INDIAN TRADITION OF THE SCIENCE OF LANGUAGE: SOME REFLECTIONS†

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The science of language occupies foremost position in the history of the development of scientific thought in India. It arose with the dawn of civilization in this country and developed into a full-fledged system of knowledge in the course of about three thousand years. The linguistic tradition in India owes its importance not only to the perfect language analysis that any grammar could ever achieve but also to a unique methodology of science which was accepted by all disciplines. Indologists have, on a number of occasions, observed the fundamental role the science of grammar played in shaping the philosophic thought in this country which is comparable to the role the science of mathematics played in the development of the Western Philosophy.

The present paper represents a humble attempt to highlight some features of the Indian linguistic tradition. The first brilliant manifestation of the sustained and keen interest of the ancient Indian thinkers in the linguistic phenomenon is Pāṇini's *Aṣṭādhyāyī* the foremost and the most perfect available grammar of Sanskrit that could ever be written. This grammar which has fetched high praise from all over the world because of its unique contribution to the theory of grammar has provided a foundation for logical thinking for later generations of scientists. It represents a major breakthrough in the development of scientific thought in this country. Our enquiry into the quintessential characteristics of the Indian linguistic tradition begins with Pāṇini. An attempt is made here to summarize some distinct features of Pāṇini's grammar.

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Pāṇini is, perhaps, the first revolutionary to secularise science. It is well-known that all intellectual activities of the earliest Indian thinkers were centred round the religion, the sacred literature, the Vedas, their interpretation and preservation. Pāṇini deserves the credit of bringing the goddess of speech from heaven down to the earth and articulating its terrestrial appearance. While thus freeing the science from the shackles of religion, he still maintained affiliation of the profane with the sacred by offering the sacred language its due share in his analysis.

Formalism is one of the most striking characteristics of the Pāṇiniam system. It is, in fact, his pioneering contribution to the development of the concept of science in India. An outstanding feature of his formalism is his metalanguage which, though being essentially Sanskrit, is distinctly separate from the language he describes. Pāṇini has, indeed, for the first time, offered separate identity to meta-language as a scientific tool. Linguistic atomism revealed by his *sūtras* which can be reduced to algebraic formulae, structural and analytic approach to language, simplicity or economy prevailing over all the aspects of methodology and theory of substitution are among the major achievements of Pāṇini's metalanguage.

The awe-inspiring level of the sophistication Pāṇini arrived at in his language analysis, his descriptive technique consisting of algebraic formations and his employment of notational devices have tempted some modern scholars to compare Pāṇini with Euclid, one of the earliest Greek scientists.

It is interesting to note that we come across hardly any attempt to compare Pāṇini's grammar with the Greek grammar, though both the languages belong to hoary antiquity and their respective grammars are not much distant from each other in point of time.

Euclid who came probably a century after Pāṇini is credited with the earliest treatise on Geometry called *Elements* which consists of 13 books. The most apparent ground for comparison between the two classics, the *Aṣṭādhyāyī* and the *Elements*, though belonging to disciplines completely different from each other, is the fact that both the classics are being used as text-books in the respective subjects in the school curricula over a period of two millennia. Even a cursory glance at these two works shows that they are not meant for beginners. Just as adequate knowledge of Sanskrit as a native language as well as of the essentials of Sanskrit grammar are prerequisites of the study of

Pāṇini's grammar, the Euclidean geometry "was not written for schoolboys or schoolgirls, but for the grown man who would have the necessary knowledge and judgment to appreciate the highly contentious matters ..."[1]

This matured look both these works owe to their formalism. Although both Pāṇini and Euclid are indebted to their predecessors whose works were eclipsed by their works, their reworking on the earlier material brought in a total change in the systems so much so that they came to be looked upon as founders of their own systems. The greatness these two stalwarts share consists in their leaving a permanent impression on the subsequent development of scientific thinking. F. Staal who has triggered a comparison between them observes, "the mathematical method is characteristic of much of Western philosophy, whereas the grammatical method is characteristic of much of Indian philosophy."[2]

