Annotation Scheme for Kāraka Level Tagging and Guidelines

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0 Background

Manually annotated corpus at various levels has become now an essential resource for analysis of language texts using computers. Such a resource is not only useful for machine learning but also comes handy as a test data for rule-based systems. To extract various kinds of relations between the words in a sentence, it is necessary to have a corpus tagged at the level of word relations. Three natural questions arise while tagging the word relations in a text.

1. What is the intended level of semantic tagging?
2. Which relation to mark and which to not?
3. How to treat function (द्योतक) words?

Here are a few examples of such relations:

0.1 What is the intended level of semantic tagging?

In the sentence, स्थाली पचति what is the relation between स्थाली and पचति? Is स्थाली an अधिकरण (locus) of the action पचति or is it a कर्ता? Taking into account the reality, one would like to mark the relation as अधिकरण. The relation of अधिकरण is a better representation of the अर्थजगत् whereas the relation of कर्ता is faithful to what has been coded by the morphemes, thereby representing the शब्दजगत्. Thus there are two distinct levels of tagging. The relation of कर्ता can be marked just by looking at the suffix involved, whereas to mark the relation of अधिकरण, one needs to know the 'पदार्थ'.

We, at this point in time, decide to mark only the information coded by morphemes, and thus confine ourselves to the शब्दजगत्, and not to the अर्थजगत्.

0.2 Which relation to tag and which to not?

Some relations are marked explicitly (by means of a suffix in Sanskrit), while some are not. For example, in the sentence, रामः दुग्धम् पीत्वा शालाम् गच्छति the relation between रामः and पीत्वा is not marked explicitly by any suffix. On the other hand, गच्छति, being in कर्तरिप्रयोग marks the कर्ता. Here राम, which is the कर्ता of the activity of going, thus takes the प्रथमाविभक्ति. In other words, the relation of कर्ता between रामः and गच्छति is marked in the अभिहितत्व (agreement). But the relation between रामः and पीत्वा is not marked explicitly by any means. पाणिनि provides a special rule 'समानकर्तृकयोः पूर्वकाले', which states that in case one activity precedes the other one and they share the कर्ता, then the preceding activity takes 'त्त्वा' suffix. Therefore the knowledge that रामः is the कर्ता of पीत्वा as well, is not marked by any morpheme but is the result of the inference: since पीत्वा has त्त्वा suffix and this activity that of the going, the कर्ता of गच्छति and पीत्वा should have been the same. In other words, the knowledge that रामः is कर्ता of पीत्वा is a पार्श्विकबोध and **hence we do not code this relation directly**.

From the two relations viz. the पूर्वकालसम्बन्ध between पीत्वा and गच्छति and the कर्तृसम्बन्ध between रामः गच्छति, appealing to the rule समानकर्तृकयोः पूर्वकाले, one may infer automat-

ically that रामः is also the कर्ता of पीत्वा. Thus, to decide the कर्ता of the verb in क्त्वा, one should know which activity it precedes.

Consider another sentence, बालकः हस्तेन कदलीफलम् छित्वा खादन्तम् वानरम् पश्यति. Here the activity of छिद् precedes both – that of खाद् as well as that of पश्य. So unless one finalises the precedence, one can not decide the कर्ता of छिद्. Therefore, we decide **NOT to mark this relation at the syntactico-semantic level of annotation**.

0.3 द्योतकपद् versus वाचकपद्

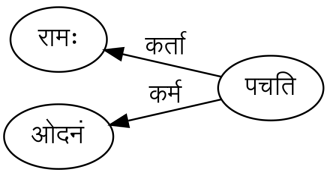
We mark the relations between पदs, where पद is a 'सुप्तिङन्तम् पदम्'. For example, the relation of गच्छति with रामः is that of कर्ता. A पद may be either a वाचक or द्योतक. Consider a sentence रामेण सह सीता वनम् गच्छति. In this sentence, 'सह' marks the relation between रामेण and सीता.

0.4 Convention for marking the relations

We mark the relations by using a directed label arrow. The direction of an arrow decides the name of a relation. For example, the relation between रामः and पचति is called कर्ता and is marked with an arrow from पचति ending onto रामः.

The relation between ओदनं and पचति is called कर्म and is marked with an arrow from पचति ending onto ओदनं. We name the relations using प्रथमान्त words.

From these diagrams, one can get various शाब्दबोधs following different schools, by focussing on appropriate nodes.



For example, starting with रामः covering all nodes, and terminating at the main verb, one gets the वैयाकरण's शाब्दबोध as रामकर्तृक-ओदनकर्मक-पाकानुकूलव्यापारः. If we traverse the diagram ending in the प्रथमान्त word रामः, we get नैयायिकs शाब्दबोध as ओदनकर्मक-पाकानुकूल-कृतिमान् रामः. Though one can generate the शाब्दबोध following different schools, the diagram will have one pre-dominant node from where arrows emerge. This node is called a 'root' node and denotes the मुख्यविशेष्य. Since we will be following the वैयाकरण's शाब्दबोध, typically this will be the main verb in the sentence which will be the मुख्यविशेष्य according to वैयाकरणs.

Since we follow वैयाकरणs शाब्दबोध, we expect a तिङन्त to be present. In case तिङन्त is not present in a sentence, we insert an appropriate verb अस्ति/ भवति. This is in tune with पतञ्जलि's statement अस्तिभवन्तीपरः प्रथमपुरुषोऽप्रयुज्यमानोऽप्यस्ति.[1]

Since for computational purpose we require a text file and not the graphics images, we propose the following scheme of annotation for text.

[1] महाभाष्यम् (2.3.1)

The words in a sentence are written one word per line and are numbered. The relation of a word with respect to the other is marked by its name followed by a number indicating the word with which it is related. We decided to choose between a word and its number, the number. Because in a sentence, the same word can occur more than once, and hence may lead to an ambiguity. The numbers, on the other hand, are unique. This also means that the head of the sentence (also known as मुख्यविशेष्य), will not have any relation marked against it. Thus, the relations in the sentence रामः ओदनं पचति are represented as:

1 रामः कर्ता 3
2 ओदनं कर्म 3
3 पचति

0.5 Granularity

The relations proposed by Prof. K V Ramkrishnamacharyulu (2009) are given in the AppendixA. As one can see from the relations, they are very fine-grained, each of the कारकs is being sub-divided into many. Though the fine-grained कारक-analysis is necessary for deeper analysis, as well to handle cases of divergences between languages, it also needs a good understanding of व्याकरण on the part of an annotator. We suggest 3-tier tagging as follows:

1. Level 1: Coarse grain annotation, as suggested in this draft,
2. Level 2: Sharing of relations, and fine-grained annotation (This may be done mechanically),
3. Level 3: Semantic level annotation.

Level 1: In the sentence रामः दुग्धम् पीत्वा शालाम् गच्छति, राम: will be marked as कर्ता of गच्छति at the first level of tagging. In the second level of tagging, the machine will mark the relation between रामः and पीत्वा as कर्ता automatically.

Level 2: In the sentence घटः नश्यति, घटः will be marked as कर्ता at the first level. At the second level, घटः by looking at the verb can be marked as अनुभवी-कर्ता mechanically.

Level 3: In the sentence स्थाली पचति। स्थाली will be marked as a कर्ता in the first level. In the third level, one can then further mark स्थाली as an अधिकरण.

In what follows we discuss only the first level of tagging.

0.6 Unit for Tagging

Before we start the discussion on tagging, let us also decide what is the unit for tagging. Since we are now talking about the relations between words, it is natural to think of a **sentence** as a unit. Then, the natural question is how do we define a sentence?

From a computational point of view, we may define a sentence as one that is terminated by either a full stop or a question mark. So here are some examples of sentences:

- रामः वनम् गच्छति।
- रामः प्रतिदिनं शालां गच्छति।

- किन्तु सः पाठं न पठति।
- रामः खादति पिबति च।
- यदि त्वं इच्छसि तर्हि अहं भवतःगृहम् आगमिष्यामि।
- यत्र नार्यः तु पूज्यन्ते रमन्ते तत्र देवताः।

Among these, the first three have only one तिङन्तपदम्, while the rest have more than one तिङन्तपदs.

0.7 Proposed कारक-tag-set for Sanskrit

The tags may be broadly classified into two types:

1. वाक्याभ्यन्तरः (Intra-sentential): Each of the तिङन्तपदs will have its own आकाङ्क्षा. The relations within the domain of a तिङन्त are termed as intra-sentential relations.
2. वाक्येतरः (Inter-sentential): Relations which join the two तिङन्तs or the arguments in the domain of one तिङन्त with those of the other are called inter-sentential relations.

Each of these can be further subclassified looking at the lexical category of the words involved, or the semantics of the relations involved.

वाक्याभ्यन्तरः (Intra-sentential)

1. कारक-सम्बन्धः
2. कारकेतर-सम्बन्धः
3. उपपदसम्बन्धः
4. कर्मप्रवचनीयसम्बन्धः [2]

वाक्येतरः (Inter-sentential)

5. Relations marked by sentence-connecting words.
6. Relations marked by relative pronouns.

वाक्याभ्यन्तरः (Intra-sentential)

1 कारकसम्बन्धाः(Kaaraka Relations)

1.1 कर्ता

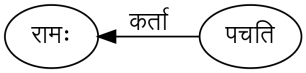
If the कर्ता is अभिहित, it is in first case otherwise it is in third case.

[2] Not implemented

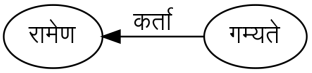
The **कर्ता** of the **कृदन्त** verbs may be in sixth case.

When the verb is in **सतिसप्तमी**, the **कर्ता** will have third or seventh case.

