

Theories of Śābdabodha and Principles of Information Coding: A computational Perspective

Amba Kulkarni

Fellow IIAS, Shimla

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- Language is a means of communication.
- Communication is a two way process.
 - Speaker expresses his thoughts through a language string (Generation)
 - Listner deciphers this language string into underlying encoded thoughts (Analysis)

Pāṇini: (Almost exhaustive) Grammar for (then prevalent) Sanskrit. This grammar deals with the generation process.

Starting with the thoughts, arriving at the surface form of a sentence.

This process is deterministic, choices being guided by the semantic and pragmatic conditions.

Śābdabodha: Process of Understanding

Involves Analysis of a given utterance.

Non-determinism involved at different stages of analysis

- Sandhi-viccheda
- Morphological analysis
- Deciding the kāraka role
- Deciding the meaning of a word

Indians were aware of this problem of Ambiguity /
Non-determinism in Natural Languages.

Kumārila Bhaṭṭa in his *Tantravārttika* mentions 3 factors necessary for the understanding of the correlation between words¹. These factors are

- Ākāṅkṣā (expectancy)
- Yogyatā (congruity)
- Sannidhi (proximity)

To this later another factor viz. Tātparya (the intention of the speaker or the purport of the sentence) was added.

¹ *Ākāṅkṣā sannidhānam ca yogyatā ceti ca trayam sambandhakāraṇatvena kṛtam nānantaraśrutiḥ.*

Ākāṅkṣā (Expectancy)

Arthaikatvāt ekam vākyam sākāṅkṣam cet vibhāge syāt.

Jaimini's *Mīmāṃsāsūtra* 2.1.46.

A group of words forms a sentence if when separated

- the words have mutual expectancy and
- it serves a single purpose

Naiyāyikas: Ākāṅkṣā is the syntactic expectancy a word has in order to correlate with another.

$$dvāram = dvāra + am$$

dvāra: denotes an object in the real world,

am: an expectancy of a verb whose karma can be *dvāra*

Two types of expectancies

- utthita ākāṅkṣā (aroused)
- utthāpya ākāṅkṣā (to be raised)

Utthita ākāṅkṣā (aroused)

- mutual, direct, natural
- niyatākāṅkṣā: yathā kriyākārapadānām parasparākāṅkṣā

dvāram pidhehi

Utthāpya ākāṅkṣā (to be raised)

- unilateral, potential
- aniyata

udayati candraḥ kumudabāndhavaḥ

Rises the moon, the friend of a lotus

viśeṣaṇa, ṣaṣṭhī

Yogyatā (Congruity)

Suitability / mutual compatibility / fitness of meanings

- *arthābādhaḥ* (absence of obstruction in meaning)
(Tarkasaṅgraha)
- *parasparānvayaprayojakadharmavattvam* (a property of promoting the mutual relationship) (Paramalaghumañjuṣā)
- *bādhakapramāviraḥaḥ* (lack of hindrance of valid cognition)
(Tattvacintāmaṇi)
- *sambandhārhatvam* (ability to establish a relation)
(Vākyārtha-mātrkāvṛtti)

- payasā siñcati
(He) wets with water
- agninā siñcati
(He) wets with fire

For a naiyāyika
linguistic expressions are the representations of reality

For a Vaiyākaraṇa
it is the representation of a mental creation

The mīmāṃsakas, not very different from the Vaiyākaraṇas

In the śloka-vārttika, Kumārilabhaṭṭa clearly states

*atyantāsaty api hy arthe jñānam śabdaḥ karoti
hi*

abādhāt tu pramām atra svataḥ prāmāṇya-niścalām

When the meanings are inconsistent, that is there is lack of yogyatā among the meanings, the overall meaning will still be conceivable. When the meanings are consistent, that is, when there is congruity among the meanings of various words in a sentence, the sentence produces not only a verbal cognition but also a valid cognition.