The influence both these classics exercised on the later traditions is mainly due to their methodology. Staal has discussed the points of comparison between the two at a greater length. His discussion can be summarized in the following manner:

> The scope for the comparison is opened by the remark of Proclus, the commentator of Euclid's work, Elements, who while commenting on the Greek term for *Elements* said, "just as an expression in language consists of most simple principles which we call elements and just as each discourse is constructed from these, there are certain theories called elements which precede the whole geometry."[3]
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> Referring to the similarity of approach between the two Staal says, "Both systems exhibit a structure of logical deduction with the help of rules and both scholars attempted to arrive at a structural description of facts. In both systems contradictions and unnecessary complications are avoided. In both cases the aim is adequate and simple description. ... both show a desire to shorten principles while disregarding the length of derivation."[4]

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1 Heath [1995: v]

2 Staal [1965: 99]

3 Staal [1965: 100]

4 Staal [1965: 113]

Although Pāṇini's work opens, just as that of Euclid's, with definitions and axioms, it has been observed that Pāṇini takes for granted quite a few axioms of universal character. Since Pāṇini's system is closer to ordinary behaviour, Pāṇini could afford to bank upon general commonsense, while Euclid could not since he was dealing with rather abstract phenomena. Staal has also noted other achievements of Pāṇini in these words; "Pāṇini's system produced at an early date such logical distinctions as those between language and metalanguage, theorem and metatheorem, use and mention which were discussed much later in Europe."[5]

Dr. D.D. Mahulkar has also attempted a comparison between Euclid and Pāṇini mainly on the point of the use of letter symbolism.[6] He has shown how both Pāṇini and Euclid could achieve simplicity with the help of this device. He has further pointed out that the letter symbolism of Euclid was confined to mathematical functions such as measuring and counting, whereas in Pāṇini's system it developed into algebraic notations, went beyond mathematical functions and was used to express rational operations, both, countable and noncountable. Pāṇini's letter symbolism thus shows a distinct feature of performing computational functions. The notational symbols carry a deeper meaning in Pāṇini's grammar. To sum up in the words of Staal; "the conclusions which these comparisons lead can help to dispel the naive but persistent view that only the Western tradition has produced and employed rational and scientific views."[7]

An important point that emerges from this comparison is that the Pāninian system was, to a large extent, responsible for the methodology of Indian philosophy in as much as Euclid's method was responsible in shaping Western thought. The greatness of the Indian linguistic tradition thus lies in its role in providing a framework of thought for the whole intellectual exercise reflected in diverse branches of knowledge. A couple of illustrations to substantiate the point may be mentioned in this context. Staal has already made a reference to the Vaiśeṣika categories and has cited the view of another scholar, that these categories were based on grammatical distinctions.[8] P.S. Filliozat makes a similar observation in connection with the

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5 Staal [1965: 114]

6 Mahulkar [unpublished: 2]

7 Staal [1965: 100]

8 Staal [1965: 105]

science of Mathematics in India. He argues that since Indian mathematicians were basically Sanskrit Pandits, grammar which was one of the main components of their intellectual education exercised a strong influence on their methodology.[9]

Indologists like L. Renou have, therefore, rightly observed that one has to think like a grammarian in order to understand the deeper Indian thought.

The Pāṇinian tradition is described as *trimuni* tradition. It believes in the authority of the three *munis*, Pāṇini, Kātyāyana and Patañjali. It reflects the early ideology prevailing at least in the linguistic tradition that was opposed to the concept of science as emanating from a single authority. It further reflects the belief that every science has to go through an acid test before it is accepted as such. A casual look at the *Vārttikas* of Kātyāyana the second *muni* reveals the fact that Pāṇini's rules were subjected to a close scrutiny. Pāṇini was questioned and cross questioned not only with reference to the words and phonemes in his *sutras* but also with reference to their implications in usage. He was thus tested for both, theory and practice on the three levels of *ukta* 'what is stated, *anukta* 'what is not stated' and *durukta* 'what is wrongly stated'. It must be mentioned in this context that the interrogative tone of Kātyāyana's *Vārttikās* has led some scholars to think that Kātyāyana was an antagonist of Pāṇini.[10] Although it would be out of place to examine this view here, it may be noted that the foremost available commentary on Pāṇini's grammar was more critical and enquiring in nature than being a mere expository.

