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 (थोंक) words?

Here are a few examples of such relations:

0.1 What is the intended level of semantic tagging?

In the sentence, स्थाली पर्चति what is the relation between स्थाली and पर्चति? Is स्थाली an अधिकरण (locus) of the action पर्चति 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 अर्थनः whereas the relation of कर्ता is faithful to what has been coded by the morphemes, thereby representing the शब्दाचरण. 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 शब्दाचरण, and not to the अर्थनः.

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 द्रुधम पीवा शालाम गच्छति the relation between रामः and पीवा is not marked explicitly by any suffix. On the other hand, गच्छति, being in कर्तरिप्रयोग marks the कर्ता. Here रामः, 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 असहितित्व (agreement). But the relation between रामः and पीवा is not marked explicitly by any means. पाणिनि provides a special rule ‘समानकर्तसंबन्धः पूर्वकारः’, which states that in case one activity precedes the other one and they share the कर्ता, then the preceding activity takes ‘स्वा’ suffix. Therefore the knowledge that रामः is the कर्ता of पीवा as well, is not marked by any morpheme but is the result of the inference: since पीवा has त्वा suffix and this activity that of the going, the कर्ता of गच्छति and पीवा should have been the same. In other words, the knowledge that रामः is कर्ता of पीवा is a पाणिनिक निर्देशिक and hence we do not code this relation directly.

From the two relations viz. the पूर्वकारसंबन्ध between पीवा and गच्छति and the कर्तरसंबन्ध between रामः गच्छति, appealing to the rule समानकर्तसंबन्धः पूर्वकारः, one may infer automat-
ically that रामः is also the कर्ता of पील्वा. Thus, to decide the कर्ता of the verb in च्वा, one should know which activity it precedes.

Consider another sentence, बालकः हस्तेन कदलीफलम् छिढ्वा स्वादन्तयु वानरम् पद्यति. Here the activity of छिढ्वा precedes both — that of स्वादन्तयु as well as that of पद्यति. So unless one finalises the precedence, one can not decide the कर्ता of छिढ्वा. Therefore, we decide NOT to mark this relation at the syntactico-semantic level of annotation.

0.3 धोतकपद versus वाचकपद

We mark the relations between पद्स, where पद् is a ‘सुचिकुल्लतम् पदम्’. For example, the relation of गच्छति with रामः is that of कर्ता. A पद् may be either a वाचक or धोतक. 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 पचित is called कर्ता and is marked with an arrow from पचित ending onto रामः.

The relation between ओदनं and पचित is called कमिति and is marked with an arrow from पचित ending onto ओदनं. We name the relations using प्रथमान्त्र words.

From these diagrams, one can get various शाब्दविशेष as 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 शाब्दविशेष as रामकर्तुसः-ओदनकमिति-पाकानुकूलसाधनम् रामः. If we traverse the diagram ending in the प्रथमान्त्र word रामः, we get the तैवातिक शाब्दविशेष as ओदनकमिति-पाकानुकूल-कृतिमान् रामः. Though one can generate the शाब्दविशेष 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 मुख्यविशेष. Since we will be following the वैयाकरण’s शाब्दविशेष, typically this will be the main verb in the sentence which will be the मुख्यविशेष according to वैयाकरण.

Since we follow वैयाकरण, शाब्दविशेष, we expect a लिङ्ग to be present. In case लिङ्ग is not present in a sentence, we insert an appropriate verb असित/ भवित. This is in tune with पतजलि’s statement असितबलानुसारः प्रथमपञ्चोप्रमुख्यमात्राध्यस्तिः।

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 मुख्यविशेषण), will not have any relation marked against it. Thus, the relations in the sentence राम: ओदनं पचित are represented as:

1 राम: कर्ता 3
2 ओदनं कर्म 3
3 पचित

0.5 Granularity

The relations proposed by Prof. K V Ramkrishnamacharyulu (2009) are given in the Appendix. As one can see from the relations, they are very fine-grained, each of the कारक 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),

Level 1: In the sentence राम: दुधम्य पीवा शालाम गच्छि, राम: will be marked as कर्ता of गच्छि at the first level of tagging. In the second level of tagging, the machine will mark the relation between राम: and पीवा as कर्ता automatically.

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

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

- राम: वनम् गच्छि।
- राम: प्रतिदिन शालां गच्छि।
Among these, the first three have only one ितङ्पदम, while the rest have more than one ितङ्पदम.

