

**THE VEDANGAS
FOR
THE FIRST TIME READER
BY
N.KRISHNASWAMY**



PANINI

**AS REPRESENTED ON A
COMMEMORATIVE POSTAGE STAMP
ISSUED BY THE GOVERNMENT OF INDIA**

A VIDYA VRIKSHAH PUBLICATION



AUM

IS THE SYMBOL OF
THAT
ETERNAL CONSCIOUSNESS
FROM WHICH SPRINGS
THY
CONSCIOUSNESS OF
THIS
MANIFESTED EXISTENCE

THIS IS THE CENTRAL TEACHING OF THE UPANISHADS
EXPRESSED IN THE MAHAVAKYA OR GREAT APHORISM

तत् त्वं असि

THIS SAYING **TAT TVAM ASI** TRANSLATES AS
THAT THOU ART

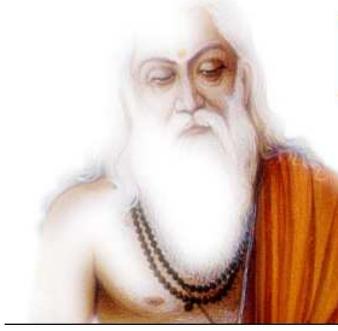
Dedicated to
Natesan
who lived the life of a Jeevanmukta

ACKNOWLEDGEMENT

This book is less a fresh composition than a compilation of relevant information derived from the Internet, specially those wonderful compilations of the Wikipedia, and writings of authors like Fruits Staal and others. I have not sought prior approval from them or their publishers as this book is intended for free distribution to and for the benefit and pleasure of a small circle first time readers among my friends and well-wishers. For these trespasses I seek the pardon of the authors and publishers and I express my gratitude to them.

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THE VEDANGAS FOR THE FIRST TIME READER

PREFACE

In the ancient Indian approach to knowledge, the individual could take an intellectual position from where he could proceed in any of two directions : one probing with his resources of faith, instinct, and intuition to a synthetic understanding of existence in terms of the highest levels of abstractions in the widest possible philosophical or spiritual context; and the other, probing with the resources of thought, sound, word and meaning to an analytical understanding of the deepest detail of the specifics of the more immediate and compelling circumstances of physical existence. The terms Sruti and Smriti applied to the ancient sources of Knowledge seemed to reflect this dual approach. If the Vedas or Scriptures followed the direction of synthesis, the Shashtras or Disciplines followed the direction of analysis. If Vyasa and the Rishis before him were exemplars of the first group, Panini and the Linguist-Grammarians who followed were clearly the exemplars of the second. In respectively presenting truly massive perspectives of these two approaches to knowledge, Vyasa and Panini had an awesome reputation that raised them to the status of divinity. They were indeed the only two of the ancient seers whom Sankara addressed as Bhagavan.

Where do the two apparently diverging paths of synthesis and analysis ultimately take us ? Some irreverent wags have it that both seek to know more and more, the first about larger ideas at level of principle and the second about smaller details at the level of fact, but both ultimately learn everything about nothing. Yet, the ancients of India on both sides of this seeming semantic divide, remained committed to a total over-arching Unity of all principle and fact, where divisions were but constructs of a roving mind that could proceed, indeed wander, in any direction it chose.

In understanding these two perspectives of Knowledge, one must first take note of the fact that the Scriptures or Vedas are described as Sruti, what was heard by the ancient Rishis. That they were “Aupurusheya” or Divine, and “Anadi” or Timeless, were not so claimed in the Vedas themselves but were so described by later texts like the Mimamsa, to invest them with the status of a divine authority that placed them beyond question. Few however would doubt that the Rishis who composed them were men of great insight and what was “heard” by them could well be understood as what they received in inspiration, and were therefore considered as authoritative prescriptions that were beyond question. In contradistinction, texts like the Vedangas that later, sought to elaborate or explain what the Vedas said or meant, were considered to be Smriti, the products of lesser minds, that could be questioned, debated and even contradicted. The

fundamental debate on whether knowledge could be authoritative or empirical continues to the present day, with scholars ranged on the two sides of the divide, especially between those referred to as the Darshanikas or philosophers, and the Vaiyakaranikas or grammarians, and often taking seemingly opposite and irreconcilable positions in respect of the knowledge about Reality of Existence.

It should also be noted that the Vedas, whether considered authoritative prescriptions or not, did present knowledge at two levels; one addressing the small number of higher aspirants in terms of spiritual knowledge; and the other addressing the large mass of common people in terms of physical, ritualistic activity. The distinction clearly arose from the level and extent of understanding that obtained at their respective levels. And in any case, with the Vedic texts being far too esoteric and cryptic for easy or clear understanding, there was a serious need for elaboration and explanation of the texts so that their content and intent could be maintained and preserved in their pristine purity for all time. This need was fulfilled by successive generations of scholars focusing on one or other facet of the textual corpus of the Vedas. It was this impetus that led to the creation of the Vedangas, meaning limbs of the Vedas. Two of the Vedangas, Jyotisha (Astronomy and Astrology) and Kalpa set out details respectively, of how the auspicious time and place for the performance of rituals could be determined and how precisely, the rituals should be organized and conducted. The other four of the Vedangas addressed the structure and function, the Word content and the Meaning intent of the Vedas, through the disciplines of Siksha (Phonetics), Nirukta (Etymology), Vyakarana (Grammar), and Chandas (Poesy).

Over the succeeding centuries, each elaboration of the content of the Vedas and Vedangas generated a vast corpus of various disciplines and sub-disciplines by scholars of exceptional merit. The analysis of the early scholars like Yaska, Panini and Patanjali, continue even to this day, to unleash a vast proliferation of knowledge in the fields of linguistic disciplines like Phonetics, Phonology, Morphology, Philology, Etymology, Semantics, Pragmatics, Epistemology, Ontology etc, with the highest of modern scholars like Bloomfield and Chomsky acknowledging that they drew their inspiration ultimately from those awesome early pioneers.

Today Panini is acknowledged as the first and greatest grammarian known to any of the world's cultures, with an influence reaching even into the structures of computer languages of today. And the content of the Jyotisha and the Kalpa Vedangas have been shown to carry a great range and depth of knowledge of Astronomy and Mathematics and have also been considered by many great scholars to have indeed been the ultimate source of the knowledge of these subjects that for long had been attributed by historians to other ancient cultures like those of Egypt, Greece,

Sumeria and Mesopotamia One of the striking features of the ancient knowledge of India, documented in its Srutis and Smritis, is the range and depth that it achieved over 3000 years ago, through the use of just one instrument, man's own mind, and had anticipated so much of what the modern mind had achieved but with the aid of the vast methods and instrumentation of Science. The range and depth of the ancient knowledge is however recognized today as so incisive, that they have had a profound influence on modern studies especially in the area of linguistics,. And much of the ancient knowledge in this area form the corpus of the Vedangas.