रामः पचति।
1 **रामः कर्ता** 2
2 **पचति**

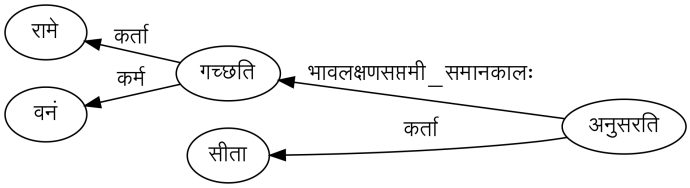


रामेण गम्यते।
1 **रामेण कर्ता** 2
2 **गम्यते**



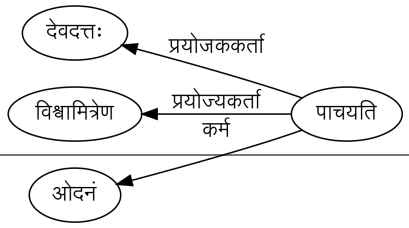
रामस्य गमनं भवति।
1 **रामस्य कर्ता** 2
2 **गमनं कर्ता** 3
3 **भवति**

रामे वनं गच्छति सीता अनुसरति।
1 **रामे कर्ता** 3
2 **वनं कर्म** 3
3 **गच्छति भावलक्षणसप्तमी_समानकालः** 5
4 **सीता कर्ता** 5
5 **अनुसरति**



1.1.1 प्रयोजककर्ता

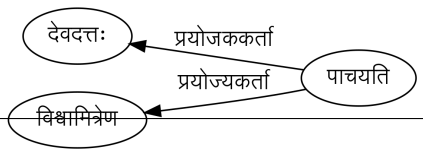
देवदत्तः विश्वामित्रेण ओदनं पाचयति।
1 **देवदत्तः प्रयोजककर्ता** 4
2 **विश्वामित्रेण प्रयोज्यकर्ता** 4
3 **ओदनं कर्म** 4
4 **पाचयति**



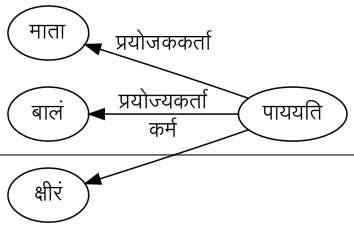
1.1.2 प्रयोज्यकर्ता

The **प्रयोज्यकर्ता** is by default in **तृतीयाविभक्ति**. In the case of verbs belonging to **गतिबुद्धिप्रत्यवसानार्थशब्दकर्मक** (1.4.52) the **प्रयोज्यकर्ता** is in **द्वितीयाविभक्ति**.

देवदत्तः विश्वामित्रेण पाचयति।
1 **देवदत्तः प्रयोजककर्ता** 3
2 **विश्वामित्रेण प्रयोज्यकर्ता** 3
3 **पाचयति**



माता बालं क्षीरं पाययति।
1 माता प्रयोजककर्ता 4
2 बालम् प्रयोज्यकर्ता 4
3 क्षीरम् कर्म 4
4 पाययति

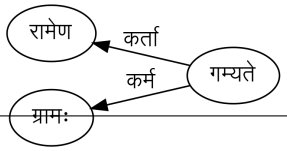


1.2 कर्म

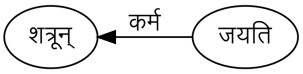
If the कर्म is अभिहित, then it is in प्रथमा, otherwise, it is in द्वितीयाविभक्ति.

The कर्म of a कृदन्त takes षष्ठीविभक्ति.

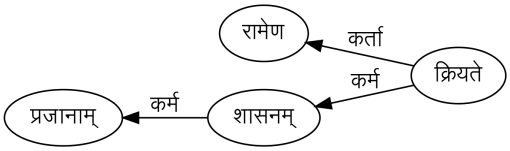
रामेण ग्रामः गम्यते।
1 रामेण कर्ता 3
2 ग्रामः कर्म 3
3 गम्यते



शत्रून् जयति।
1 शत्रून् कर्म 2
2 जयति

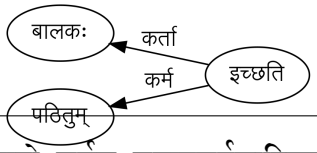


रामेण प्रजानाम् शासनं क्रियते।
1 रामेण कर्ता 4
2 प्रजानाम् कर्म 3
3 शासनम् कर्म 4
4 क्रियते



तुमुनन्त as a कर्म of इष् धातु.

बालकः पठितुम् इच्छति।
1 बालकः कर्ता 3
2 पठितुम् कर्म 3
3 इच्छति



The कर्मसंज्ञा in this sentence is justified by the सन्-विधायकसूत्र "धातोः कर्मणः समानकर्तृकादिच्छायाम् वा" (3.1.7).

1.2.1 गौणकर्म and मुख्यकर्म

In Sanskrit there are certain verbs mentioned in the following कारिका—

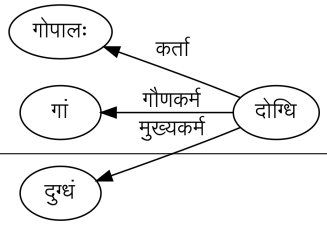
> दुह्याच्पच्दण्ड्रुधिप्रच्छिचिब्रूशासुजिमथ्मुषाम्।
> कर्मयुक् स्यादकथितं तथा स्यान्नीहृकृष्वहाम्॥[3]

which are द्विकर्मकs. Out of these one कर्म is गौण and the other is प्रधान/मुख्य. We decided to mark them as गौणकर्म and मुख्यकर्म, instead of just कर्म. This is to ensure that only

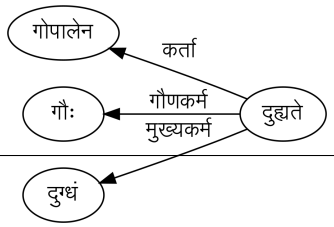
[3] सिद्धान्तकौमुदी, अकथितं च (1.4.51) इति सूत्रव्याख्याने

द्विकर्मकs have more than one **कर्म**, and no other **धातु**s allow more than one **कर्म**. Further the information of **गौण** and **मुख्य** is also useful in transforming and active sentence to passive.

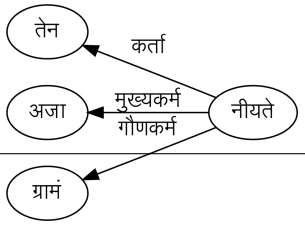
गोपालः गां दुग्धं दोग्धि।
1 **गोपालः कर्ता** 4
2 **गां गौणकर्म** 4
3 **दुग्धं मुख्यकर्म** 4
4 **दोग्धि**



गोपालेन गौः दुग्धम् दुह्यते।
1 **गोपालेन कर्ता** 4
2 **गौः गौणकर्म** 4
3 **दुग्धं मुख्यकर्म** 4
4 **दुह्यते**

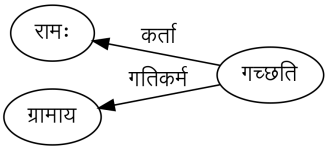


तेन अजा ग्रामं नीयते।
1 **तेन कर्ता** 4
2 **अजा मुख्यकर्म** 4
3 **ग्रामं गौणकर्म** 4
4 **नीयते**



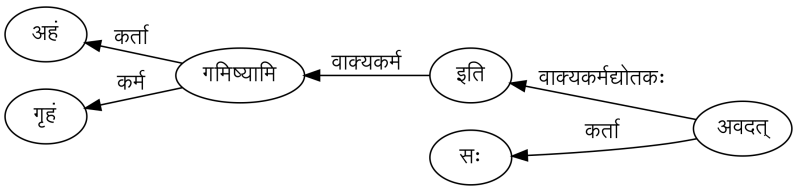
1.2.2 गतिकर्म

रामः ग्रामाय गच्छति।
1 **रामः कर्ता** 3
2 **ग्रामाय गतिकर्म** [4] 3
3 **गच्छति**



1.2.3 वाक्यकर्म(Sentence connector इति) .

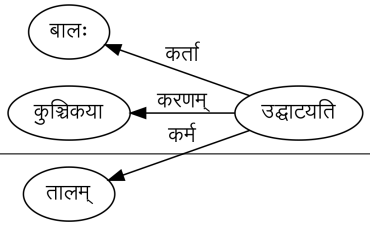
अहं गृहं गमिष्यामि इति सः अवदत्।
1 **अहं कर्त्ता** 3
2 **गृहं कर्म** 3
3 **गमिष्यामि प्रतियोगी** 4
4 **इति वाक्यकर्म** 6
5 **सः अधिकरणम्** 6
6 **अवदत्**



[4] Not marked in the parser

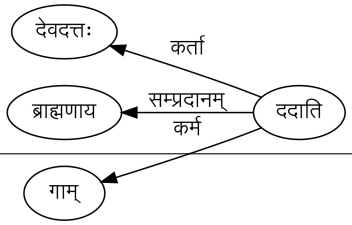
1.3 करणम्

बालः कुञ्चिकया तालम् उद्घाटयति।
1 बालः कर्ता 4
2 कुञ्चिकया करणम् 4
3 तालम् कर्म 4
4 उद्घाटयति

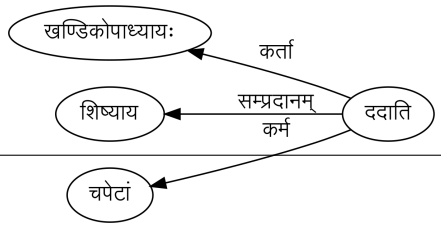


1.4 सम्प्रदानम्

देवदत्तः ब्राह्मणाय गां ददाति।
1. देवदत्तः कर्ता 4
2. ब्राह्मणाय सम्प्रदानम् 4
3. गाम् कर्म 4
4. ददाति

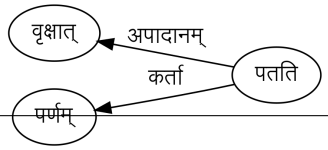


खण्डिकोपाध्यायः शिष्याय चपेटां ददाति।
1 खण्डिकोपाध्यायः कर्ता 4
2 शिष्याय सम्प्रदानम् 4
3 चपेटां कर्म 4
4 ददाति



1.5 अपादानम्

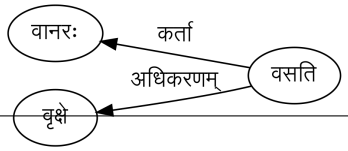
वृक्षात् पर्णं पतति।
1. वृक्षात् अपादानम् 3
2. पर्णम् कर्ता 3
3. पतति



1.6 अधिकरणम्

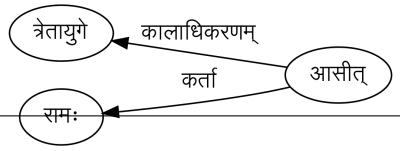
If the पदार्थ denotes देश , काल or विषय we mark them as देशाधिकरणम्, कालाधिकरणम्, and विषयाधिकरणम् respectively. The default marking is अधिकरणम् .