Sannidhi (Proximity)

padānām avilambena uccāraṇam (Tarkasaṅgraha)

(an utterance of words without any gap)

avyavadhānena padajanya padārthopasthitih

(the presentation of word meanings without any intervention)

Example of Sannidhi violation

Viśvanātha Pañcānana in Nyāyasiddhāntamuktāvalī

- giriḥ bhuktam agnimān devadattena.
Hill is eaten fiery by Devadatta.

Tātparyajñāna (purport / intention of the speaker)
vaktur icchā tu tātparyam – Siddhāntamuktāvalī

The meaning of a sentence is what a speaker intends.

The Vedāntins and Mīmāṃsakas: No reference to the speaker

Tātparya: meaning of a sentence that is over and above the sum total of the meaning of its constituent words.

Some alamkārikas (rhetoricians) include tātparya in suggestive meaning².

gato'stam arkaḥ
the sun is setting

- For a child playing in the ground
it is time to stop playing and go home
- For a Brahmin
it is time to do the *sandhyāvandana*
- For a young person
it is time to meet his/her lover

²tātparyārthaḥ ca vyañgārtha eva, (Prataparudriya II under v. 5)

Since *yogyatā* and *tātparya* involve word meaning,

We look briefly at Indian theories of word meanings.

Relation between word and its meaning

- Abhidhā (primary / literal meaning)
- Lakṣaṇā (secondary / metaphoric usage)
- Vyañjanā (suggestive meaning)

Abhidhā (primary / literal meaning)

- Rūḍha (conventional)
- Yaugika (etymological)
- Yogarūḍha (etymological but restricted by convention)
- Yaugikarūḍha (etymological and conventional independently)

Understanding word meaning in Indian Theories

Lakṣaṇā: A referent different from its primary one, but related to it.

Comes into play when the primary meaning is incompatible with the meanings of other words in the sentence.

Skt: gaṅgāyāṁ ghoṣaḥ

Gloss: gaṅgā{loc.} city

city on the **banks** of Gaṅgā

Primary meaning: Gaṅga

Implied meaning: On the banks of Gaṅga

Vyaṅgyārtha: Suggestive meaning

Does not have any boundaries.

Limited only by the poet's imagination.

Skt: gato'stam arkaḥ

Primary meaning: The Sun is setting.

Different meanings for different listeners, and also depends on who the speaker is.

What is the computational significance of

- Ākāṅkṣā
- Yogyatā
- Sannidhi
- Tātparya

and that of

- Abhidhā
- Lakṣaṇā
- Vyājanā

Ākāṅkṣā: Establishes relations between words

- Where is the relation coded?
- How is it coded?
- Which relations are coded?

Clues for extracting the relations

- Abhihitatva (property of being expressed)
- Vibhakti
- Indeclinables (avyaya)
- Sāmānādhikaraṇya (being in g-n-p agreement)
- Nitya sambandhaḥ

How is the relation coded?

Which relations to represent – **Explicit** or **Implicit**?

samānakartṛkayoḥ pūrvakāle (3.4.21)

ktvā marks pūrvakālīnatva or kartṛtva or both?

SKT: **rāmaḥ** dugdham **pītvā** śālām **gacchati**.

Eng: After drinking milk Ram goes to school.

Explicit(abhihita) or Implicit(ākṣipta)

Bhartrhari in Vākyapadīyam states (3.7.81-82),

pradhānetayor yatra dravyasya kriyayoḥ pṛthak
śaktir guṇāṣrayā tatra pradhānam anurudhyate 3.7.81

pradhānaviṣayā śaktiḥ pratyayenābhidhīyate
yadā guṇe tadā tadvad anuktāpi prakāśate 3.7.82

i.e., in case X is an argument of both the main verb as well as the subordinate verb, it is the main verb which assigns the case and the relation of X to the sub-ordinate verb gets manifested even without any other marking.

rāmaḥ dugdham **pītvā** śālām **gacchati**.

rāmeṇa dugdham **pītvā** śālā **gamyate**.