The catechism in the *Mahābhāṣya* of Patañjali, the third *muni* also reflects the spirit of enquiry and empirical testing as the basic criteria of a science. This commentary, which has a unique place not only in the history of Indian linguistics but also in the history of Indian literature, reveals a number of striking features of the Indian linguistic tradition. It marks, to start with, a turning point in the history of the development of linguistic thought. It is in the *Mahābhāṣya* that the science of linguistics is made to stand in confrontation with other branches of knowledge and is asked to establish its utility and relevance. Patañjali adds a number of secular purpose of the study of grammar to the list of purposes given by

9 Filliozat [1994: 49]

10 For details, see Cardona [1980: 250-251].

Kātyāyana. The lengthy passage in the beginning of the *Mahābhāṣya* devoted to the purposes of the study of Vyākaraṇa is important from the point of view of understanding how the makers of science look at their own science. While Kātyāyana appears to be satisfied more with religious rather than secular purposes, Patañjali with his marketing skill tries to prove that the study of grammar is essential to live a better life on this planet. A glance through the long list of citations each accompanied by a deduced precept added by Patañjali show how Patañjali connects the study of grammar with day-to-day living and even with personality development.[11] However, this multitude of citations in support of the utility of the science of language itself shows Patañjali's awareness of the superfluous character of grammar for leaning a language. He has, in fact, recorded the contemporary opinion in this regard which shows that the study of grammar was not much respected during his time.[12] At another place he openly declares grammar as an instruction for the non-intelligent.[13] Similar remark about the *Aṣṭādhyāyī*, namely, *śiśṣṭajñānārthā aṣṭādyāyī* 'The study of the *Aṣṭādhyāyī* is meant for understanding who the *śiṣṭas* are'[14] also shows his candidness in accepting that the science of language has a limited purpose to serve.

Incidentally, it may be noted that among the later grammarians it is Bhartṛhari who follows Patañjali in his estimation of the utility of grammar as a science. Although he speaks very high of the metaphysical merits of the science of language in the first Kāṇḍa of his *Vākyapadīya*, at another place he describes it merely as an eye for the blind.[15] In fact, in his philosophy of linguistic monism where *Vākya* stands as the only reality the science of grammar has no scope apart from being one of the means to reach the reality.

This forthright approach to grammar by the Indian grammarians is characteristic of their honesty and acceptance of realism (though hidden beneath idealism). Yet another aspect of the grammarian's

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11 See *Vyākaraṇamahābhāṣya,* Vol. 1 pp. 1-3.

12 *Vyākaraṇamahābhāṣya,* Vol. 1, p. 5: *tadadyatve na tathā. vedamadhītya tvaritā vaktāro bhavanti. vedānno vaidikāḥ śabdāḥ siddhā lokāc ca laukikāḥ. anarthakaṃ vyākaraṇam iti.* "Now-a-days it is not so (as it was before). After having studied Veda they immediately say, "Vedic words are (known) to us from the Vedas and ordinary words are known from the people. The science of grammar is purposeless."

13 *Vyākaraṇamahābhāṣya,* Vol. 1, p. 209: *anvākhyānam eva tarhīdaṃ mandabuddheḥ.*

14 *The Vyākaraṇamahābhāṣya,*Vol. 3, p.174.