वानरः वृक्षे वसति।
1 वानरः कर्ता 3
2 वृक्षे अधिकरणम् 3
3 वसति



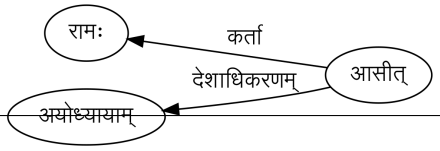
1.6.1 कालाधिकरणम्

त्रेतायुगे रामः आसीत्।
1 त्रेतायुगे कालाधिकरणम् 3
2 रामः कर्ता 3
3 आसीत्



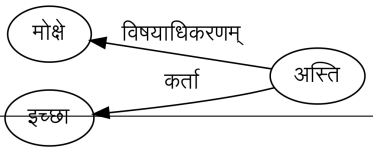
1.6.2 देशाधिकरणम्

रामः अयोध्यायाम् आसीत्।
1. रामः कर्ता 3
2. अयोध्यायाम् देशाधिकरणम् 3
3. आसीत्



1.6.3 विषयाधिकरणम्

मोक्षे इच्छा अस्ति।
1. मोक्षे विषयाधिकरणम् 3
2. इच्छा कर्ता 3
3. अस्ति



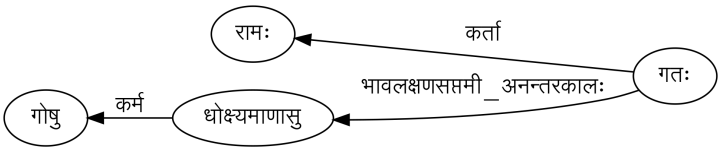
2 कारकेतरसम्बन्धाः

क्रियाक्रियासम्बन्धाः

2.1 भावलक्षणसप्तमी_अनन्तरकालः

An action denoted by the verb in **शतृ** or **शानच्** suffix, that comes in the place of **लृट्** , and is in the seventh case suffix indicates an action which will take place later with respect to another relation. The relation here, therefore, is called **भावलक्षणसप्तमी_अनन्तरकालः** .

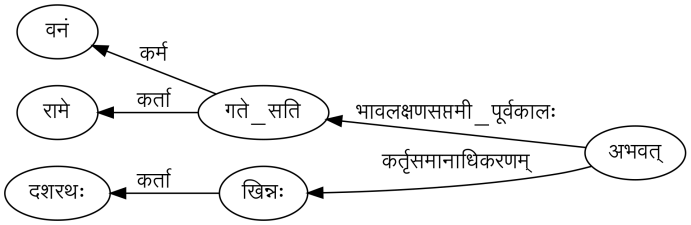
गोषु धोक्ष्यमाणासु रामः गतः।
1 गोषु कर्म 2
2 धोक्ष्यमाणासु भावलक्षणसप्तमी_अनन्तरकालः 4
3 रामः कर्त्ता 4
4 गतः



2.2 भावलक्षणसप्तमी_पूर्वकालः

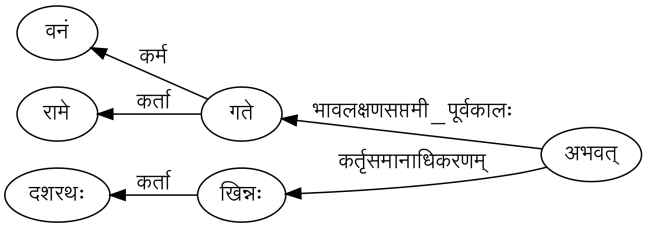
An action denoted by a verb in a क्त with 7th case suffix precedes the action denoted by the main verb. This relation is marked as भावलक्षणसप्तमी_पूर्वकालः.

रामे वनं गते सति दशरथः खिन्नः अभवत्।
1 रामे कर्ता 3
2 वनं कर्म 3
3 गते_सति भावलक्षणसप्तमी_पूर्वकालः 6
4 दशरथः कर्ता 6
5 खिन्नः कर्तृसमानाधिकरणम् 6
6 अभवत्



Here the relation of गते_सति with अभवत् is marked as भावलक्षणसप्तमी_पूर्वकालः. सति may be absent, as in -

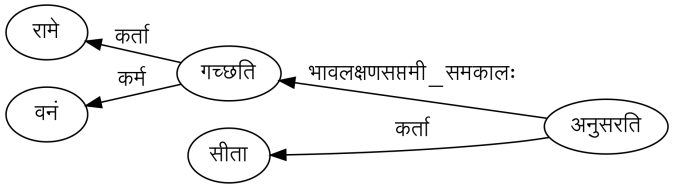
रामे वनं गते दशरथः खिन्नः अभवत्।



2.3 भावलक्षणसप्तमी_समानकालः

An action denoted by a verb in शतृ or शानच् with a 7thcase suffix in the place of लृट् indicated the simultaneity of the activity with the main activity. This relation is marked by as भावलक्षणसप्तमी_समानकालः.

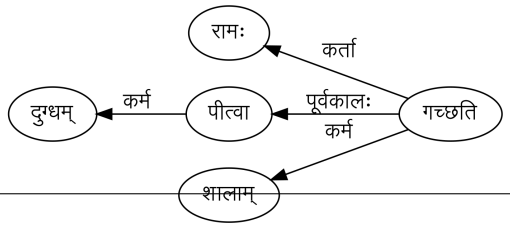
रामे वनं गच्छति सीता अनुसरति।
1 रामे कर्त्ता 3
2 वनं कर्म 3
3 गच्छति भावलक्षणसप्तमी_समानकालः 5
4 सीता कर्त्ता 5
5 अनुसरति



2.4 पूर्वकालः

An action denoted by the verb in कृदन्त suffix त्वा, indicates the precedence relation with respect to another verb. Such relations are marked as पूर्वकालः.

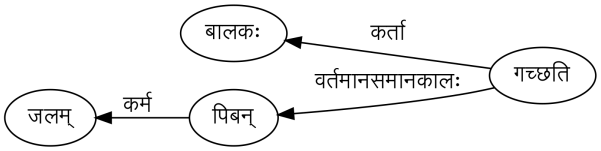
रामः दुग्धं पीत्वा शालां गच्छति
1 **रामः कर्ता** 5
2 **दुग्धम् कर्म** 3
3 **पीत्वा पूर्वकालः** 5
4 **शालाम् कर्म** 5
5 **गच्छति**



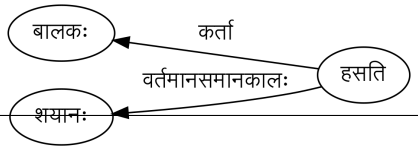
2.5 वर्तमानसमानकालः

An action denoted by the verb in **कृदन्त** suffix **शतृ/ शानच्** in place of **लट्** and it is related to an action denoted by another verb, the two actions are simultaneous. Hence the relation here is called **वर्तमानसमानकालः**.

बालकः जलं पिबन् गच्छति
1 **बालकः कर्ता** 4
2 **जलम् कर्म** 3
3 **पिबन् वर्तमानसमानकालः** 4
4 **गच्छति**



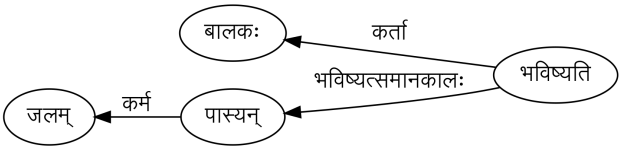
बालकः शयानः हसति
1 **बालकः कर्ता** 3
2 **शयानः वर्तमानसमानकालः** 3
3 **हसति**



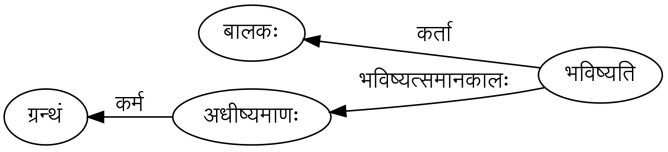
2.6 भविष्यत्समानकालः

If **कृदन्त** suffix **शतृ/ शानच्** is used in place of **लृट्** then the relation is called **भविष्यत्समानकालः**.

बालकः जलं पास्यन् भविष्यति।
1 **बालकः कर्ता** 4
2 **जलम् कर्म** 3
3 **पास्यन् भविष्यत्समानकालः** 4
4 **भविष्यति**

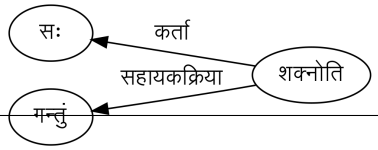


बालकः ग्रन्थं अधीष्यमाणः भविष्यति।
1 **बालकः कर्ता** 4
2 **ग्रन्थं कर्म** 3
3 **अधीष्यमाणः भविष्यत्समानकालः** 4
4 **भविष्यति**



2.7 सहायकक्रिया

सः गन्तुं शक्नोति
1. **सः कर्ता** 2
2. **गन्तुं सहायकक्रिया** 3
3. **शक्नोति**

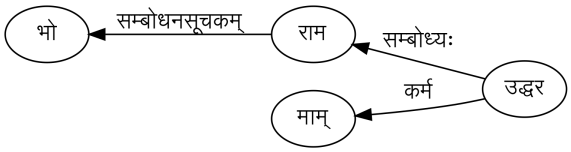


क्रियासम्बन्धाः

2.8 सम्बोध्यः

The relation of a word in **सम्बुद्धि** is marked as **सम्बोध्यः** of the corresponding verb. Words such as **भो, अयि, हे, अरे** etc. are the **सम्बोधनसूचकाव्यय**s and hence are marked as **सम्बोधनसूचकम्**.