The central concern of the ancient Rishis of India, revolved around the basic question of existence and its meaning and purpose. The starting point of their philosophical formulations was that existence was a manifestation of something that was finite in terms of time and space from out of something that their intuitions indicated as being infinite and eternal. Existence as a manifestation, implied creation of form with a purpose, which meant an action with a result, or a cause with an effect. This generative concept evolved in a variety of contexts, like sound generating the word, or as the ancient grammarians proposed, at the later levels of development, the cause-effect chain of thoughts generating words, and from within the domain of words, the verb generating the noun, and then the sentence and language as the final vehicle of meaning.

Sound in the ancient Indian tradition was considered the first manifestation of a divine vital energy or Prana, the vital energy that created and sustained all life and its activities. Sound in its crudest form is what we call noise, an unregulated chaos of vibrations or what in physics might be called frequencies. The word 'vibrant' suggests something that is full of energy, full of life. Vibrations in the air register on our ear as sound, and if they are in the higher frequencies they may register on our eye as colour, or on our skin as heat or on our wireless instruments as a buzz, all of which we describe as noise until they become vehicles bearing significance of some kind, like meaning. Once frequencies become more regular, they become recognizable as tones and if they fall into the intervals of an octave, they acquire the more attractive forms of music. The voice box of all creatures produce all these shades of sound, ranging from the croak of a frog to the song of the bird. While man too can sing, he has the endowment of a powerful mind that uses sound for articulating his thought into the word, laden with meaning and structured by language for communication with the world around him. The mind of man also gives him a host of other capacities : the capacity to count and calculate, draw and measure, compare and contrast, differentiate and integrate, elaborate and explain (and also confuse and confound), observe the external world around him, store internally what he sees, hears or otherwise senses, as images or words and reflect on all that happens in the world within him.

These skills lead him into deep understanding and great accomplishments of knowledge of both the external world of Nature and internal world of the human Nature. And given the duration and rhythm of the breathing process, when the Rishis committed all this knowledge to the word in the Rig Veda and Sama Veda, it seemed just natural that they should set the word to poetry and music in the rhythms of metre and tala

A sound when the mouth was opened, automatically became the sound of the letter A or its equivalent in all languages. As the mouth started closing, the sound gradually morphed into the sound of U, and when the mouth was closed with the sound continuing, became the hum of the silent M, a hum that even then, retained its capacity for music ! Here then was the first word "AUM" proclaimed by the Vedas as the very first manifestation of the Divine as the Word ! Of course, the mouth continued to use the different parts of its anatomical structure to give further shapes and stresses to these basic vowel sounds. It used the throat, palate, tongue, teeth and lips to create the guttural, cerebral, palatal dental and labial consonants that could then create all the possible basic sound components of speech, not surprisingly, common to virtually every language spoken by man. The pure sounds that originated in the vocal chords were the Svaras or vowels and when these were shaped by the different parts of the mouth, they became the Vyanjanas or consonants of the Sanskrit alphabet. It is of special interest that the shaping of sound as it emerged from the throat to the lips should be reflected correspondingly in the Ka-Cha-Ta-Tha-Pa syllabic groups of the consonants, five in number, called the Vargash. What should surprise the first time reader is that these components were first suggested in the Vedas and clearly elaborated later by the Shiksha, one of the six Vedangas, constituting a masterly exposition of the disciplines of Phonology and Phonetics developed in India, long before any other culture of the world had anything comparable to show for itself.

Again, early language often used letters of the alphabet for numeric representation, till the appearance of specific symbols and words standing for numbers. The external world needed to be understood as much in quantitative as in qualitative terms. Time and distance required to be expressed in units. One early device was to embed numeric codes through letters in texts. A typical example was the Katapayadi scheme where one could derive the numeric position of a Raga in the 72- Melakarta Raga scheme of Carnatic music, from the letters that figured in the name of the Raga. That scheme that tabulates the system of 72 basic ragas derives from a permutation and combination of the 12 half-tone intervals that comprise the octave and that figures so universally as to suggest an almost natural endowment or inheritance of all mankind. One can recognize in these devices, the concepts could have led inevitably to the development of mathematical symbols and skills, and on the later

development of advanced levels of knowledge in Mathematics and Astronomy. A fascination for Music, Mathematics and the Stars, leading on to God, would seem to characterize man everywhere and at all times !

This brings us squarely into the discussion of what Words mean and indeed to the philosophical question of what Meaning itself means. A fundamental question then is, where does meaning come from ? From the thought, the word, from the choice or sequence of words, the whole sentence, or even the silent expression of what is not spoken ? Is there a gap between what is said and what is meant, and if so, how is it bridged ? These are the central concerns of language, communication and meaning. And it is these questions that are addressed by the Vedangas. These disciplines of the Vedangas were later elaborated, codified and presented in extraordinary range and depth by a succession of the early brilliant scholars like Yaska, Panini and Patanjali and the later ones like Bhartrhari.

Their concepts reach down today in every significant work of modern linguistics Panini's central work, the Ashtadhyayi, so named after the eight chapters that comprise the work, has the totality of the Sanskrit language corpus, analysed and presented as rules of grammar in a total of 3998 Sutras or aphorisms of phenomenal brevity. It has indeed been considered a masterpiece of encapsulation of the entire science of linguistics in a way that George Cardona says : "*Panini's grammar merits asserting ... that it is one of the greatest monuments of human intelligence*".

An enormous amount of scholarly writing has been addressed to the chronology of development of the various disciplines covered by the Vedangas. Much of this seeks to place the origins of these disciplines in various points of time three or more millenia ago and various places like Egypt, Greece, Asia Minor, Mesopotamia and India, with passionate claims for each location. Early Western scholars tended to say everything originated in Greece, till investigations started unveiling incontrovertible evidence from other locations. Claims of India remained unrecognized for a long time, simply because of want of physical recorded material such as were available in other locations, and simply because the significance of the what was derived from a largely oral tradition, in Sanskrit could not be understood or evaluated. Texts and scholars from India were simply not heard.