0.7 Proposed कारक-tag-set for Sanskrit

The tags may be broadly classified into two types:

1. वाॆतारः (Intra-sentential): Each of the ितङ्पद will have its own आकाा. The relations within the domain of a ितङ्ण are termed as intra-sentential relations.
2. वाॆतारः (Inter-sentential): Relations which join the two ितङ्ण or the arguments in the domain of one ितङ्ण 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.

वाॆतारः (Intra-sentential)

1. कारक-समक्ल्फः
2. कारकेॆत-समक्ल्फः
3. उपपदसमक्ल्फः
4. कम्प्रवचनीयसमक्ल्फः

वाॆतारः (Inter-sentential)

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

वाॆतारः (Intra-sentential)

1 कारकसमक्ल्फः (Kaaraka Relations)

1.1 कर्ता

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

Not implemented
The कता of the कृद्न �verbs may be in sixth case.

When the verb is in सन्तिसमयी, the कता will have third or seventh case.

**रामः पचित।**
1 रामः कर्ता 2
2 पचित

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

**रामस्य गम्यन्त पञ्चित।**
1 रामस्य कर्ता 2
2 गम्यन्त कर्ता 3
3 पञ्चित

**रामे वन गच्छित सीता अनुसरित।**
1 रामे कर्ता 3
2 वन कर्ता 3
3 गच्छित
भावालक्षणसमयी_समानकालः:
5
4 सीता कर्ता 5
5 अनुसरित

1.1.1 प्रयोजककर्ता

**देवद्रतः विश्वामित्रेण ओदनं पचित।**
1 देवद्रतः प्रयोजककर्ता 4
2 विश्वामित्रेण प्रयोजककर्ता 4
3 ओदनं कर्ता 4
4 पचित

1.1.2 प्रयोजककर्ता

The प्रयोजककर्ता is by default in तृतीयाविभिन्तय। In the case of verbs belonging to गलिविकुमत्युक्तयोक्तायद्वध्वक्तमकः (1.4.52) the प्रयोजककर्ता is in द्वितीयाविभिन्तय।
1.2 कर्म

If the कर्म is अभिहित, then it is in प्रथम, otherwise, it is in द्वितीयाविभिन्न.

The कर्म of a कृद्धा takes पश्चिमविभिन्न.

रामेण ग्रामं: गम्यते।
1 रामेण कर्ता 3
2 ग्रामं: कर्म 3
3 गम्यते

शशुरं जयित।
1 शशुरं कर्म 2
2 जयित

रामेन प्रजानाम् शासनं कियते।
1 रामेन कर्ता 4
2 प्रजानाम् कर्म 3
3 शासनम् कर्म 4
4 कियते

तुमुन्त as a कर्म of इष्ठ धातु.

बालकं: प्रतिदूतमू प्रवचिति।
1 बालकं: कर्ता 3
2 प्रतिदूतमू कर्म 3
3 प्रवचिति

The कर्मसंस्था in this sentence is justified by the सन्द्विधायकसूऽ “धातोः कर्मणः समानकारितविधायाम् बा” (3.1.7).

1.2.1 गौणकर्म and मुख्यकर्म

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

तुद्धाराष्ट्राययुतपरमनमितिवितक्षशासुजयितमभुक्तम्।
कर्मयुक्त यथावतति तथा स्वात्सीहकुच्चहाम्॥

which are हिन्दुकर्म. Out of these one कर्म is गौण and the other is प्रथाय/मुख्य. We decided to mark them as गौणकर्म and मुख्यकर्म, instead of just कर्म. This is to ensure that only
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द्विकर्मकs have more than one कर्म, and no other धातुs allow more than one कर्म. Further the information of गौण and मुख्य is also useful in transforming and active sentence to passive.

1.2.2 गतिकर्म

राम: ग्रामाय गच्छति।
1 राम: कर्ता 3
2 ग्रामाय गतिकर्म 4 3
3 गच्छति

1.2.3 वाक्कर्म (Sentence connector इति).