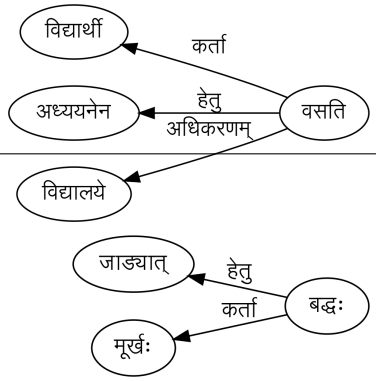
भो राम माम् उद्धर।
1. **भो सम्बोधनसूचकम्** 2
2. **राम सम्बोध्यः** 4
3. **माम् कर्म** 4
4. **उद्धर**



2.9 हेतुः

The relation of 'cause' is marked by **हेतुः**, Sanskrit uses either **तृतीया** or **पञ्चमीविभक्ति** to mark this relation.

विद्यार्थी अध्ययनेन विद्यालये वसति।
1 **विद्यार्थी कर्ता** 4
2 **अध्ययनेन हेतुः** 4
3 **विद्यालये अधिकरणम्** 4
4 **वसति.**



जाड्यात् मूर्खः बद्धः।
1 **जाड्यात् हेतुः** 3
2 **मूर्खः कर्ता** 3
3 **बद्धः**

In the case of **अस्त्यर्थधातु**s the relation of **हेतुः** might be between two nouns as in the following example.

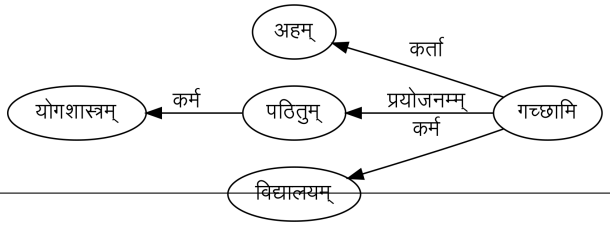
दण्डेन घटः अस्ति।
1 **दण्डेन हेतुः** 2
2 **घटः कर्ता** 3
3 **अस्ति**

2.10 प्रयोजनम्

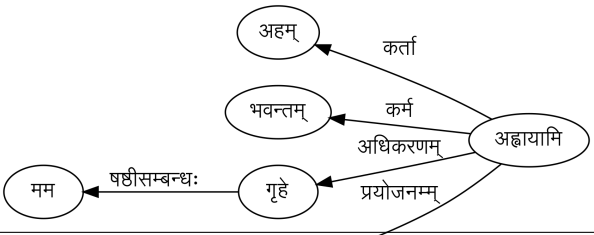
The relation of a **तुमुनन्त** verb with the main verb is marked as **प्रयोजनम्**.

Sometimes instead of **तुमुन्**, **चतुर्थी विभक्ति** or '**अर्थ**' is also used with **भावार्थकप्रत्यय** to indicate the **प्रयोजनम्**. These are also marked as **प्रयोजनम्**.

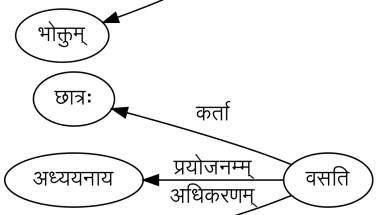
अहं योगशास्त्रं पठितुम् विद्यालयं गच्छामि
1 **अहम् कर्ता** 5
2 **योगशास्त्रम् कर्म** 3
3 **पठितुम् प्रयोजनम्** 5
4 **विद्यालयम् कर्म** 5
5 **गच्छामि**



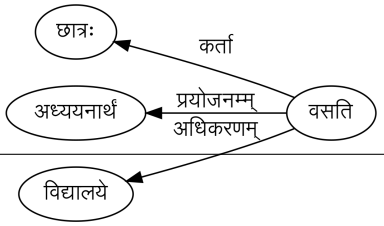
अहं भवन्तं मम गृहे भोक्तुं आह्वयामि
1 **अहम् कर्ता** 6
2 **भवन्तम् कर्म** 6
3 **मम शेषषष्ठी** 4
4 **गृहे अधिकरणम्** 6
5 **भोक्तुम् प्रयोजनम्** 6
6 **अह्वायामि**



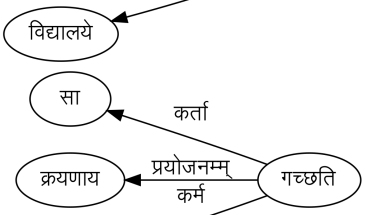
छात्रः अध्ययनाय विद्यालये वसति।
1 **छात्रः कर्ता** 4
2 **अध्ययनाय प्रयोजनम्** 4
3 **विद्यालये अधिकरणम्** 4
4 **वसति**



छात्रः अध्ययनार्थं विद्यालये वसति।
1 **छात्रः कर्ता** 4
2 **अध्ययनार्थं प्रयोजनम्** 4
3 **विद्यालये अधिकरणम्** 4
4 **वसति**

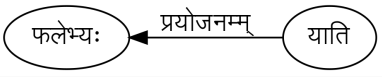


सा क्रयणाय आपणम् गच्छति।
1 **सा कर्ता** 4
2 **क्रयणाय प्रयोजनम्** 4
3 **आपणम् कर्म** 4
4 **गच्छति**

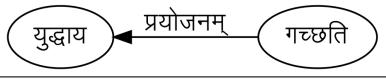


Sometimes the verb with which a verb has **प्रयोजनम्सम्बन्ध** is elided (**लुप्त**). In such cases, the **कर्म** of the elided verb takes a 4th case by the **सूत्र** "**क्रियार्थोपपदस्य च कर्मणि स्थानिनः**" (2.3.14). In such cases also we mark the relation as **प्रयोजनम्** eg.

फलेभ्यः याति।
1 **फलेभ्यः प्रयोजनम्** 2
2 **याति**

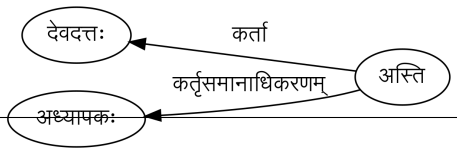


युद्धाय गच्छति।
1 **युद्धाय प्रयोजनम्** 2
2 **गच्छति**

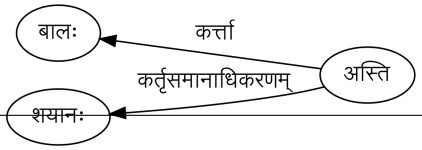


2.11 कर्तृसमानाधिकरणम्

देवदत्तः अध्यापकः अस्ति।
1 देवदत्तः कर्ता 3
2 अध्यापकः कर्तृसमानाधिकरणम् 3
3 अस्ति

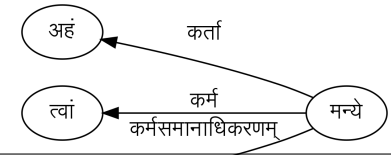


बालः शयानः अस्ति।
1 बालः कर्त्ता 3
2 शयानः कर्त्तृसमानाधिकरणम् 3
3 अस्ति

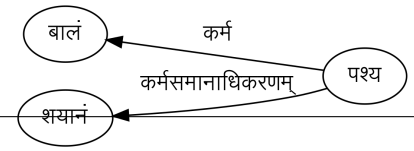


2.12 कर्मसमानाधिकरणम्

अहं त्वां शुनं मन्ये।
1 अहं कर्ता 4
2 त्वां कर्म 4
3 शुनं कर्मसमानाधिकरणम् 4
4 मन्ये



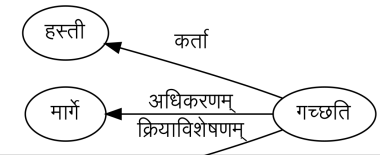
बालं शयानं पश्य।
1 बालं कर्म 3
2 शयानं कर्मसमानाधिकरणम् 3
3 पश्य



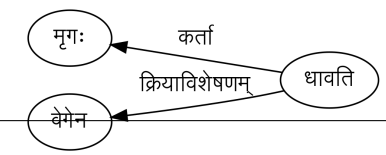
2.13 क्रियाविशेषणम्

When a word qualifies either an action or the result of an activity, then it is marked as a क्रियाविशेषणम् .

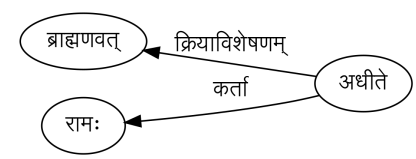
हस्ती मार्गे मन्दं गच्छति।
1 हस्ती कर्ता 4
2 मार्गे अधिकरणम् 4
3 मन्दम् क्रियाविशेषणम् 4
4 गच्छति



मृगः वेगेन धावति।
1 मृगः कर्ता 3
2 वेगेन क्रियाविशेषणम् 3
3 धावति



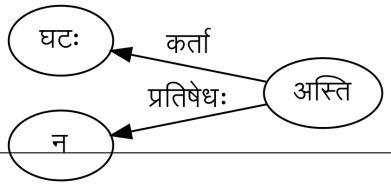
ब्राह्मणवत् रामः अधीते।
1. ब्राह्मणवत् क्रियाविशेषणम् 3
2. रामः कर्ता 3
3. अधीते



2.14 प्रतिषेधः

In case of a negation indicating the **निषेध**, we mark the relation of **न** with verb as **प्रतिषेधः** as shown below.

घटः न अस्ति।
1 **घटः कर्ता** 3
2 **न प्रतिषेधः** 3
3 **अस्ति**

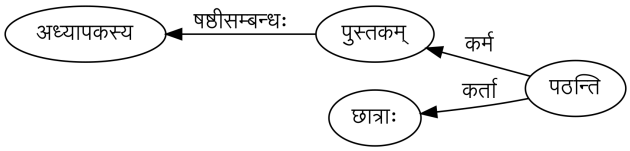


नामपदसम्बन्धाः

2.15 षष्ठीसम्बन्धः

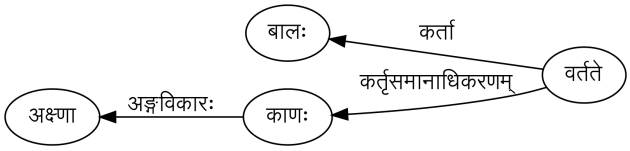
The words with **षष्ठीविभक्ति** which do not indicate **कारकविभक्ति**s, are marked simply as **षष्ठीसम्बन्धः**.