While Western scholars began to see significances in the Indian tradition in the 19th Century, it was really in the next century that showed great advances in Western scholarship in Sanskrit, when the traditional Western biases started wearing down, and a true understanding and evaluation of the ancient tradition began to be realized. They began indeed to recognize an extraordinary commonality binding languages across the cultures of

East and West, to suggest a common Indo-European heritage, that is easily recognizable in the following table of names of numbers

THE NAMES OF THE NUMERALS IN NINE INDO-EUROPEAN LANGUAGES

ENGLISH	SANSKRIT	PERSIAN	GREEK	LATIN	LITHUANIAN	CELTIC	GOthic	GERMAN
ONE	EKA	YAK	ELS	UNUS	VINAS	ONE	AINS	EINS
TWO	DVA	DU	DUO	DUO	DVY	DAU	TWAI	ZWEI
THREE	TRI	SIH	TRELS	TRES	TRYS	TRI	THREIS	DREI
FOUR	CATUR	CHAHAR	TERSSARES	QUATTAR	KETURI	CETHIR	FIDWR	VIER
FIVE	PANCA	PANJ	PENTE	QUINQUE	PENKI	COIC	FIMF	FUNF
SIX	SHAT	SHASH	EZ	SEX	SZEZI	SE	SAIHS	SECHS
SEVEN	SAPTA	HAFT	EPTA	SEPTEM	SEPTYNI	SECHT	SIBUN	SIEBEN
EIGHT	ASHTAU	HASHT	OKTO	OCTO	ASZTUANI	OCHT	AHTAU	ACHT
NINE	NAVA	NUH	ENNEA	NOVEM	DEVYNI	NOI	NIUN	NEUN
TEN	DASHA	DAH	DEKA	DECEM	DESZIMT	DEICH	TAIHUN	ZEHN

Even so, many Western biases persisted, and even today, scholarly opinion remains divided on the origin in place and time, not only the Vedic civilization, but of many ancient knowledge disciplines that formed part of it, especially in the areas of astronomy and mathematics. The conflict of scholarly opinions, such as those of Shrikant Talageri and Michael Witzel, have indeed taken extreme positions of hostility. It is possible however, that all findings or points of view of scholars still rest on inadequate and inconclusive evidence, if we consider that only physical evidence is acceptable. It does not however make sense to quarrel over such issues. It matters little whether the theorem on the right-angled triangle originated from Pythagoras or from the Shulba Sutras. We need to be generous enough to accept it as wonderful human contribution of fellow-human beings, often concurrent or consecutive by accident, and not get drawn into an East versus West song and dance. There seems however, to be one point on which there is general agreement across all shades of opinion : that among all the known cultures of the world, the Indian contribution to an understanding of the philosophy of Language and the mechanics of Linguistics is the oldest and most pre-eminent. And this a position obtaining today that surely originates from the Vedangas.

What then is unique about the Indian contribution ? One of the most crucial starting points was the unquestioned sanctity of the word of the Veda, which presented man's inner and outer world as an indivisible continuum of a Reality that was Infinite and Eternal, and that the best that man could do to understand this Reality was through finite bits of this

Reality symbolized by the word. The early scholars started looking at the word of the Veda as something that originated from the intuitive, perceptive mind of the Seer, become a vehicle of meaning, and lend itself to articulation in speech to enable a sharing of all that it was intended to convey. The mind then, clearly bore the faculty, that could just with a thought, initiate the chain of inner events that culminated in the spoken word. The scholars reflected deep on these inner sequences and named the starting point the Sabda, the pure sound or wordless language, originating in turn from an Ultimate Reality called the Sabda Brahman. The Sabda carried the creative energy to shape an intent or meaning into a word and transfer its energy to the vocal chords and cause the word to be articulated. The meaning could come from a recall of an earlier experience stored in their original words, or a new thought or a new experience or meaning, and clothe it in one of the older words, creating additional meanings for the same word, or create a new words derived from the old words or create new words altogether.

The early scholars who first received and reflected on the text of the Vedas were clearly overawed by the range, depth and value of knowledge that was embedded in their hymns. They saw that the Rishis were persons of extraordinary vision, intellect and intuition who set their inspired visions to words. It was inevitable therefore to invest the content and intent of these hymns with an authority and a sanctity of Sruthi, or divinely inspired works and canonize them as a sacred scripture. It became their sacred responsibility to establish every possible discipline, organization and method to ensure that they would be maintained in their pristine purity for all time.

The first step was to establish an iron disciple for the recitation of the texts, and this became the Siksha Vedanga. A basic step was to compile authoritative lists of the words of which the texts were composed, lists later referred to as the Nighantu, on which the onward related disciplines could then be built. A clear understanding was set out on how basic sounds were physically generated and then shaped by time intervals and stresses and euphonic considerations into the basic components of speech. We see here the first formulations of sound into the gutturals, cerebrals, palatals, dentals and labials; the rising, falling and modulating stresses, analogous to the modern diacritic variations of the accent, grave and circumflex; and the euphonic changes at word junctions, typified in variations in the use of the indefinite article in English as between say, “a ball” and “an apple”. All these formulations represented the oldest known compilations of Phonology and Phonetics presenting concepts that remain valid to the present day.

To explain the Vedas the ancient scholars had obviously to start with the words of the Vedas, and then start looking at the words that had

proliferated subsequently, and then determine whether these processes submitted to specific rules or disciplines. The earliest of these exercises were embodied in the Pratishakyas, that attached as explanatory notes to each Veda.

By the time of Panini, the structure and vocabulary of Sanskrit had greatly expanded and it was to this expanded word Universe that he addressed himself. He not only established a rule base governing their totality but went on to state the rule base in terms that would apply to the future growth of Sanskrit, and state these in generalized terms that had obvious applicability to the growth of languages in general even extending to computer languages of today. The first major developments in the progressive evolution of modern Linguistics, in the works of Saussure, Bloomfield and Naom Chomsky were greatly inspired by the work of Panini, which they acknowledged in glowing terms.

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CHAPTER 1 : INTRODUCTION

The word Vedanga means a limb or aid or auxiliary of the Veda. The word Veda means Knowledge, being derived from Vid, which means to know. And the Knowledge that Veda stands for, refers to the Knowledge of the One Reality, the One Absolute, the One Truth. Not just the reality of existence as it appears within our cognition, that is Transient, Relative or Partial, but that is Knowledge of the One behind the Many. In this search for the One Truth we subject everything that we know to the unrelenting questions : What, How, When, Where and Why.