अहं गूः गमिष्याय इति स्यः अवदत।
1 अहं कर्ता 3
2 गूः कर्म 3
3 गमिष्याय प्रतिवेदि 4
4 इति वाक्कर्म 6
5 स्यः अधिकरणम् 6
6 अवदत।

4 Not marked in the parser
1.3 करणम्

वाल: कृषिका तालम् उदाहारण।
1 वाल: कर्ता 4
2 कृषिका करणम् 4
3 तालम् कर्म 4
4 उदाहारण

1.4 सम्प्रदायम्

देवदत्त: बालणाय गा ददाति।
1. देवदत्त: कर्ता 4
2. बालणाय सम्प्रदायम् 4
3. गाम कर्म 4
4. ददाति

खणिकोपाध्याय: शिष्याय चपेटा ददाति।
1. खणिकोपाध्याय: कर्ता 4
2. शिष्याय सम्प्रदायम् 4
3. चपेटा कर्म 4
4. ददाति

1.5 अपादानम्

वृषात पर्ण पति।
1. वृषात अपादानम् 3
2. पर्ण कर्ता 3
3. पति

1.6 अधिकरणम्

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

वाणर: वृषे वसति।
1 वाणर: कर्ता 3
2 वृषे अधिकरणम् 3
3 वसति
1.6.1 कालाधिकरणम्

\begin{itemize}
  \item श्रेतायुगे रामः आसीत।
  \item 1 श्रेतायुगे कालाधिकरणम् 3
  \item 2 रामः कता 3
  \item 3 आसीत
\end{itemize}

1.6.2 देशाधिकरणम्

\begin{itemize}
  \item रामः अयोध्याय आसीत।
  \item 1. रामः कता 3
  \item 2. अयोध्याय देशाधिकरणम् 3
  \item 3. आसीत
\end{itemize}

1.6.3 विश्वाधिकरणम्

\begin{itemize}
  \item मोके इच्छा असित।
  \item 1. मोके विश्वाधिकरणम् 3
  \item 2. इच्छा कता 3
  \item 3. असित
\end{itemize}

2 कारकेतरसम्बन्धः:

क्रियाकियासम्बन्धः:

2.1 भावलक्रमसम्बन्धः अनन्तरकालः

An action denoted by the verb in शत्रु or शान्त्र suffix, that comes in the place of लृत्, 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 भावलक्रमसम्बन्धः अनन्तरकालः.
2.2 भावलक्षणसमामी_पूर्वकालः:

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

रामे वनं गते सति दशरथः खिल: अभवत।
1 रामे कर्ता 3
2 वनं कर्म 3
3 गते_सति
भावलक्षणसमामी_पूर्वकालः
4 दशरथः कर्ता 6
5 खिलः कर्तृसमानाधिकरणम् 6
6 अभवतु।

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

रामे वनं गते दशरथः खिल: अभवत।

2.3 भावलक्षणसमामी_समानकालः:

An action denoted by a verb in रूप or शान्ति with a 7th case suffix in the place of लृद्द indicated the simultaneity of the activity with the main activity. This relation is marked by as भावलक्षणसमामी_समानकालः.

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

2.4 पूर्वकालः:

An action denoted by the verb in कृद्द suffix च्वा, indicates the precedence relation with respect to another verb. Such relations are marked as पूर्वकालः.
2.5 वर्तमानसमानकालः:

An action denoted by the verb in कृद्ध suffix शतुः / शानच in place of लट्ट और it is related to an action denoted by another verb, the two actions are simultaneous. Hence the relation here is called वर्तमानसमानकालः.

बालकः जलं पीबन गच्छति
1 बालकः: कर्ता 4
2 जलम: कर्म 3
3 पीबन वर्तमानसमानकालः: 4
4 गच्छति

बालकः शयानः हसति
1 बालकः: कर्ता 4
2 शयानः कर्म 3
3 हसति

2.6 भविष्यत्समानकालः:

If कृद्ध suffix शतुः / शानच is used in place of लट्ट और then the relation is called भविष्यत्समानकालः.

बालकः जलं पाबन भविष्यति।
1 बालकः: कर्ता 4
2 जलम: कर्म 3
3 पाबन भविष्यत्समानकालः: 4
4 भविष्यति

बालकः ग्रन्थं अधीयमाणं: भविष्यति।
1 बालकः: कर्ता 4
2 ग्रन्थं कर्म 3
3 अधीयमाणं: भविष्यत्समानकालः: 4
4 भविष्यति
### 2.7 सहायकक्रिया

<table>
<thead>
<tr>
<th>सः</th>
<th>गन्तु शकोति</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>सः कर्ता 2</td>
</tr>
<tr>
<td>2.</td>
<td>गन्तु सहायकक्रिया 3</td>
</tr>
<tr>
<td>3.</td>
<td>शकोति</td>
</tr>
</tbody>
</table>

### क्रियासम्बन्धः:

#### 2.8 सम्बोधः:

The relation of a word in सम्बुधिर is marked as सम्बोधः of the corresponding verb. Words such as भो, अिय, हे, अिे etc. are the सम्बोधनसूचकायाः and hence are marked as सम्बोधनसूचकम्.