15 Bhate and Kar [1992: 66, verse 80]: ... *śāstraṃ cakṣur apaśyatām.*

attitude to grammar is visible in their remarks on the relation between grammar and language. On a number occasions Patañjali and his followers have emphatically described the role of grammar as subservient to language. *Vyākaraṇa* is described by both Kātyāyana and Patañjali as *sadanvākhyāna* 'instruction in to that which is already existing.[16] Citing an analogy of a pot maker Patañjali maked a blunt remark on the secondary role of grammar *vis-a-vis* language. He says, "Nobody goes to a grammarian and asks "Please create words so that we will be able to use them" just as somebody would go to a pot made and say "Please make a pot so that I can use it."[17] The grammar is not allowed to generate new forms which are not found in the usage even if it is capable of doing so. The predominance of usage over grammar is very beautifully illustrated in the *Mahābhāṣya* in the story of a charioteer and a grammarian.[18]

This static approach to language as an all-time given event, as presupposed by the early Indian grammarians has resulted in arresting its growth as a spoken language. These grammarians are also responsible for restricting the use of Sanskrit to a limited number of communicative functions in its whole history. This *lakṣyaikacakṣuṣka* approach 'with emphasis on usage alone' was replaced by *lakṣaṇaika-cakṣuṣka* approach 'with emphasis on grammar' alone, in later period. A few words about this will be said later.

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16 *Vyākaraṇamahābhāṣya,* Vol. 1, p. 161: *sacchāstreṇānvākhyāyate sato va śāstram anvākhyāyakaṃ bhavati sadanvākhyānac chāstrasya.* "That which already exists is described by science or science is an instruction in to that which already exists because of the nature of science being that of an instruction into that which exists."

17 *Vyākaraṇamahābhāṣya,* Vol. 1, p. 7: *tad yathā ghaṭena kāryaṃ kariṣyan kumbhakārakulaṃ gatvāha kuru ghaṭaṃ kāryam anena kariṣyāmīti. na tadvac chabdān prayokṣyamāṇo vaiyākaraṇakulaṃ gatvāha kuru śabdān prayokṣya iti.*

18 The story occurs in the *Bhāṣya* on P.2.4.56. It goes like this: *evaṃ hi kaścid vaiyākaraṇa āha. ko sya rathasya praveteit. sūta āha āyuṣmann ahaṃ prājiteti. vaiyākaraṇa āha apaśabda iti. sūta āha prāptijño devānāṃ priyo na tv iṣṭijña iṣyata etad rūpam iti. ... vaiyākaraṇa āha āho khalv anena bādhyāmaha iti. sūta āha na khalu veñaḥ sūtaḥ sutater api sūto yadi suvateḥ kutsā prayoktavyā duḥsūteneti taktavyam.* (*Vyākaranamahābhāṣya,* Vol. 1, p. 488) The rough rendering the above passage would be as follows: A grammarian (who wanted to hire a chariot for going somewhere approached a 'chariot stand' and looking for the driver of a chariot standing there) asked "who is the *pravetṛ* (driver) of this chariot?" The charioteer (came forward and) said "Here I am, Sir, the *prājitṛ* (driver)". The grammarian said, "(*prājitṛ*) is a corrupt word." The Charioteer said, "My dear sir (literally 'one who is dear to god') you know what is (grammatically) applicable but not that which is applicable through desire (i.e., usage), this word (*prājitṛ*) is desired (by people)." (The charioteer then drove the grammarian a few steps. Due to the rough road the grammarian received jerks and bumps.) The grammarian said, "Ah, I am being hurt by this *duruta* (bad driving)." The charioteer said, "The word *sūta* is not derived from (*su+uta, uta* being derived from) root *ve,* but from (*suv+ta* i.e., from) root *suv.*" If contempt of the action conveyed by root *suv* is to be expressed *duḥsūta* is to be used."

The grammarians' approach to grammar appears to have sometimes covered a wider area, namely, an enquiry into the nature of science in general. Patañjali offers a number of definitions of science. *Nivartakam śāstram*[19] 'a science is preventive in character' is for instance, applicable to normative sciences. At one place he defines *śāstra* as both *kṛtakārin* 'doing what is already done' and *akṛtakārin* 'doing that which is not done' and illustrates how grammar has to be both.[20] Among his observations on science in general may be mentioned the statement, *na hi avyavasthākāriṇā śastreṇa bhavitavyam/ śāstrato hi nāma vyavasthā* 'science must not be a cause for disorder; system is developed through science'.[21] He further observes that a *śāstra* applies to universals rather than particulars.[22] Through all these definitions emerges the primary notion of science as a systematic body of generalizations about the reality.