अध्यापकस्य पुस्तकं छात्राः पठन्ति।
1 **अध्यापकस्य षष्ठीसम्बन्धः** 2
2 **पुस्तकम् कर्म** 4
3 **छात्राः कर्ता** 4
4 **पठन्ति**



2.16 अङ्गविकारः

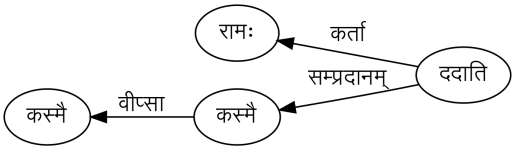
बालः अक्ष्णा काणः वर्तते।
1 **बालः कर्ता** 4
2 **अक्ष्णा अङ्गविकारः** 3
3 **काणः कर्तृसमानाधिकरणम्** 4
4 **वर्तते**



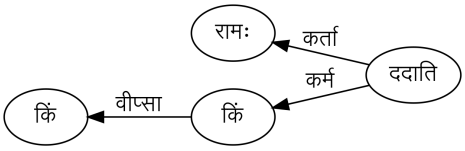
2.17 वीप्सा

When there is a **वीप्सा**, the relation of the first word with its repetition as second is marked as **वीप्सा** and the relation of second word will have a natural **कारक/अकारकसम्बन्ध** as the case may be. Here are some examples.

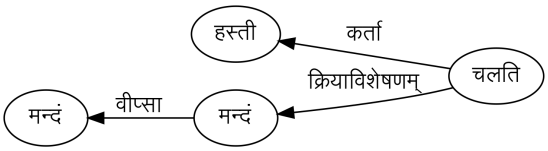
रामः कस्मै कस्मै ददाति।
1 **रामः कर्ता** 4
2 **कस्मै वीप्सा** 3
3 **कस्मै सम्प्रदानम्** 4
4 **ददाति**



रामः किं किं ददाति।
1 रामः कर्ता 4
2 किं वीप्सा 3
3 किं कर्म 4
4 ददाति



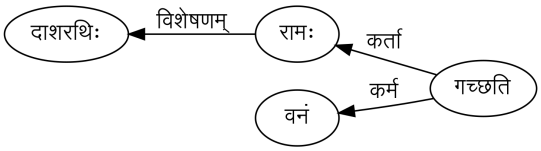
हस्ती मन्दं मन्दं चलति।
1 हस्ती कर्ता 4
2 मन्दं वीप्सा 3
3 मन्दं क्रियाविशेषणम् 4
4 चलति



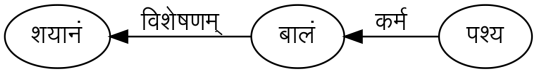
2.18 विशेषणम्

विशेषणs are of two types - those qualifying the **उद्देश्य** and the other ones which are **विधेय**. The **विशेषण**s which qualify the **उद्देश्य** are called **विशेषण**s, and the **विशेषण**s which act as **विधेय**s will be classified as **कर्तृसमानाधिकरणम्** or **कर्मसमानाधिकरणम्**. Here are examples.

दाशरथिः रामः वनं गच्छति।
1 दाशरथिः विशेषणम् 2
2 रामः कर्ता 4
3 वनं कर्म 4
4 गच्छति



शयानं बालं पश्य।
1 शयानं विशेषणम् 2
2 बालं कर्म 3
3 पश्य

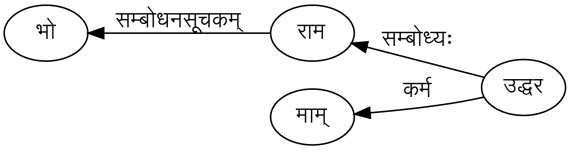


Compare this with **बालकः शयानः हसति।** [2.5].

2.19 सम्बोधनसूचकम्

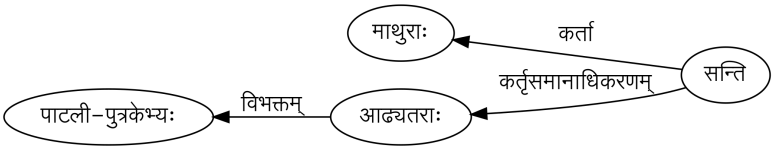
The relation of a word in **सम्बुद्धि** is marked as **सम्बोध्यः** of the corresponding verb. Words such as **भो, अयि, हे, अरे** etc. are the **सम्बोधनसूचकाव्यय**s and hence are marked as **सम्बोधनसूचकम्**.

भो राम माम् उद्धर।
1. भो सम्बोधनसूचकम् 2
2. राम सम्बोध्यः 4
3. माम् कर्म 4
4. उद्धर



2.20 विभक्तम्

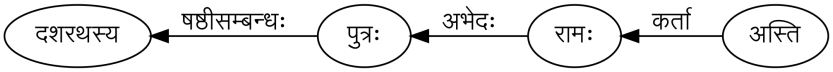
माथुराः पाटलीपुत्रकेभ्यः आढ्यतराः सन्ति।
1 **माथुराः कर्ता** 4
2 **पाटलीपुत्रकेभ्यः विभक्तम्** 3
3 **आढ्यतराः कर्तृसमानाधिकरणम्** 4
4 **सन्ति**



2.21 अभेदः

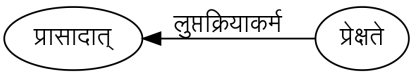
अभेदः is a special kind of **विशेषण**. All the **उपाधि** / relation denoting terms such as **आचार्य, पुत्र, पिता**, etc., are marked with **अभेदसम्बन्ध**.

दशरथस्य पुत्रः रामः अस्ति
1 **दशरथस्य षष्ठीसम्बन्धः** 2
2 **पुत्रः अभेदः** 3
3 **रामः कर्ता** 4
4 **अस्ति**



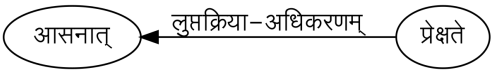
2.22 ल्यप्कर्माधिकरणम्

प्रासादात् प्रेक्षते।



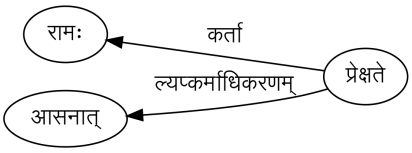
or

आसनात् प्रेक्षते।



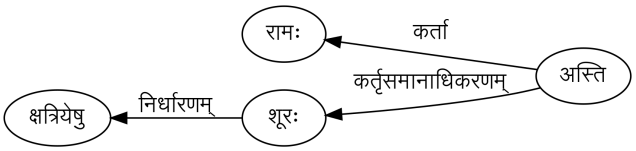
Here the words **प्रासादात्** or **आसनात्** do not have any direct relation with **प्रेक्षते**. So in order to have a proper **शाब्दबोध** of these sentences, it is necessary to supply the missing verb such as **आरुह्य** or **उपविश्य**. After supplying this missing **क्रिया**, sentences change to **प्रासादम् आरुह्य प्रेक्षते** or **आसने उपविश्य प्रेक्षते** and then the relation of **प्रासादम्** with **ल्यबन्त** word **आरुह्य** is that of **कर्म** . Similarly the relation of **आसने** with **उपविश्य** is that of **ल्यप्-अधिकरणम्**. Whenever **ल्यप्** word is missing in a sentence we mark the relation of **आसनात्** with **प्रेक्षते** as **ल्यप्कर्माधिकरणम्** following the **वार्तिक ' ल्यब्लोपे कर्मण्यधिकरणे च'**.

रामः आसनात् प्रेक्षते
1 **रामः कर्ता** 3
2 **आसनात् ल्यप्कर्माधिकरणम्** 3
3 **प्रेक्षते**



2.23 निर्धारणम्

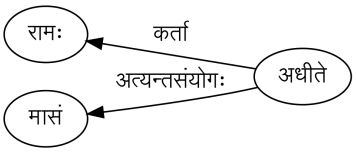
रामः क्षत्रियेषु शूरः अस्ति।
1. क्षत्रियेषु निर्धारणम् 2
2. शूरः कर्तृसमानाधिकरणम् 3
3. रामः कर्ता 4
4. अस्ति



2.24 अत्यन्तसंयोगः

When a कालवाचि and अध्ववाचि takes an accusative case-marker, we mark the relation of such words with the verb as अत्यन्तसंयोगः.

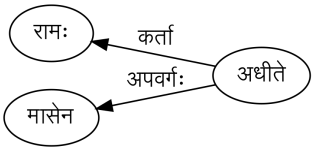
रामः मासं अधीते।
1. राम कर्ता 3
2. मासम् अत्यन्तसंयोगः 3
3. अधीते



2.25 अपवर्ग_सम्बन्धः

When a कालवाचि and अध्ववाचि takes an instrumental cases, we mark the relation as such words with the verb as अपवर्गः.