भो राम माम उदर।
1. भो सम्बोधनसूचकम् 2
2. राम सम्बोधः 4
3. माम कर्म 4
4. उदर

#### 2.9 हेतुः:

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

| विचारः अत्यन्तन विचाराये बसति। |
|---|---|
| 1. | विचारः कर्ता 4 |
| 2. | अत्यन्तन हेतुः 4 |
| 3. | विचाराये अविकरणम् 4 |
| 4. | बसति |

| जाडात मूर्ति बदः। |
|---|---|
| 1. | जाडात हेतुः 3 |
| 2. | मूर्ति कर्ता 3 |
| 3. | बदः |

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

| दण्डेन घटः असित। |
|---|---|
| 1. | दण्डेन हेतुः 2 |
| 2. | घटः कर्ता 3 |
| 3. | असित |

15
2.10 प्रयोजनम्

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

Sometimes instead of तुमुन्ना, चतुर्द्धिकार्मित or 'अर्ध' is also used with भावार्थकक्षय to indicate the प्रयोजनम्. These are also marked as प्रयोजनम्.

अहं योगशा्म पद्धतम विधालयं गच्छामि
1 अहम कर्ता 5
2 योगशा्म कर्म 3
3 पद्धतम प्रयोजनम् 5
4 विधालयः कर्म 5
5 गच्छामि

अहं भवत्त मम गृहे भोक्ता आद्यामि
1 अहम कर्ता 6
2 भवत्त मम कर्म 6
3 मम शेषे 4
4 गृहे अधिकरणम् 6
5 मम प्रयोजनम् 6
6 आद्यामि

छात्रः अध्ययन्नाय विधालये वसति।
1 छात्रः कर्ता 4
2 अध्ययन्नाय प्रयोजनम् 4
3 विधालये अधिकरणम् 4
4 वसति

छात्रः अध्ययन्नार्थ विधालये वसति।
1 छात्रः कर्ता 4
2 अध्ययन्नार्थ प्रयोजनम् 4
3 विधालये अधिकरणम् 4
4 वसति

सा क्रयाभाव आयामम् गच्छति।
1 सा कर्ता 4
2 क्रयाभाव प्रयोजनम् 4
3 आयामम् कर्म 4
4 गच्छति

Sometimes the verb with which a verb has प्रयोजनम् is elided (उल्लम्श). In such cases, the कर्म of the elided verb takes a 4th case by the सूऽ “कियायांपदत्व च कर्मणि विद्यानिन्” (2.3.14). In such cases also we mark the relation as प्रयोजनम्.

फलेन्यः याति।
1 फलेन्यः प्रयोजनम् 2
2 याति

युद्धाय गच्छति।
1 युद्धाय प्रयोजनम् 2
2 गच्छति
2.11 कर्तृसमानाधिकरणम्

- देवदर्श: अध्यापक: असित।
- वातः: श्रवण: असित।

2.12 कर्मसमानाधिकरणम्

- अहं त्वा चुनुन मन्ये। बालं शयानं पदय।

2.13 किर्याविशेषणम्

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

- मृगः: वेगेन धावित।
2.14 प्रतिषेधः

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

![Diagram showing the relation of न with verb as प्रतिषेधः]

नामपदसम्बन्धः:

2.15 पश्चासम्बन्धः

The words with पश्चासम्बन्ध which do not indicate कारकमिविभक्तिः, are marked simply as पश्चासम्बन्धः.

![Diagram showing the relation of पश्चासम्बन्ध with the words and क्रमम्]

2.16 अञ्जविकारः

बालः अञ्जन काणः वर्तते।

![Diagram showing the relation of बालः and काणः in the sentence बालः अञ्जन काणः 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 ददाित।

![Diagram showing the relation of रामः and कस्मै in the sentence रामः कस्मै कस्मै ददाित]
2.18 विशेषणम्

विशेषणम् are of two types - those qualifying the उदेश्य and the other ones which are विभेद. The विशेषणम् which qualify the उदेश्य are called विशेषणम्, and the विशेषणम् which act as विभेद will be classified as कर्मसमानानाधिकरणम् or कर्मसमानानाधिकरणम्. Here are examples.