Another striking feature of the concept of science emerging from the *Mahābhāṣya* is its close relation with the common life. Time and again Patañjali engages himself in the task of bridging the gap between *śāstra* and *loka,* science and ordinary practice. The abundantly used popular maxims scattered throughout the *Mahābhāṣya* dispel the myth that science is an enterprise to be carried on by a scientist sitting in an ivory tower. A few interesting illustrations will show how Patañjali tries to impress upon his student that a bit of commonsense is enough to unravel the knotty points in the science of linguistics.

While explaining the principle of *utsarga* and *apavāḍa* 'generalization and exception' Patañjali refers to popular practice of dealing with exceptions in two different situations described in the following illustrations:[23] *tadyathā brāhmaṇā bhojyantāṃ māṭharakauṇḍinyau parivevisṭāṃ nedānīṃ tau bhuñjāte/ loke hi saty api saṃbhave bādhanaṃ bhavati/ tadyathā dadhi brāhmaṇebhyo dīyatām/ takraṃ*

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19 *Vyākaraṇamahābhāṣya,* Vol. I, p. 60.

20 *Vyākaraṇamahābhāṣya,* Vol. I, 196: *akṛtakāri khalv api śāstram agnivat. tad yathā agnir yadadagdhaṃ tad dahati. ... . kṛtakāri khalv api śāstraṃ parjanyavat. tad yathā. parjanyo yāvad ūnaṃ pūrṇaṃ ca sarvam abhivarṣati.* "Science indeed does that which is not already done, just as fire burns that which is not already burnt. Science also does that which is already done. for instance, rain falls on whatever is devoid (of water) as well as filled (with water)."

21 *Vyākaraṇamahābhāṣya,* Vol. 2, p. 74.

22 *Vyākaraṇamahābhāṣya,* Vol. 1, p. 360: *ākṛtau śāstrāṇi pragartante.*

23 *Vyākaraṇamahābhāṣya,* Vol. 1, pp. 28, 115.

kauṇḍinyāyeti/ saty api sambhave dadhidānasya takradānaṃ nivartakam/

Some time while referring to ordinary practice Patañjali turns a humorist and is found engaged in passing his sarcastic comments on human behaviour. For instance, he says, "Although it is true that generally a person who has already taken food does not eat again or a person who has shaven does not shave again, sometimes we do find that a person eats again when there is a special dish or he gets shaven again if he comes across a special barber."[24] So there are some circumstantial factors which force a man to repeat an action. His frequent recourse to humour has nullified the concept of science as a pursuit of a resigned and callous mind. For him knowledge is a blissful experience. He has immortalized a cheerful and inspiring teacher making both teaching and learning an enchanting experience and leaving his electrified student in an ecstatic mood. A couple of illustrations of his instruction sparkling with humour will show how he tries to remove the barricade between science and art.

In the very beginning of his *bkāṣya* while explaining *dharma* 'merit achieved by the use of correct words as the purpose of grammar, Patañjali refers to the view of a student who argues, "If merit is achieved by correct use then the whole world will be invested with merit'. Patañjali asks him, "Why do you envy the whole world if it is gaining merit?"[25]

A similar argument by another student is recorded on the statement: *ekaḥ śabdaḥ samyag jñātaḥ śāstrānvitaḥ suprayuktaḥ svarge loke kāmadhug bhavati* "(Even) a single word properly understood and correctly used becomes the fruityielding cow both in heaven and in this world." The student asks, "If a single word is enough to yield fruits like a *kāmadhuk,* why is second or third word used? *yady ekaḥ śabdaḥ samyag jñātaḥ suprayuktaḥ svarge loke kāmadhug bhavati kim arthaḥ dvitīyastṛtīyaś ca prayujyate?* Prompt comes the answer, *na vai kāmānāṃ tṛptir asti,*[26] "there is no end to desires".