The first reference to Vedangas is made in the Mundaka Upanishad in the following words :

तत्रापरा ऋग्वेदो यजुर्वेदः सामवेदोऽथर्ववेदः शिक्षाकलपो व्याकरणं

निरुक्तं छन्दो ज्योतिषमिति । अथ परा यया तदक्षरमधिगम्यते । ५ ।

Of these, the lower comprises the Rig Veda, Yajur Veda, Sama Veda, Atharva Veda, Shiksha (Phonetics), Kalpa (the code of rituals), Vyakarana, (Grammar), Nirukta (Etymology), Chandas (Poesy) and Jyothisha (Astrology and Astronomy). The higher knowledge is the one by which the Imperishable One is attained. (5)

Cognition itself addresses two levels of reality : an Absolute and a Relative, a Conceptual and an Empirical, a Mental and a Physical. We see existence as a matrix of Energy, Space and Time springing from One Consciousness. We utilize Energy in the form of Sound, and Sound in the form of Speech to relate to all these levels. The Veda itself rests on the articulated word, which we use for identifying the different levels of existence that are presented to our cognition. At the physical level we relate to a world of activity in an environment of objects. The Vedas use the Word to present an integrated view of the inner world of the Mind and the outer world of Object and Activity. The Scripture uses the words Mantra, Yantra and Tantra to symbolize Thought, Object and Activity . That integrated view is what we call meaning.

Do we have a complete view of the meaning of every word in the Vedas ? The simple answer is No. Every word has a deeper, higher meaning originating in the mind itself, and a superficial lower meaning resting on what we take in from the physical world, through our senses. Grasping the

meaning at both levels requires two levels of vision, sight on one, insight on the other. The ancient Rishis presented the Vedas in words representing a total vision of all existence. The scholars who followed later, and who realized their true meaning and value, felt it necessary to establish mechanisms for their preservation, transmission and understanding through time, for the benefit of posterity. It was their effort that resulted in the six Vedangas.

Four of the Vedangas were addressed to the structure and function of the word content of the Vedas : Shiksha or Phonetics for their correct articulation; Nirukta or Etymology, on how the words originated; Vyakarana or Grammar, on how words should be used in sentences to convey meaning; and Chandas how sentences should be rendered as music or poetry through metrical structures, The other two Vedangas went beyond the realm of the word, to address the realm of activities and objects : Kalpa or Ritual, on how and with what objects and actions, sacrificial rituals should be conducted; and Jyotisha or Astronomy on how time and place for the conduct of the sacrifices should be determined. The first four Vedangas present a remarkable treatment of the entire spectrum of the discipline Linguistics, that are recognized today as directly relevant to the formulations of modern linguistics. The last two are also seen to have a remarkable conceptual anticipation of many aspects of Astronomy and Mathematics of the present day.

Even a cursory reflection on the idea of existence will tell anyone at once that it is whatever is set in a framework of Space and Time. Existence also has two. basic dimensions : the external physical, and the internal mental. The deeper reflections of the ancient Seers reflected probed far beyond and deep into these two dimensions, both within the internal world of the individual and the external reaches of the cosmos. Looking at the heavens they saw massive units of distance and time at work, which seemed to be vastly scaled down to reach down into the internal consciousness of the individual. The energies and configurations of the planets and stars seemed to have their counterparts in the energies and the cells that supported life in the individual and share in what could best be described by a continuum of a single vast consciousness that was presented as existence. Time too, seemed to share the same quality of presenting vast units of aeons scaled down to the time rhythms of the years, seasons and days and nights, which invested the planets and stars with the same regularity as the heart-beat and breath of the individual, giving them the same sense of belonging to a single continuum of systemic existence. From these concepts the Seers drew the inspiration of the highest values relevant to a spiritual life and the knowledge of the most practical values to a physical life : the first, finding expression in the Vedas and the second, leading to the Vedangas.

The uniqueness of the ancient Indian Knowledge tradition lies in its avoiding the narrow perspectives arising from the usual dichotomy of approach, of integration and differentiation, or synthesis and analysis. Instead it insisted and persisted in consistently pursuing and presenting everything within a holistic approach, always seeking analytical insights, yet absorbing them in the earlier synthesis. It never conceded that, as the cliché has it, that the “sky is the limit” in any area of thought, but indeed that there were no limits to anything, except those that our faculties might impose on us, or that we might momentarily assume for life’s transient, practical purposes. Knowledge had first to come to terms with and explain the meaning and purpose of existence. In contradistinction to other cultures, the Seers and Scholars, the Rishis and Acharyas of India, all seemed to constitute a really large collegium working within such a shared holistic view of existence. The Rig Veda alone records the contributions of nearly 350 Rishis sharing this holistic vision, though giving expression to them through a vast number and variety of separate hymns. The entire course of subsequent Indian scholarship treated their formulations as part of a sacrosanct holistic foundation of ultimate knowledge (or knowledge of the ultimate) on which they founded their differential or analytical elaborations or explanations. The philosophical vision of the Rishis conceived of an eternal state of “Being” presented as finite “appearances” through a process of “Becoming” through transient intervals of space and time. This ontological approach lent itself to explanation of states and processes addressed by virtually every branch of empirical knowledge. In the explanations of language, speech and word, for instance, “Being” and “Becoming” became in the conceptual downstream, the “thought” and the “word”, or in more generic terms, the “verb” and the “noun”, and this led Yaska in his Nirukta, to state that verbs were the cause and nouns the effect, or, in other words, all nouns originated from verbs, which therefore constitute of roots of all words. In the field of Linguistics, we will now see why the depth and profundity of Yaska remain unexcelled by all later scholarship. Yāska also defends the view, presented first in the lost text of [Sakatayana](#) that etymologically, most nouns have their origins in verbs. An example in English may be the noun *origin*, derived from the Latin *originalis*, which is ultimately based on the verb *oriri*, "to rise". This view is related to the position that in defining agent categories, behaviours are ontologically primary to, say, appearance. This was also a source for considerable debate for several centuries.

This philosophical perspective clearly enabled the ancient scholars to make their analysis of any subject reach out to its greatest possible width and its greatest possible depth. The perceptions of language and communication in relation to knowledge spread all the way from the impulse and thought that manifested from the unconscious and took the form of words, which were then strung together as a sentence and invested with meaning in the conscious, and shaped as sounds with appropriate modulations and stresses in throat and structures of vocal

passage and finally emerged from the mouth to launch the process of communication. And that chain became complete with a corresponding, complementary process in the person receiving the communication. Taking the words of the Vedas as the first sacrosanct starting point, each of the above link sequences in this long chain from thought to speech, were then analysed in depth and expressed in terms of principles and rules which went on to form the disciplines of the Vedangas. The ancient scholars who later built on the word foundations of the Vedas, saw too, that its words had to submit to the compulsions imposed by the physical speech mechanisms on modulations, stresses and articulation and also the time limits of the exhalation phase of respiration, when alone these could occur. This led them clearly to the rules of recitation, especially the euphonies of smooth transitions between words that determined the rules of Sandhi referred to in the Shiksha and the Nirukta and the metric measures of the Chandas.