रामः मासेन अधीते।
1. राम कर्ता 3
2. मासेन अपवर्गः 3
3. अधीते

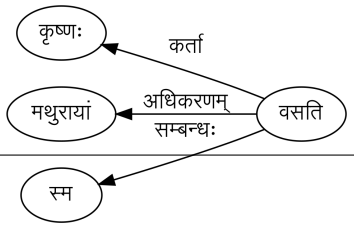


2.26 सम्बन्धः

There are certain words such as न, इव, एव, इति etc. whose relations are decided by the meaning of these words. There is no other suffix indicating their relations. For example, the word न marks the negation, the word स्म indicates the past tense, इव indicates the similarity. However, some words such as इति, एव etc. indicate a variety of relations. For example, इति sometimes is used to indicate the शब्दस्वरूप, while sometimes it is used to indicate समाप्ति, sometimes it is used to indicate the कर्म. The word एव sometimes indicate बलाधान (emphasis), sometimes अवधारण. When such words are related to two words, and one of the relations is a कारक /कारकेतर, then the other relation is marked as सम्बन्ध. Otherwise, we mark the relations as प्रतियोगी and अनुयोगी and when they are related to a single word, the relation is marked as सम्बन्धः. The word सम्बन्धः here stands for यत्-पदम्-तत्-योग्य-सम्बन्ध. That is, if the relation is with एव, then it is एव-योग्य-सम्बन्धः, if it is with न, then it is न-योग्य-सम्बन्धः

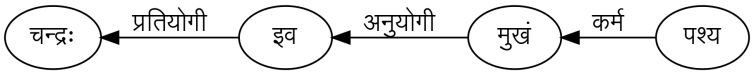
2.26.1 स्म

कृष्णः मथुरायां वसति स्म।
1 **कृष्णः कर्ता** 4
2 **मथुरायां अधिकरणम्** 3
3 **वसति**
4 **स्म** 3 **सम्बन्धः**



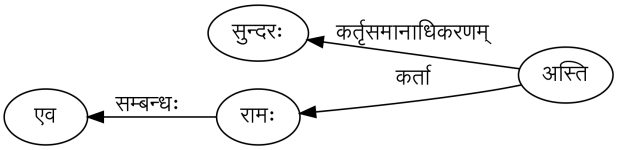
2.26.2 इव

चन्द्रः इव मुखं पश्य।
1 **चन्द्रः कर्ता** 4
2 **इव सम्बन्धः** 1
3 **मुखं कर्म** 4
4 **पश्य**

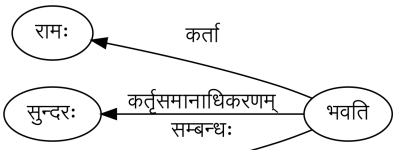


2.26.3 एव

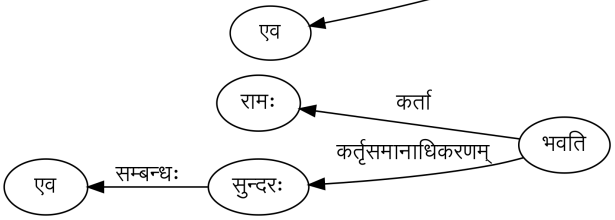
रामः एव सुन्दरः अस्ति।
1 **रामः कर्ता** 4
2 **एव सम्बन्धः** 1
3 **सुन्दरः कर्म कर्तृसमानाधिकरणम्**
4 **अस्ति**



रामः सुन्दरः भवति एव।
1 **रामः कर्ता** 3
2 **सुन्दरः कर्तृसमानाधिकरणम्** 3
3 **भवति**
4 **एव सम्बन्धः** 4

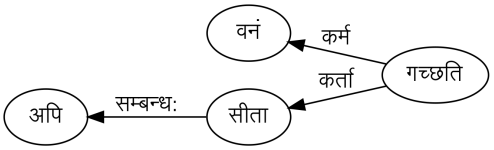


रामः सुन्दरः एव भवति।
1 **रामः कर्ता** 4
2 **सुन्दरः कर्तृसमानाधिकरणम्** 4
3 **एव सम्बन्धः** 2
4 **भवति**



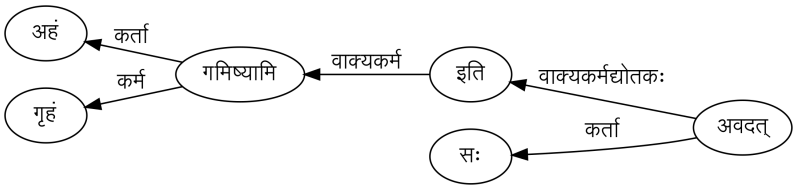
2.26.4 अपि

सीता अपि वनं गच्छति।
1 **सीता कर्ता** 4
2 **अपि सम्बन्ध**: 1
3 **वनं कर्म** 4
4 **गच्छति**



2.27 वाक्यकर्मद्योतकः

अहं गृहं गमिष्यामि इति सः अवदत्।
1 अहं कर्त्ता 3
2 गृहं कर्म 3
3 गमिष्यामि वाक्यकर्म 4
4 इति वाक्यकर्मद्योतकः 6
5 सः अधिकरणम् 6
6 अवदत्



3 उपपदसम्बन्धाः (Upapada-Relations)

उपपदs are related to other nouns or verbs by specific relations such as कारक relation or विशेषण etc.

Upapadas may be classified in two different ways.

- विभक्त्याधारित (Based on their morpho-syntactic properties)
- अर्थाधारित (Based on the semantics they express)

We discuss each of them in detail.

All the उपपदs demand a specific vibhakti on the preceding noun. But when we look at their relation with other words, we see that they fall under 2 categories.

3.1 विभक्त्याधारित-उपपदविभागः

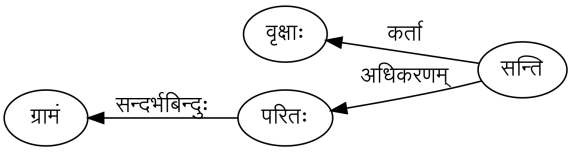
There are six types of उपपदविभक्तिs namely उपपदद्वितीया, उपपदतृतीया, etc.

3.2 अर्थाधारित-उपपदविभागः

Here are some examples:

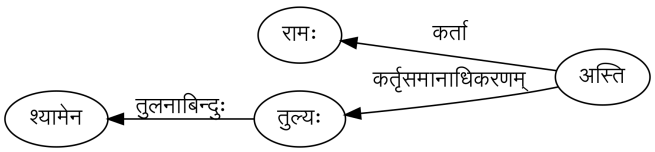
3.2.1 सन्दर्भबिन्दुः (Reference point for direction)

ग्रामं परितः वृक्षाः सन्ति।
1. ग्रामं सन्दर्भबिन्दुः 2
2. परितः अधिकरणम् 4
3. वृक्षाः कर्ता 4
4. सन्ति



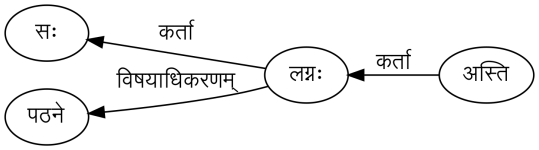
3.2.2 तुलनाबिन्दुः (Reference point for comparison)

श्यामेन तुल्यः रामः अस्ति।
1. श्यामेन तुलनाबिन्दुः 2
2. तुल्यः कर्तृसमानाधिकरणम् 4
3. रामः कर्ता 4
4. अस्ति



3.2.3 विषयाधिकरणम् (Locus showing the domain)

सः पठने लग्नः अस्ति ।
1. सः कर्ता 4
2. पठने विषयाधिकरणम् 2
3. लग्नः कर्ता 4
4. अस्ति

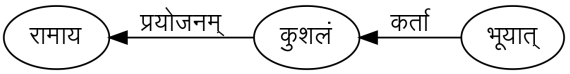


3.2.4 निर्धारणम् (Determination)

गवां प्रसूता अस्ति ।
1. गवां निर्धारणम् 2
2. प्रसूता कर्ता 3
3. पश्यति

3.2.5 प्रयोजनम् (Purpose)

रामाय कुशलं भूयात् ।
1. रामाय प्रयोजनम् 4
2. कुशलं कर्ता 2
3. भूयात्

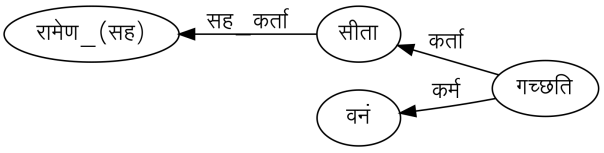


3.2.6 उद्गारवाचकः (Exclamatory)

दुर्जनं धिक् भवतु ।
1. दुर्जनम् उद्गारवाचकः 2
2. धिक् क्रियाविशेषणम् 3
3. भवतु

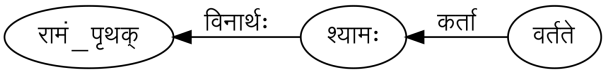
3.2.7 सहार्थः (Association)

रामेण सह सीता वनं गच्छति ।
1. रामेण_सह सहकर्ता 2
2. सीता कर्ता 4
3. वनं कर्म 4
4. गच्छति



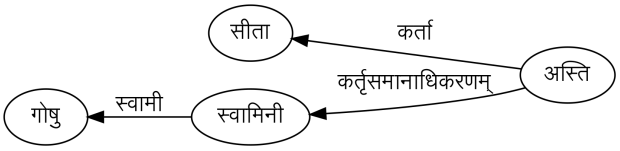
3.2.8 विनार्थः (Dis-association)

रामं पृथक् श्यामः वर्तते ।
1. रामं_पृथक् विनार्थः 2
2. श्यामः कर्ता 3
3. वर्तते



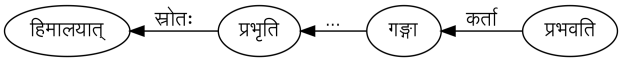
3.2.9 स्वामी (Possessor-possessee)

सीता गोषु स्वामिनी अस्ति ।
1. सीता कर्ता 4
2. गोषु स्वामी 2
3. स्वामिनी कर्तृसमानाधिकरणम् 4
4. अस्ति



3.2.10 स्रोतः (Source)

हिमालयात् प्रभृति गङ्गा प्रभवति।
1. हिमालयात् स्रोतः 4
2. प्रभृति विषयाधिकरणम् 2
3. गङ्गा कर्ता 4
4. प्रभवति



4 वाक्येतरसम्बन्धाः (Inter Sentential Relations)

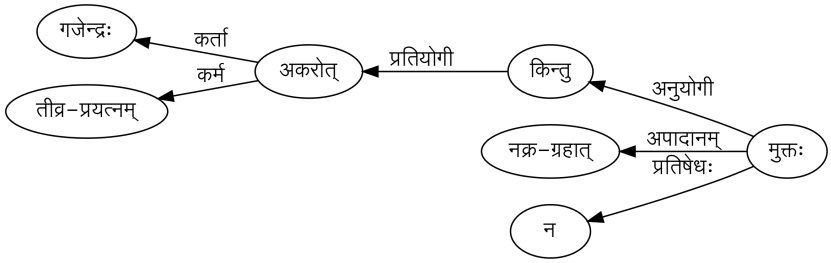
When a sentence has more than one तिङन्तs, then the relation between the two वाक्यs formed by these two तिङन्तs get established in three ways :

1. Connectors such as किन्तु, परन्तु, etc.
2. Connectors which occur in pairs.
3. Sentence connector इति as वाक्यकर्म.

4.1 Connectors such as किन्तु, परन्तु, etc.

Such connectors join two sentences, which are complete individually. Hence after the first sentence the second sentence start with किन्तु/परन्तुand it connects the two sentences with अनुयोगी and प्रतियोगि relation.