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24 *Vyākaraṇamahābhāṣya,* Vol. 1, p. 196: *na hi bhuktavān punar bhuṅkte na ca kṛtaśmaśruḥ punaḥ smaśrūṇi kārayati. nanu ca punaḥ pravṛttir api dṛṣṭā. bhuktavāṃś ca punar bhuṅkte kṛtaśmaśruś ca punaḥ śmaśrūṇi kārayati. ... . sāmarthyāt tatra punaḥ pravṛttir bhavati bhojanaviśeṣāc chilpigiśeṣād vā.*

25 *Vyākaraṇamahābhāṣya,* Vol. 1, p. 10: *yadi prayoge tharmáḥ sarvo loko 'bhyudayena yujyeta. kaścedānīṃ bhavato matsaro yadi sarvo loko 'bhyudayena yujyate.*

26 *Vyākaraṇamahābhāṣya,* Vol. 3, p. 58.

The *Mahābhāṣya* with its catechism interspersed with witty humorous remarks has thus made a landmark not only in the history of Indian linguistics but also in the history of scientific literature. Patañjali's contribution to the interpretative methodology applied particularly to terse texts like the *Aṣṭādhyāyī* has, perhaps, no parallel in the world.

With Bhartṛhari, another stalwart, the science of language has shifted its emphasis from word to meaning. His *Vākyapadīya* marks the beginning of a new trend in the development of linguistic thought in India. The science of language has established itself as a full-fledged system of philosophy at the hands of Bhartṛhari. While his linguistic monism appearing in the form of *śabdabrahman* provided a metaphysical dimension to Indian linguistics, the theory of *sphoṭa* as well as *vākyavāda* laid down the foundations of Indian philosophy of language. His outstanding contribution in the development of scientific thought consists, however, in his accomplishment in correlating grammatical as well as semantic categories with ontological categories. This achievement is characteristic of his unique approach described as perspectivism by a Western scholar.[27] For the first time in the history of science in India, and perhaps in the world, we come across an intellectual polymath advocating a multidisciplinary approach. Although credit goes to Patañjali for giving the first articulation to the multidimensional character of the science of grammar though in a restricted sense,[28] and also for placing grammar face to face with other branches of knowledge, it is Bhartṛhari, who, with his deep erudition in other disciplines profusely draws upon systems such as Nyāya and Mīmāṃsā for illustrating concepts used in grammar. His reconciliatory attitude reflected in his work is an argument to prove that no science can develop in isolation; it has to avail of the knowledge in other systems. Bhartṛhari has emphatically stated his philosophy of academics[29] and has lived it.

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27 Houben [1997: 317 -358]

28 *Vyākaraṇamahābhāṣya,* Vol. 1, p. 400: *sarvavedapāriṣadaṃ hīdaṃ śāstram. tatra naikaḥ panthāḥ śakya ārhdātum.* "This science (of grammar) belongs to all the Vedas. It is not possible to resort to one course (of interpretation)."

29 For instance, towards the end of the second Kāṇḍa (II.489) Bhartṛhari says:

prajñā vivekaṃ labhate bhinnair āgamadarśanaiḥ /
kiyad vā śakyam unnetuṃ svatarkam anudhāvatā //

Intellect is equipped with the power of discrimination by (the study of) various schools of knowledge and systems of philosophy. How much it is, indeed, possible for one following his own logic to progress?

The later history of the Indian grammatical traditions shows a two-fold development: 1) commentarial literature and 2) semantics as a separate component of linguistics. The process of the reorganization of Pāṇini's grammar into a system of derivation which started around the tenth century A.D. and culminated in the *Siddhānta-kaumudī* of Bhaṭṭoji Dīkṣita in the 16th century was the result of the need for a more sophisticated pedagogical model of Pāṇini's grammar. This process traditionally called *Prakriyā* helped reestablish the study of grammar in traditional schools. Through a number of commentaries and super commentaries Bhaṭṭoji and others engaged themselves in the task of rendering the system foolproof and immaculate. As Cardona has already observed, the commentators approached Pāṇini with certain assumptions such as the ability of the grammar to account for usages for all times and its most succinct character.[30] Due to these assumptions the commentators are found often squeezing out the desired meaning from a rule rather than interpreting it in its own light.