Svatantraḥ kartā (1.4.54)

- **John** opened the door with a key.
- **This key** opened the door.
- **The wind** opened the door.
- **The door** opened.

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- **John** opened the door with a key.
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- **John** opened the door with a key. **Agent**
- **This key** opened the door. **Instrument**
- **The wind** opened the door. **Cause**
- **The door** opened. **goal**

In Pāṇinian Framework, all of them are **kartā**!

Greatness of *Pāṇini* lies in identifying **EXACTLY HOW MUCH** information is coded in a language string.

⇒

Upper Bound for the possible Analysis using only a language string and grammar.

We can extract precisely only that information which can be decoded from the language string 'without any requirement of additional knowledge'.

Analogy:

We can not do high quality work with low quality energy.

Yogyatā is between the word meanings.

Which meaning is captured by yogyatā?

What is the level of signification?

- abhidhā (literal meaning)?
- lakṣaṇā (metaphoric meaning)?
- vyañjanā (suggestive meaning)?

Clue: *barhirnyāya* of Mīmāṃsā³

Of the senses viz. mukhya and gauṇa it is only the mukhya which is to be accepted as being conveyed by the Mantra and it alone has to be connected with the enjoined act, which when applied to similar case means that words, as far as possible, must be understood as conveying their mukhyārtha alone,...

G. V. Devasthali (1959)

Use abhidhā (literary meaning) by default.

³*tasmānmukhyagauṇayormukhye kāryasampratyaya iti siddham [SB p=751]* ॥

Mīmāṃsā: *yadāñjasyena śabdārtho nāvakalpate tadā lakṣaṇayāpi kalpyamānaḥ sādhubhavadati*

Lakṣaṇā is resorted only as a means to avoid ānarthakya-doṣa (defect of being non-sensical) and that it can be resorted to only if the literal sense is found to be unsuitable in the context; and that to only as the last resort. [G V Devasthali (1959) pp 79]

Only when abhidhā fails (there is no yogyatā / anvaya-upapatti) go for lakṣhaṇā (Metaphorical meaning)

Essential conditions for lakṣaṇā (Metaphor)

- inapplicability / unsuitability of primary meaning (*mukhya-artha-bādhā*)
- possibility of some relation between primary meaning and the referent (*mukhya-artha-yoga*)
- sanction for the transferred sense by popular usage ?? (*rūḍhi / prayojana*)

Level of signification: Suggestive meaning

Skt: gato'stam arkaḥ

Eng: The sun is setting

Impossible to process the suggestive meaning **objectively**.
This meaning is **in addition** to the primary meaning.

Use abhidhā (literal meaning) for analysis.

In case abhidhā fails to give ANY analysis, use lakṣaṇā (metaphor).
It is impossible to process the suggestive meaning objectively.

This puts an **upper limit** on the meaning that can be extracted from a language string.

Sannidhi may be characterised as:

No cross linking of relations when words are presented in linear order.

Only cases of cross linkings are those of

- Adjectives (Viśeṣaṇa)
- Genitives (ṣaṣṭhīsambandhaḥ)

Sanskrit allows only those word orders in which the projection of the dependency graph on a plane does not lead to crossing of links, with an exception of **Viśeṣaṇas and **ṣaṣṭhīsambandhas**.**

A Human Versus a Machine

A well known hymn from the Rgveda, also quoted in the Mahābhāṣya (I p 4) distinguishes between a man who understands only literary meaning and a man who understands suggestive meanings as well.

*uta tvaḥ paśan na dadarśa vācam
uta tvaḥ śṛṇvan na śṛṇoty enām
uto tvasmai tanvaṃ visasre
jāyeva patya uśatī suvāsāḥ (Rg Veda 10.71.4)*

The former sees but does not see, he hears but does not hear, while to the latter speech reveals herself completely like a loving wife to her husband.