दाशरिथः: रामः वनं गच्छति।
1 दाशरिथः: विशेषणम् 2
2 रामः कर्ता 4
3 वनं कर्म 4
4 गच्छति

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

Compare this with बालकः: शयानः हसित। [2.5].

2.19 सम्बोधनसूचकम्

The relation of a word in सम्बूद्धि is marked as सम्बोध्य: of the corresponding verb. Words such as भो, अधि, हे, ओर etc. are the सम्बोधनसूचकम् and hence are marked as सम्बोधनसूचकम्.

भो राम माम् उद्घर।
1. भो सम्बोधनसूचकम् 2
2. राम सम्बोध्य: 4
3. माम् कर्म 4
4. उद्घर
2.20 विभक्तम्

माथुरः पाटलीपुरकेम्यः आद्वैतरः सन्ति।
1 माथुरः कर्ता 4
2 पाटलीपुरकेम्यः विभक्तम् 3
3 आद्वैतरः कर्तृसमानाधिकरणम्
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 अभेदसम्बन्धः.

दशरथस्य पुत्रः रामः अस्ति
1 दशरथस्य पशीसम्बन्धः 2
2 पुत्रः अभेदः 3
3 रामः कर्ता 4
4 अस्ति

2.22 लघुकमाधिकरणम्

प्रासादात् प्रेष्ठते।

or

आसनात् प्रेष्ठते।

Here the words प्रासादात् or आसनात् do not have any direct relation with प्रेष्ठते. So in order to have a proper शास्त्रोपदेश of these sentences, it is necessary to supply the missing verb such as आश्वय or उपविद्य. After supplying this missing किर्म, sentences change to प्रासादम् आश्वय प्रेष्ठते or आसने उपविद्य प्रेष्ठते and then the relation of प्रासादम् with लघुकमाधिकरणम् आश्वय is that of कम्। Similarly the relation of आसने with उपविद्य is that of लघु-अधिकरणम्। Whenever लघु word is missing in a sentence we mark the relation of आसनात् with प्रेष्ठते as लघुकमाधिकरणम् following the वार्तिक ‘लघुकमाधिकरणम्’.
2.23 निर्धारणम्

रामः कर्त्येव शुरः अर्थिः।
1. कर्त्येव निर्धारणम्
2. शुरः कर्त्येवानाधिकरणम्
3. रामः कर्ता
4. अर्थिः

2.24 अत्यन्तसंयोगः:

When a कारकवाचि और अध्यावाचि takes an accusative case-marker, we mark the relation of such words with the verb as अत्यन्तसंयोगः:

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

2.25 अपवगः समवतः:

When a कारकवाचि और अध्यावाचि takes an instrumental cases, we mark the relation as such words with the verb as अपवगः:

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

2.26 समवतः:

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 इव indicates the past tense, इति 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 साधवर्कृ, while sometimes it is used to indicate साधस्वि, sometimes it is used to indicate the कर्म. The word एव sometimes indicate वेदापापं (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 समवतः. Otherwise, we mark the relations as प्रतियोगी and अनुयोगी and when they are related to a single word, the relation is marked as समवतः. The word समवतः here stands for एव-परम-तत्त-योग-समवतः. That is, if the relation is with एव, then it is एव-योग-समवतः; if it is with न, then it is न-योग-समवतः.
2.26.1 रम

कृष्ण: मथुरायां वसित रम।
1 कृष्ण: कर्ता 4
2 मथुरायां अधिकरणम् 3
3 वसित
4 रम 3 सम्बन्ध:

2.26.2 इव

चन्द्र: इव मुखं पश्य।
1 चन्द्र: कर्ता 4
2 इव सम्बन्ध: 1
3 मुखं कर्म 4
4 पश्य

2.26.3 एव

राम: एव सुन्दर: असि।
1 राम: कर्ता 4
2 एव सम्बन्ध: 1
3 सुन्दर: कर्म कर्तृसमानाधिकरणम्
4 असि

राम: सुन्दर: भवि एव।
1 राम: कर्ता 3
2 सुन्दर: कर्तृसमानाधिकरणम् 3
3 भवि
4 एव सम्बन्ध: 4

राम: सुन्दर: एव भवि।
1 राम: कर्ता 4
2 सुन्दर: कर्तृसमानाधिकरणम् 4
3 एव सम्बन्ध: 2
4 भवि

2.26.4 अधि

सीता अधि वनं गच्छित।
1 सीता कर्ता 4
2 अधि सम्बन्ध: 1
3 वनं कर्म 4
4 गच्छित
3.1 विभक्तिधारित-उपपदविभागः

There are six types of उपपदमिलकि नम्बरूपः उपपदद्विहितीया, उपपदद्वितीया, etc.