The *lakṣaṇaikacakṣuṣka* approach is a distinct feature shared by the semantic tradition with the commentarial literature. Due to their commitment to the grammar rather than to the language these grammarians involved themselves in the hairsplitting discussions and lengthy arguments to establish inherent harmony of the system. In their efforts to justify every single word and letter of the Masters by providing examples and counter-examples they did not mind taking recourse to intellectual gymnastics. Overemphasis on theorization compelling the whole tradition to provide examples and counter-examples for every rule led to the creation of what is called "grammarian's Sanskrit."[31] This language which can be reconstructed from the illustrations in these grammatical works appears to have started taking shape in the ancient most commentaries like the *Mahābhāṣya* and the *Kāśikāvṛtti*. However, it flourishes in the later period. The whole tradition appears to be unmindful of the semantic compatibility *yogyatā* as one of the primary criteria of a communicative system.

However, behind this intellectual gymnastics which is characteristic of the whole intellectual tradition of that period stands the ardent faith of the followers in their forefathers and their sincere and keen desire to highlight the magnificent achievements of the

30 Cardona [1980: 289-90]

31 I have discussed this point in detail in Bhate [1996: 90-97].

master-mind in their discipline. Even a cursory glance at the elaborate discussions on certain points in commentaries like the *Śabda-kaustubha* and *Uddyota* reveals that these grammarians have left no stone unturned in their efforts to fully establish the greatness of the pronouncements of their masters. Their marvelous skill and amazing patience in carrying out investigations in to the statements of the early grammarians, their computational approach and multi-pronged attack are the special contributions of the later grammatical tradition to the methodology of science in general.[32]

Reference was made earlier to the unfailing faith in and a strong commitment to the *trimuni* tradition shown by the later grammatical tradition. However, it is not a blind faith. There is always an utmost effort to guard the system against all possible objections by providing a sound logical basis. The genius of these custodians of tradition is tested when they encounter internal contradictions among the three *munis.* For instance, while justifying Patañjali's acceptance of five internal efforts against Pāṇini's tacit acceptance of four, Bhaṭṭoji argues that Patañjali's view is also based on experience and hence acceptable.[33] This shows how the Indian grammatical tradition which mainly consists in the transmission of the legacy was supported, from time to time, by empirical testing. The deep faith did not detract their ability to ratiocinate. On the contrary these grammarians developed their own discursive logic which was capable of accommodating faith. Grammarians as early as Kātyāyana have set up a tradition of expressing discord with their Master. One should not be obvious to this openness and honesty of approach amply reflected in the whole grammatical tradition.

To sum up the special contributions of the Indian linguistic tradition to the development of scientific thought we can mention the following:

(i) Pāṇini is the first linguist of the world who provided a formal design for science.

(ii) Mathematical formulae were employed to describe non-countable functions.

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32 I have discussed this point in greater detail in my paper entitled "Exegetics of Sanskrit Grammar" unpublished, typescript where I have described with illustrations some features of the methodology of interpretation of later Indian grammatical tradition.

33 *Śabdakaustubha,* p. 117: *bhāṣyakārās tu nājjhalāv ity asya pratyākhyānāvasare ūṣmaṇāṃ svarāṇāṃ ca īṣadvivṛtatvaṃ vivṛtaṃ ceti vailakṣaṇyaṃ vakśyanti tad api anubhavānusāryeti sahṛdayair ākalanīyam.*

(iii) The science of language set up a scientific methodology which influenced the development of scientific thought in India to a great extent.

(iv) The first Indian grammar developed a full-fledged metalanguage which was accepted as the metalanguage for writing grammar of any language.

(v) The later linguistic tradition developed a special kind of discursive logic which was adapted to Indian ethos.

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