The Vedangas are thus, the six auxiliary disciplines for the understanding and tradition of the [Vedas](#). Traditionally, Vyakarana and Nirukta are shared across all four [Vedas](#), while each Veda has its own Siksha, Chandas, Kalpa and Jyotisha. Later, they developed into independent disciplines, each with its own corpus of Sutras. These ancient disciplines became the foundations of virtually all the disciplines that obtain today, of Phonology, Phonetics, Etymology, Philology, Semantics, Syntax, Grammar, Aesthetics, or the History, Psychology and Philosophy of language, or any aspect indeed of Linguistics.

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CHAPTER – 2 : JYOTHISHA – ASTRONOMY & ASTROLOGY – SPACE & TIME

The story is told that as the grammar of the Russian language does not have the definite and indefinite article, a Russian, not having a watch, and wanting to know the time, asked Einstein “What is time”. And Einstein replied that that was what he had spent a lifetime to discover.

In another context, millenia ago, the Indian ancients too may have given a similar answer. They did indeed spend a lot of time studying and reflecting on Space and Time. On the one hand as they gazed at the cosmos, they noted the vast finite stretches of Space, stretching out to Infinity. On the other hand, they saw finite stretches of Time, marked by the yearly encircling of the earth around the sun in a never ending cycle of Eternity. They saw too that being able to visualise all this, human consciousness, notwithstanding its finite and transient character, must clearly be a finite part of an Infinite and Eternal Consciousness. Our finiteness in Time was marked by the cyclic succession of days and nights and months and seasons, regulated by the relative movements of the sun and the moon. The watch on the wrist or the calendar on the wall were but tiny local devices that reflected the time keeping functions of the Sun, Moon and the stars. The days and nights decided when we could work and rest, and the months and seasons told us when we could sow and harvest, and the years determined when we could marry and procreate or call it a day. The ancients taught that all these came as blessings from a higher power for which we must offer our loving gratitude at least in a symbolic way, through ritual and sacrifice. The planets and the stars seemed indeed to ordain the time and place of everyone of our activities. It became important therefore that we set a time and place, as set by the stars that was auspicious for the conduct of all actions, and this was particularly so in respect of rituals and sacrifices. Small standard lengths of tiny units of distance in Space became necessary to measure out areas of land for food crops or the dimensions and shapes of for structures and materials of sacrificial altars and led to the development of numbers and shapes of arithmetic and geometry. These along with details of the time and activity content of the sacrifices, got vastly elaborated and came to form the guidelines and disciplines of the Kalpa Vedanga. This was how the ancients related in finite terms to the Infinite expanses of Space and Time

The rationalist might look askance at the use of the word “auspicious”, in relation to time and place of any event. But might feel more comfortable with words like “timeliness” or “appropriate” which could equally well sum

up the intent of Jyotisha. If the ancients took an integrated approach to the study of astronomy and astrology, it came simply from an unquestionable conviction that all activity had an appropriate, if not indeed inevitable, setting of time and place. And then they went on not only to build a vast corpus of observation of astronomical phenomena but how these were seen to be associated with human activities and relationships. These associations were generally presented as probable, never asserted as inevitable, as some astrologers may be prone to do. Indeed when any planetary conjunction suggested possibility of an unfavourable event, it was invariably accompanied by advice on a ritual that could avert, if not mitigate that event, what was referred as a Parihara. Implicit in such advice was that it prepared a person with an attitudinal or psychological preparedness for whatever might happen, to the point that it could indeed avert if not mitigate that event. Surely this could be considered to have as much logic to it as the advice of a doctor or a psychiatrist today to a person with an ailment. The advice or guidance of the ancient scholars clearly rested on an abundant mix of reason, commonsense, concern and goodwill. The superstitions and distortions of later times certainly do not reflect accurately the true sense and a legacy of ancient times.

When we talk of space, we immediately come up to concepts of shape and size and their dimensions and inter-relationships. We start with numbers, the most abstract mode of quantification, be they of sizes or distances, or indeed of anything. When we talk of size, we start with the point, something without dimensions. From the point, we draw a line as a measure of length or distance and an indicator of direction. From the same point we draw another to line enclose an angle, Join two points on these two lines and you get a triangle with the added dimension of a planar area. Join more points on the same plane and you get polygons of different shapes and sizes. Join a very large of points in a plane equidistant from the starting point, now designated the centre, and you get the many-sided polygon starting to acquire the perfection of the circle. But let the centre point grow equally in all directions on a plane, you get the perfect circle, and expand the point in all directions in space, you get the perfect sphere. At this stage your sphere (or irregular shape or space, depending on how it is developed) is still a figment of your imagination, but fill it up with matter and add colour, and you get a solid, a physical existence, a house perhaps, or if you are God adding a vast variety of solids. liquids and gases, and living and non-living things, you might be creating the Cosmos itself ! And for all this with their vast dimensions, you start from a point with no dimensions ! And all this is precisely the cryptic description of the Creation of the Cosmos given in the Purusha Sukta of the Rig Veda. (RV – X-90) And all this is both implicit and explicit in terms of the Mathematics of the Kalpa and the Astronomy of the Jyotisha.

Embedded and implicit in the Mathematics of The Kalpa, presented in the Shulba Sutras, that deals with the construction of the Vedic Altar, as a symbol of the Cosmos, are all the disciplines of arithmetic, algebra, and geometry, within a conceptual frame that not only anticipates but goes far in conception, beyond Pythagoras and Euclid and Newton and Einstein. There is here a basic common symbolism that unites arithmetic, algebra and geometry. When historians propose that algebra originated from the Arabs and geometry from the Greeks, they are missing the fundamental philosophical and intellectual framework of the Indian ancients from whom the basic concepts of these disciplines originated though stated in different words. The modern scholar is often conditioned by the narrowness and rigidity of modern definitions. Thus, while he may consider $a^2 = b^2 + c^2$ to be an algebraic representation of geometry theorem of Pythagoras, it is not very different from its Vedic expression as a arithmetic triple like (3,4, 5) that is a specific example of that relationship, when one considers 3, 4, and 5 to be symbols just like a, b and c. Indeed there is such an overwhelming symbolism in general Vedic usage that could suggest for it an almost natural algebraic orientation and also equally suggest how it anticipates the concepts of modern semiotics.