गजेन्द्रः तीव्रप्रयत्नम् अकरोत् किन्तु नक्रग्रहात् न मुक्तः।
1 गजेन्द्रः कर्त्ता 3
2 तीव्रप्रयत्नम् कर्म 3
3 अकरोत्
4 किन्तु प्रतियोगी 3
5 नक्रग्रहात् अपादानम् 7
6 न प्रतिषेधः 7
7 मुक्तः अनुयोगी 4

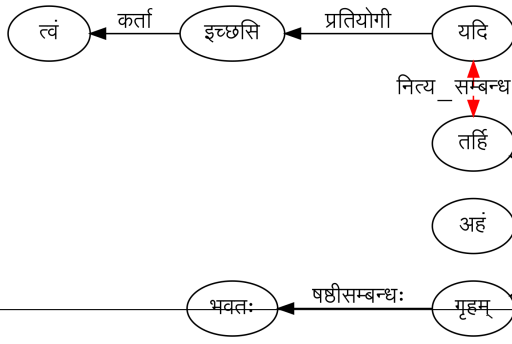


4.2 Connectors which occur in pairs

When sentences are connected by pair of connectors such as:

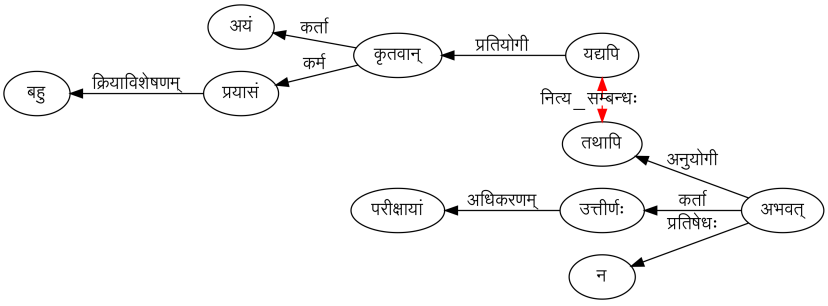
1. यदि तर्हि
2. यद्यपि तथापि
3. यतः ततः/अतः
4. यावत् तावत्

here we mark the relations between each of the individual sentences separately, and mark the relations between the main verbs in each of the sentences with यदि and तर्हि, etc. respectively by प्रतियोगी and अनुयोगी and the words यदि-तर्हि etc. are connected with each other by the relation नित्यसम्बन्धः. e.g. यदि त्वं इच्छसि तर्हि अहं भवतः गृहम् आगमिष्यामि।
1 यदि नित्यसम्बन्धः 4
2 त्वं कर्ता 3
3 इच्छसि प्रतियोगी 1
4 तर्हि नित्यसम्बन्धः 1
5 अहं कर्ता 8
6 भवतः षष्ठीसम्बन्धः 7
7 गृहम् कर्म 8
8 आगमिष्यामि अनुयोगी 4

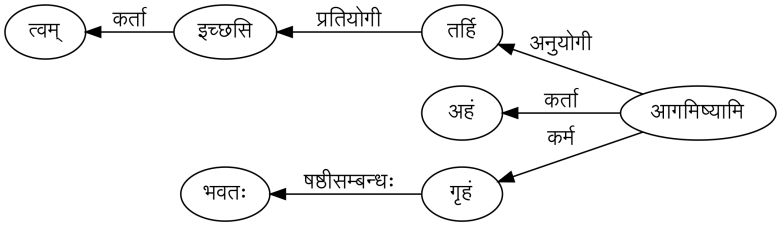


Thus the overall head/ मुख्यविशेष्य of these sentences is आगमिष्यामि.

यद्यपि अयं बहु प्रयासं कृतवान् तथापि परीक्षायां उत्तीर्णः न अभवत्
1 यद्यपि नित्यसम्बन्धः 6
2 अयं कर्ता 5
3 बहु क्रियाविशेषणम् 4
4 प्रयासं कर्म 5
5 कृतवान् प्रतियोगी 6
6 तथापि नित्यसम्बन्धः 1
7 परीक्षायां अधिकरणम् 10
8 उत्तीर्णः कर्ता 10
9 न प्रतिषेधः 10
10 अभवत् 6

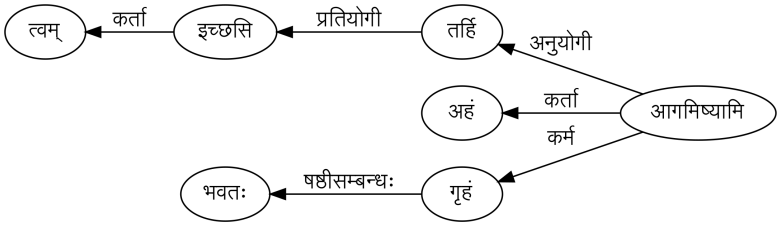


यतः समये न आगतः आसीत् ततः परीक्षायां न अनुमतः अस्ति।
1 यतः नित्यसम्बन्धः 6
2 समये अधिकरणम् 5
3 न प्रतिषेधः 4
4 आगतः कर्ता 5
5 आसीत् प्रतियोगी 6
6 ततः नित्यसम्बन्धः 1
7 परीक्षायां अधिकरणम् 10
8 न प्रतिषेधः 9
9 अनुमतः कर्ता 10
10 अस्ति अनुयोगी 6

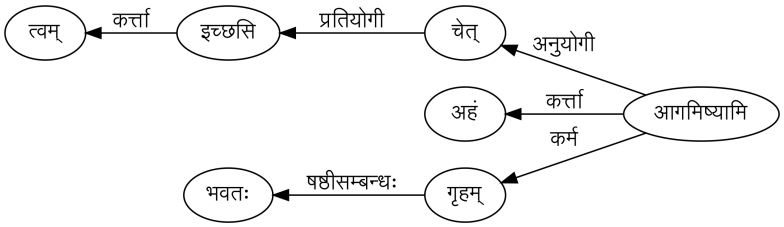


Many a times, one of the two connectives from **यदि तर्हि, यद्यपि तथापि , यतः ततः/अतः, यावत् तावत्** is absent. In such cases, while annotating the sentence, we provide the missing word in parenthesis as below.

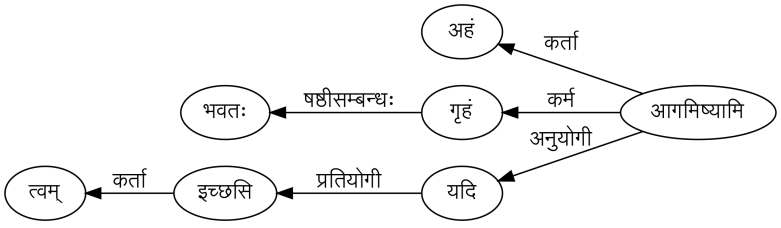
त्वम् इच्छसि तर्हि अहं भवतः गृहं आगमिष्यामि
1 त्वम् कर्त्ता 2
2 इच्छसि प्रतियोगी 3
3 तर्हि अनुयोगी 7
4 अहं कर्त्ता 7
5 भवतः षष्ठीसम्बन्धः 6
6 गृहम् कर्म 7
7 आगमिष्यामि



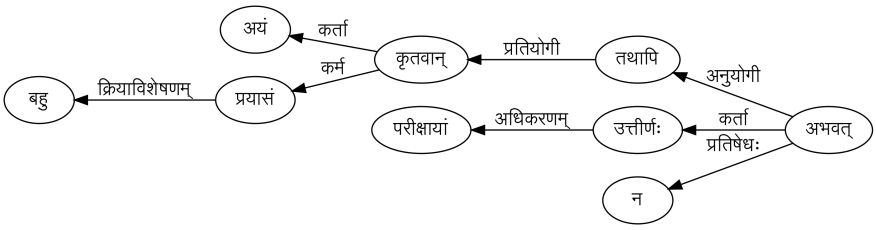
त्वम् इच्छसि चेत् अहं भवतः गृहं आगमिष्यामि।
1 त्वम् कर्त्ता 2
2 इच्छसि प्रतियोगी 3
3 चेत् अनुयोगी 7
4 अहं कर्त्ता 7
5 भवतः षष्ठीसम्बन्धः 6
6 गृहम् कर्म 7
7 आगमिष्यामि



यदि त्वम् इच्छसि अहं भवतः गृहं आगमिष्यामि।
1 यदि अनुयोगी 7
2 त्वम् कर्त्ता 2
3 इच्छसि प्रतियोगी 1
4 अहं कर्त्ता 6
5 भवतः षष्ठीसम्बन्धः 5
6 गृहम् कर्म 6
7 आगमिष्यामि

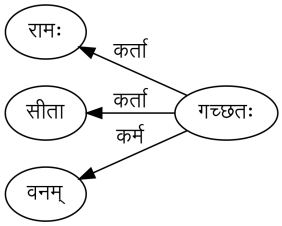


अयं बहु प्रयासं कृतवान् तथापि परीक्षायां उत्तीर्णः न अभवत्।
1 **अयं कर्त्ता** 4
2 **बहु विशेषणम्** 3
3 **प्रयासं कर्म** 4
4 **कृतवान् प्रतियोगी** 5
5 **तथापि अनुयोगी** 9
6 **परीक्षायां अधिकरणम्** 9
7 **उत्तीर्णः कर्ता** 9
8 **न प्रतिषेधः** 9
9 **अभवत्**



4.3 समुच्चितः/सुप्_समुच्चितः (Conjunction)

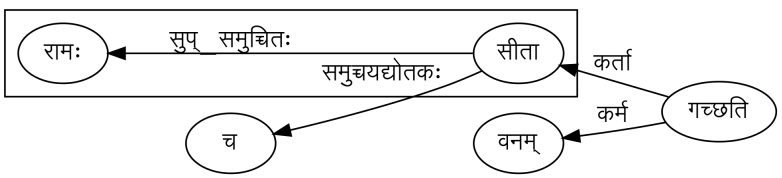
Consider a sentence **रामः सीता च वनम् गच्छतः**. In this sentence, both **राम** and **सीता** are the **कर्ता** and **वनम्** is the **कर्म** for the **धातु गम्**. So we may be tempted to mark the relations as



But the **कर्तृत्व** does not reside in **राम** and **सीता** seperately, it resides in both **राम** and **सीता** together simultaneously. This is exactly is the meaning of '**च**', which indicates **समुच्चय**. The **कर्तृत्व** resides in the **समुच्चय** of **राम** and **सीता**. We mark the relations as below.