3.2 अर्थाधारित-उपपदविभागः

Here are some examples:

3.2.1 सन्दर्भिन्दूः: (Reference point for direction)

ग्राम परितः कृष्णः सन्तिनः
1. ग्राम सन्दर्भिन्दूः 2
2. परितः अधिकरणम् 4
3. कृष्णः कर्त्ता 4
4. सन्तिनः
3.2.2 तुलनाबिन्दुः: (Reference point for comparison)

श्यामेन तुल्यः: राम: अस्ति।
1. श्यामेन तुलनाबिन्दुः: 2
2. तुल्यः: कुरुसमाधिकरणम्: 4
3. राम: कर्ता: 4
4. अस्ति

3.2.3 विषयाधिकरणम् (Locus showing the domain)

सः: पठने लघः: अस्ति।
1. सः: कर्ता: 4
2. पठने विषयाधिकरणम्: 2
3. लघः: कर्ता: 4
4. अस्ति

3.2.4 निर्णयानम् (Determination)

गवां प्रसुता अस्ति।
1. गवां निर्णयानम्: 2
2. प्रसुता 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 उद्धरवाचकः (Exclamatory)

दुर्जन धिक्क भवतु।
1. दुर्जनम् उद्धरवाचकः: 2
2. धिक्क क्रियाविषेषणम्: 3
3. भवतु

3.2.7 सहाथः (Association)

रामेण सह सीता वनं गच्छति।
1. रामेण, सह सहकर्ता: 2
2. सीता कर्ता: 4
3. वनं कर्ता: 4
4. गच्छति
3.2.8 विनार्थः (Dis-association)

रामं पृथकः श्यामः वत्ते।
1. रामं_पृथकः विनार्थः 2
2. श्यामः कर्ता 3
3. वत्ते

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

4 वाक्येतरसम्बन्धः (Inter Sentential Relations)

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

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

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/परन्तु and it connects the two sentences with अनुयोगी and प्रतियोगि relation.
4.2 Connectors which occur in pairs

When sentences are connected by pair of connectors such as:

1. यदि ताहि
2. यथापि तथापि
3. यतः ततः/अतः
4. यथवत् 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 ताहि, etc. respectively by प्रतियोगी and अनुयोगी and the words यदि-ताहि etc. are connected with each other by the relation नित्यसम्बन्धः e.g. यदि ले इच्छिसि ताहि अहं भवतः गृहम्य आगमिष्यामि।

Thus the overall head/ मुख्यविशेष्य of these sentences is आगमिष्यामि।
Many a times, one of the two connectives from यदि तत्व, तत्कालि त्यथापि, यतः ततः/अतः, यावत् तावत् is absent. In such cases, while annotating the sentence, we provide the missing word in parenthesis as below.
4.3 समुचितः/सुपु_समुचितः (Conjunction)

Consider a sentence रामः सीता च वनम् गच्छति. In this sentence, both रामः 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 कर्ता does not reside in रामः and सीता seperately, it resides in both रामः and सीता together simultaneously. This is exactly the meaning of ‘च’, which indicates समुचित. The कर्ता resides in the समुचित of रामः and सीता. We mark the relations as below.

Since ‘च’ is considered to be a function (चोतक) 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 वनम् गच्छति।
1 रामः सुपु_समुचितः 2
2 सीता कर्ता 5
3 च समुचितः चोतकः 2
4 वनम् कर्मे 5
5 गच्छति

Here the relation between ‘च’ and सीता is marked as समुचितः; and the relation between रामः and सीता is marked as सुपु_समुचितः.

When we group the word च with the second conjunct represented as follows.
When the verb shows concordance with the group of words conjoined through ‘च’, then the कारक 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

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 सङ्गीतसरामायण, and the sentences from 15th and 16th sargas of गुरुराकाण्ड, 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—

<table>
<thead>
<tr>
<th>Prof. K V Ramkrishnamacharyulu</th>
<th>Prof. Veeranarayana Pandurangi</th>
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<tr>
<td>Prof. S S Murthy</td>
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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

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