Vedic Astrology is based on a detailed understanding of naked-eye observational astronomy. Astronomy is highly developed in Vedic culture, and it is essential for astrologers to have an intuitive grasp of the astronomical concepts and relationships that bind the human and the cosmic in a common existence, as conceived in Jyotisha. A competent Jyotishi or astrologer should be able to understand and visualize astronomical phenomena like the rotation of the earth and its revolution around the sun, the equinoxes and other movements of the sun causing the seasons, solar and lunar eclipses, the concepts of solar and lunar months, the arrangement of the Zodiac and movements of planets against the background of stars in the sky

To this day, the Indian astronomer / astrologer places all the basic data of the stellar configurations for ready reference into an annual compilation called the Panchanga, corresponding to the Almanacs in the West.

Astronomy was a highly developed subject in Vedic culture. The Vedic astronomers were able to observe and predict the movements of the heavenly bodies with very accurate timings, without the aid of modern aids like computers or telescopes. Instead they developed devices and highly sophisticated structures, as reconstructed in more recent times, like the Jantar Mantar, shown here, to observe heavenly bodies and calculate their present and future positions. Five versions of the Jantar Mantar were built at Delhi, Jaipur, Ujjain, Mathura and Varanasi by Raja Jai Singh of Jaipur

between 1727 and 1734, having been requested to undertake this by the then Mughal Emperor, Muhammed Shah.

The name Jantar Mantar is derived from the words Yantra and Mantra of the ancient scriptures.



Today planetarium software programs like [Stellarium](#), can help with visualizing the planets and constellations as they were, or might be, at any place literally across time spans of millenia.. Such software has indeed been used to present the sky as obtained at the time of stellar phenomena like eclipses cited in the Mahabharata and Ramayana to fix the authenticity and chronology of the events described in these epics. This has indeed raised the status of these massive texts in the sceptical perceptions of today from the level of mythology to possibly factual history.

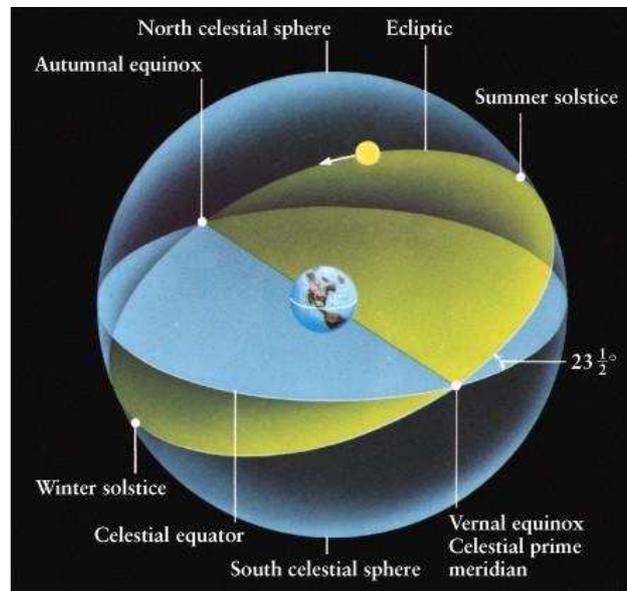
Vedic astrologers are well aware that nothing in the universe is stationary. The Vedic sages certainly were aware of Earth's motion around the Sun. and that the Sun is the center of the solar system. But the Earth, the other planets, the Sun and even the Galaxy are all in constant relative motion. To what referenced point do we relate all this movement? We live on the Earth and see the universe from this vantage point; so for Vedic astronomy, the most practical and convenient and relatively static point like the pole star, named after Polaris or Dhruva as it is known in Sanskrit. Yet as we shall see shortly in the context of the phenomenon called Precession of the Equinoxes, even this is not as static as we assume it to be.

The Zodiac is the path that the planets follow as they move relative to the background of fixed stars. You can visualize the Zodiac as a belt in the sky, about 18 degrees of arc in width, running around the earth in an east-to-west direction. Several groups of fixed stars are studded along this imaginary belt, divided into groups called Rāśis and Nakṣatras.

The fixed stars are divided into two sets, one of twelve groups and another of twenty-seven groups. The twelve groups, based on the motion of the Sun are called Signs or Rāśis; the twenty-seven groups of stars are called Nakṣatras, stellar mansions or asterisms. This imaginary belt, with 12 Rāśis and 27 Nakṣatras ranged along on it, is called the Zodiac.

The Zodiac and its divisions of Rāśis and Nakṣatras is the reference for establishing the position of any planet or star in the sky. Since it encircles the earth, it is comprised of 360 degrees. The twelve Rāśis each occupy 30° of arc along the Zodiac, and the twenty-seven Nakṣatras, being equal in size, each span 13°20'.

The heavenly bodies called planets or Grahas move, generally from west to east, in the foreground of the fixed Rāśis and Nakṣatras. The name Graha (graha = Sanskrit 'to grasp') derives from the fact that while moving against the background of the Nakṣatras, they appear to get control of one Nakṣatra after the other. Vedic astrology recognizes nine Grahas: Sun, Moon, Mars, Mercury, Jupiter, Venus, Saturn, Rahu and Ketu. Of course, the Sun is a star, the Moon is a satellite of the earth, and Rahu and Ketu are mathematical points on the Zodiac, but Vedic astronomy and astrology refer to all of them as Grahas. The Grahas (appear to) revolve around the earth along the path of the Zodiac.



The terrestrial phenomena of day and night spring from the relative rotation around its own axis with reference to the Sun, while the changes of seasons comes from a skewed revolution of the Earth with reference to the Sun, that shifts the direct overhead position of the Sun over the Earth over the Tropic of Cancer and Tropic of Capricorn to occur on the 20th March

and the 21st September, referred to as the Vernal and Autumnal Equinoxes and over the Equator on the 21st June and 21st December, referred to as the Summer and Winter Solstices which can be visualized from the above image.

From this description of Space in terms of the cosmos, we may now move on to a consideration of Time. The ancients devised several systems of time units for different purposes. Time was of course considered fundamental to all Knowledge. All different branches of knowledge and all phenomena are under the supreme control of kāla, the personification of the Supreme Godhead as Eternal Time. The astrological signs represent the bodily parts of His celestial form, called the Kala-Puruṣa. So ultimately all aspects of Space and Time are but different manifestations of the Lord as in the image below.



