whereas in the case of śabda-adhyāhāra, the missing word itself is supplied. The former is economic compared to the latter. In the dependency representation, since we are showing the dependency relations between the meanings of the words, the meaning is repeated. However, in order to build a parser that handles this situation, one has to repeat the word. The dependency representation of sentence (5) is represented in Figure 17. Note the repetition of the node is marked with a dotted line.

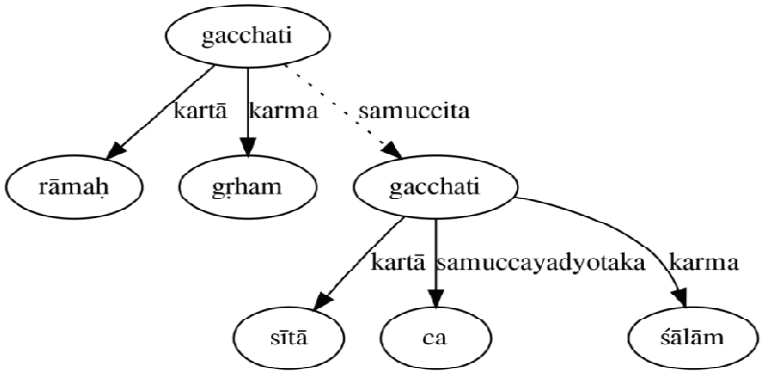

Figure 17: Rāmaḥ gṛham gacchati sītā ca śālām

6. Conclusion

We noticed that there is no unanimity regarding the analysis of sentences involving conjuncts among the Western linguists and these differences were also reflected in the tree banks developed for various languages. These differences were with respect to the following points:

- whether the relation between conjuncts and co-ordinating conjunction be symmetric or not,
- whether the conjunction governs the conjuncts or not, and
- whether the conjunctive particle is governed or not.

The survey of Indian grammatical literature and actual usages reveal the following facts:

- the conjuncts involved in conjunctions do not have any mutual expectancy,
- the concord may be either with the conjunct closest to the governer oh with the collection of conjuncts joined with conjunctive particle, and
- the conjunctive particle is neither governed by nor governs any linguistic item in a sentence.

This led us to propose the dependency relation of the governer with a conjunct close to it. In case the concord is with the collection of conjuncts the relation is with the group. The conjunctive particle is connected to the conjunct close to it, and the conjuncts themselves are connected with each other, the conjunct closest to the governer governing the other conjuncts, with the conjuncting particle being the indicator of the governance.

NOTES

[1] caitreṇa maitreṇa ca kṛtamiti vākye avayavakarṛtvasaiva pratīteḥ. caitramaitrābyām ca kṛtamiti samāse ssamudāyakartṛtvasaiva pratīteḥ (lahuśabdenduśekhara, under cārthe dvandvaḥ 2.2.29)

[2] avayavasambodhanaṁ vākyena gamyate samudāyasambodhanaṁ samāsena, in Mahābhāśsya under na ṅisambuddhyoḥ (8.2.8)

[3] tyadādini sarvernityam, tyadādīnām mithaḥ sahoktau yatparaṃ tacchiṣyate ... (Mahābhāṣya udyota, 1.2.72)

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