Since '**च**' is considered to be a function (**द्योतक**) word, it just illuminates the meaning and for establishing relation between the words, it is considered to be a meaning to decide the relation between other words. The concordance provides us a clue in the establishing of relations there are two cases. Either the word close to the verb is governed by the verb, or the whole group of words is governed by the verb as one unit. The word which is close the verb is governed by the verb, we mark the relation of the verb with this noun. Consider the following sentence:

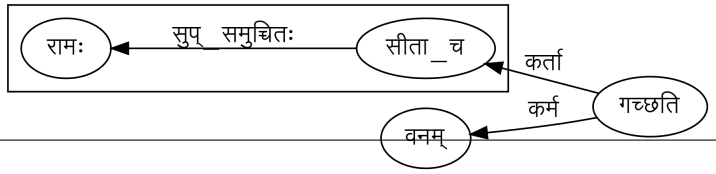
रामः सीता च वनं गच्छति।
1 **राम सुप्_समुच्चितः** 2
2 **सीता कर्ता** 5
3 **च समुच्चयद्योतकः** 2
4 **वनं कर्म** 5
5 **गच्छति**



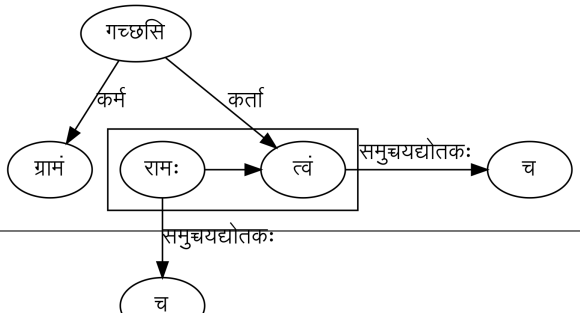
Here the relation between '**च**' and **सीता** is marked as **समुच्चयद्योतकः**, and the relation between **राम** and **सीता** is marked as **सुप्_समुच्चितः**.

When we group the word **च** with the second conjunct represented as follows.

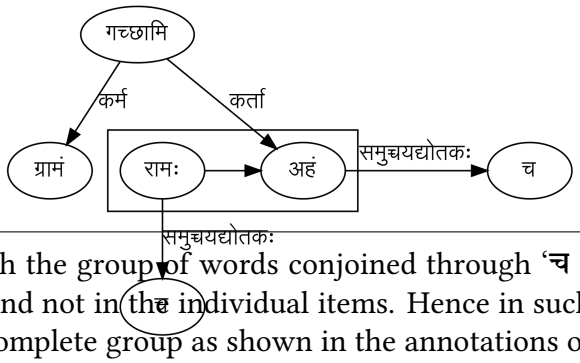
रामः सीता च वनं गच्छति।
1 **राम सुप्_समुच्चितः** 2
2 **सीता_च कर्ता** 4
3 **वनं कर्म** 4
4 **गच्छति**



रामः च त्वं च ग्रामं गच्छसि
1 **राम सुप्_समुच्चितः** 3
2 **च समुच्चयद्योतकः** 3
3 **त्वं कर्ता** 6
4 **च समुच्चयद्योतकः** 3
5 **ग्रामं कर्म** 5
6 **गच्छसि**

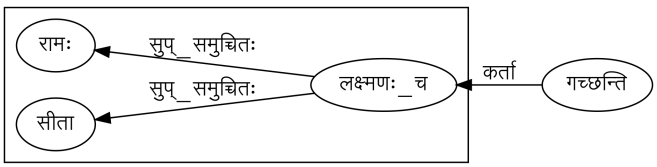


रामः च अहं च ग्रामं गच्छामि
1 **राम सुप्_समुच्चितः** 3
2 **च समुच्चयद्योतकः** 3
3 **अहं कर्ता** 6
4 **च समुच्चयद्योतकः** 3
5 **ग्रामं कर्म** 5
6 **गच्छामि**



When the verb shows concordance with the group of words conjoined through '**च** ', then the **कारकत्व** 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 annotations of following sentences

रामः सीता लक्ष्मणः च वनं गच्छन्ति।
1 **राम सुप्_समुच्चितः** 3
2 **सीता सुप्_समुच्चितः** 3
3 **लक्ष्मणः सुप्_समुच्चितः** 5
4 **वनं कर्म** 4
5 **गच्छन्ति**



5 History

The first tag proposal for kaaraka tagging was prepared by Prof. K V Ramkrishnamacharyulu and was presented in the Third International Sanskrit Computational Linguistics Symposium held at University of Hyderabad, in Jan 2009.

This tagset was compared with the existing tagset of Hindi Tree bank, and a preliminary work of tagging of 100 sentences from सङ्क्षिप्तरामायण, and the sentences from 15th and 16th sargas of सुन्दरकाण्ड, using this proposed tagset was taken up.

Based on the inputs we received, we had several meetings on kaaraka tagging at Sanskrit Academy and University of Hyderabad. The first meeting was from 24-26th July 2010, the second was from 7-9th Sept 2010, and the third was on 21-22 Oct 2010.

We thank Prof. K V Ramkrishnamacharyulu, who was instrumental in arriving at these guide lines, by providing inputs at various stages of its preparation.

We also thank all the members of the consortium, and especially those who attended the meetings and provided various kinds of inputs by raising questions, providing solutions, participating in the discussions, providing various kinds of feedback on the guidelines, etc.

Following scholars attended one or more meetings on kaaraka tagging—

Prof. K V Ramkrishnamacharyulu		Prof. Veeranarayana Pandurangi
Prof. S S Murthy		Prof. Tirumala Kulkarni
Prof. Shrinivas Varkhedi		Prof. Rajadhar Mishra
Prof. Dipti Mishra Sharma		Prof. Girish Nath Jha
Prof. Gérard Huet		Prof. Amba Kulkarni
Dr. Varalakshmi		Dr. Devanand Shukla
Acharya Ramachandra		Dr. Sheetal Pokar
Acharya Madhavacharya		Dr. R. Chandrashekhar
Shri. Pavan Kumar		Shri Anil Gupta
Ms. Sivaja		Dr. Vibhuti Nath Jha
Mrs. Preeti Shukla		Ms Monali
Ms Gayatri		Acharya Deepak
Shri Madhav Gopal		Shri Nrpendra Pathak
Shri Jagadish		Shri Lalit

Our thanks are also due to Prof. Rajeev Sangal, and Prof. Vineet Chaitanya for valuable discussions.

A Tagset of Dependency Relations implemented in the Parser as on July 2019

सम्बन्धाः

- कारकसम्बन्धः
  - कर्ता
    - प्रयोजककर्ता
    - प्रयोज्यकर्ता
  - कर्म
    - मुख्यकर्म
    - गौणकर्म
    - वाक्यकर्म
  - करणम्
  - सम्प्रदानम्
  - अपादानम्
  - अधिकरणम्
    - कालाधिकरणम्
    - देशाधिकरणम्
    - विषयाधिकरणम्
- कारकेतरसम्बन्धः
  - क्रियाक्रियासम्बन्धाः
    - भावलक्षणसप्तमी_अनन्तरकालः
    - भावलक्षणसप्तमी_पूर्वकालः
    - भावलक्षणसप्तमी_समानकालः
    - पूर्वकालः
    - वर्तमानसमानकालः
    - भविष्यत्समानकालः
    - सहायकक्रिया
  - क्रियासम्बन्धाः
    - सम्बोध्यः
    - हेतुः
    - प्रयोजनम्
    - कर्तृसमानाधिकरणम्
    - कर्मसमानाधिकरणम्
    - क्रियाविशेषणम्
    - प्रतिषेधः
  - नामनामसम्बनधाः
    - षष्ठीसम्बन्धः
    - अङ्गविकारः
    - वीप्सा
    - विशेषणम्
    - सम्बोधनसूचकम्
    - विभक्तम्
    - अभेदः
    - ल्यप्कर्माधिकरणम्
    - निर्धारणम्
    - अत्यन्तसंयोगः
    - अपवर्ग_सम्बन्धः
    - वाक्यकर्मद्योतकः
- उपपदसम्बन्धः
  - सन्दर्भबिन्दुः
  - तुलनाबिन्दुः
  - विषयाधिकरणम्
  - निर्धारणम्
  - प्रयोजनम्
  - उद्गारवाचकः
  - सह-अर्थः
  - विना-अर्थः
  - स्वामी
  - स्रोतः
- वाक्येतरसम्बन्धः
  - अनुयोगी
  - प्रतियोगी
  - नित्य_सम्बन्धः
- समुच्चयादिसम्बन्धाः
  - समुच्चितः
  - समुच्चयद्योतकः
  - अन्यतरः
  - अन्यतरद्योतकः