The Vedic seers had an elaborate method of reckoning time and expressed it in terms that carried appeal to both intellectual and the devotee alike. The following table compares some Vedic units of time with their correspondence to present measures of time, which we may compare out of curiosity, with our units of time of today ranging say, from the nano-second to the light year

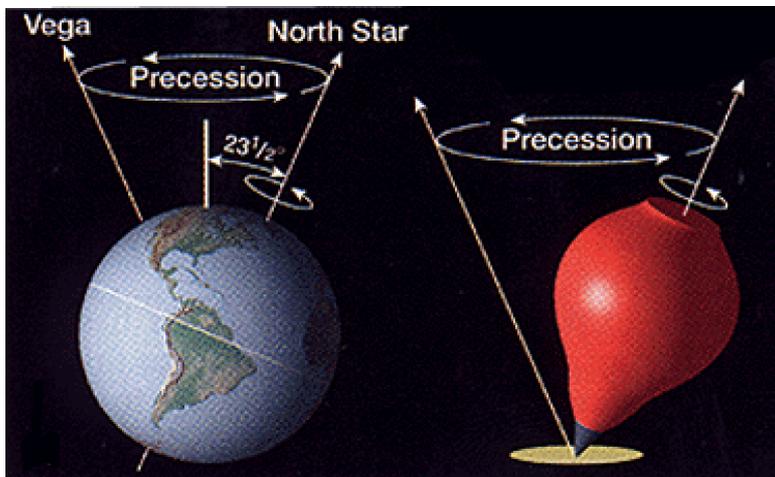
1 truṭi	8/13,500 second
1 vedha	8/135 second
1 lava	8/45 second
1 nimeṣa	8/15 second
1 kṣaṇa	8/5 seconds
1 Asu (or Prana)	4 (sidereal) seconds
1 kāṣṭhā	8 seconds
6 Asus	1 sidereal Pala (or Vighati or Vinadi or 24 seconds)
1 laghu	2 minutes
1 daṇḍa	30 minutes
60 Palas	1 Ghati (24 minutes)
1 prahara	3 hours
60 Ghatis	1 day (24 hours)
1 pakṣa	15 days
30 days	1 month
2 months	1 Ṛtū (season)
12 months	1 year
4,320,000 years	1 Yuga cycle
72 Yuga cycles	1 Manu (311,040,000 years)
14 Manus	1 Kalpa (1008 Yugas or 4,354,560,000 years)
2 Kalpas	A day and night of Brahma (8,709,120,000 years)
30 days and nights of Brahma	1 month of Brahma (261,273,600,000 years)
12 months of Brahma	1 year of Brahma (3,135,283,200,000 years)
100 years of Brahma	Life of Brahma (1 Mahakalpa or 313,528,320,000,000 years)

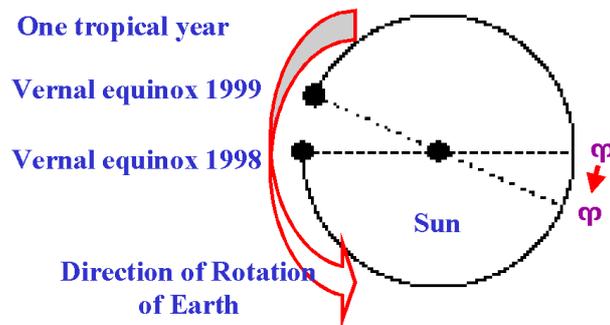
The Vedic sages also had a complete set of angular measurements :

12 Rāśis	1 celestial circle
30 Lavas	1 Rāśi (Sign)
60 Lipta	1 Lava (or Bhaga or Amśā or degree)
60 Vilipta	1 Lipta (or Kala or angular minute)
60 Tatparas	1 Vilipta (or Vikala or angular second)
60 Pratatparas	1 Tatpara

Precession of the Equinoxes :

The vernal equinox moves westward at a rate of approximately 50.26 seconds of arc each year. This precession causes a slow increase in the right ascension of the Zodiac. This precession takes 25,800 years to complete one circle. The following images will enable us to visualize this phenomenon.





The earth revolves around the Sun once in 365 days, 5 hours, 48 minutes and 46 seconds. Considered from the earth, the Sun appears to complete one round of the ecliptic during this period, which is called a tropical year. The earth regains its original angular position with the Sun in the span of a tropical year. A tropical year is also called a year of seasons, since occurrence and timing of the seasons depend on this annual Earth-Sun cycle. If we consider the revolution of the Sun around the earth from one vernal equinox to the next, it takes exactly one tropical year.

However, if we consider the position of the earth with reference to a fixed star of the Zodiac such as first degree of Meṣa (Aries) or the end of Revati Nakṣatra, at the end of a tropical year, the earth appears to lie some 50.26 seconds of celestial longitude to the west of its original position. In order for the earth to attain the same position with respect to a fixed star after one revolution, it takes a time span of 365 days, 6 hours, 9 minutes and 9.5 seconds. This duration of time is called a sidereal year. The sidereal year is just over 20 minutes longer than the tropical year; this time difference is equivalent to 50.26 seconds of celestial longitude. The difference between

the tropical year and the sidereal year is similar to the difference between the solar day and the sidereal day. Each year, the Vernal equinox will fall short by 50.26 seconds along the Zodiac reckoned along the fixed stars. This continuous receding of the Vernal equinox along the Zodiac is called the Precession of the Equinoxes.

Cause of the precession: The earth rotates around its axis like a spinning top. In doing so, its north pole (and, therefore, the celestial pole), describes a circle of some 47 degrees around the pole of the ecliptic. In other words, the point where the plane of the equator intersects the plane of the ecliptic is constantly shifting. This point, 0° Aries corresponding to the Vernal Equinox, moves westward at approximately 50.26 seconds of arc each year. The result of this precession of the equinoxes is a slow increase in the right ascensions of the Zodiac. This precession takes 25,800 years to complete one circle. An appreciation of this precession is of great importance in understanding the basic concepts of Vedic astrology and is perhaps relatable to the ancient Indian celestial Yuga calendar.

An interesting point that emerges from all this is that the shifting of the equinoxes has been noted by the star-gazers of ancient times and their timing by the ascendant star or sign of the zodiac, finds explicit reference in the Vedas and other ancient texts. These references provide unequivocal proof of the chronology and historicity of the related events, in a measure that is as reliable, if not indeed more reliable than any amount of archeological or other material evidence. The following is a brief summary of such findings on the timing of such ancient events :

Equinoxes and Dating of the Vedas :

-10,000 Taittiriya Brahmana 3.1.2 refers to Purvabhadrapada nakshatra's rising due east, a phenomenon occurring at this date (Dr. B.G. Siddharth of the Birla Science Institute), indicating earliest known dating of the sacred Veda.

-8500 Taittiriya Samhita 6.5.3 places Pleiades asterism at winter solstice, suggesting the antiquity of this Veda.

-6776 Start of Hindu king's lists according to Greek references that give Hindus 150 kings and a history of 6,400 years before 300 BCE; agrees with next entry.

-6500 Rig Veda verses (e.g., 1.117.22, 1.116.12, 1.84.13.5) say winter solstice begins in Aries (according to D. Frawley), giving antiquity of this section of the Vedas.

-5500 Date of astrological observations associated with ancient events later mentioned in the Puranas (Alain Danielou).

-3928 July 25th: the earliest eclipse mentioned in the Rig Veda (according to Indian researcher Dr. Sri P.C. Sengupta).

-3200 In India, a special guild of Hindu astronomers (nakshatra darshas) record in Vedic texts citations of full and new moon at winter and summer solstices and spring and fall equinoxes with reference to 27 fixed stars (nakshatras) spaced nearly equally on the moon's ecliptic (visual path across the sky). The precession of the equinoxes (caused by the mutation of the Earth's axis of rotation) makes the nakshatras appear to drift at a constant rate along a predictable course over a 25,000-year cycle. Such observations enable specialists to calculate backwards to determine the date the indicated position of moon, sun and nakshatra occurred.

-3139 Reference to vernal equinox in Rohini (middle of Taurus) from some Brahmanas, as noted by B.G. Tilak, Indian scholar and patriot. Now preferred date of Mahabharata war and life of Lord Krishna

-2500 Reference to vernal equinox in Krittika (Pleiades or early Taurus) from Yajur and Atharva Veda hymns and Brahmanas. This corresponds to Harappan seals that show seven women (the Krittikas) tending a fire.

-2350 Sage Gargya (born 2285), 50th in Puranic list of kings and sages, son of Garga, initiates method of reckoning successive centuries in relation to a nakshatra list he records in the Atharva Veda with Krittika as the first star. Equinox occurs at Krittikia Purnima.

-1424 Mahabharata War occurs (dated from reference in the Mahabharata citing winter solstice at Dhanishtha, which occurs around this time). (conflicts with the 3139 BC)

-1255 King Suchi of Magadha sets forth Jyotisha Vedanga, dating it by including an astronomical note that summer solstice is in Ashlesha Nakshatra.

One scholar offers the following personal opinion :

“Many Indian scholars accept the traditional date of 5109 years ago as the beginning of Kaliyuga and the death of Sri Krishna. ie 3100 BCE. Based on brahmin lineages, I have argued that Rama was two generations prior to Krishna and the Vedic scholars were at least one generation prior to him. Viswamitra who composed the Gayathri Manthra was a teacher to Sri Rama when he got married to Sita Devi. This would give us about maybe 3500 BCE for the Gayathri Mantra.

If we take it that the winter solstice occurred in Revathi Nakshatra in Vedic times and that it slipped back to Moola Nakshatra now, I am looking at a

date of roughly 8000 years ago or about 6000 BC. (There are other scholars who give this date.)

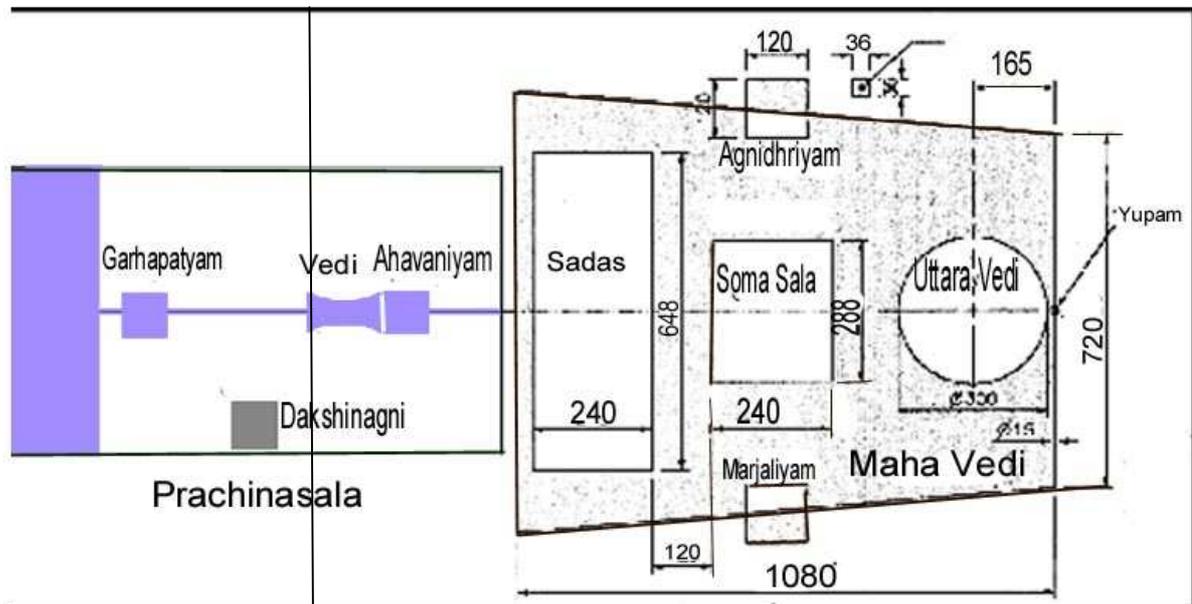
If we take it that the winter solstice occurred in Dhanistha Nakshatra in Vedic times and that it slipped back to Moola Nakshatra now, I am looking at a date of roughly 4000 years ago or about 2000 BC. There are many people who believe that the Harappan civilization was about 2000 BCE.”

THE VEDANGAS FOR THE FIRST TIME READER

CHAPTER 3 : KALPA – RITUAL & SACRIFICE - ACTIVITY

The Vedas present ritual and sacrifice as activity that best symbolize the relationship of man's own existence to the higher existence of which he is part. The Vedas affirm the need for man to live with a full consciousness of this relationship and therefore prescribed ritual and sacrifices as an obligatory and critical part of his life's activities. And in prescribing an appropriate physical setting for the ritual and sacrifice, the Kalpa Vedanga texts set out in great detail the related participatory, procedural activities and also the designs and dimensions of the Vedic altars that reflected this higher relationship. The design and the dimensions of the altar reflect those of the cosmos, and symbolize it as a place for engagement of men with gods and the higher powers, where men could make grateful offerings in return for the blessings that they had received or might later receive during their physical existence. The offerings were made with the chanting of mantras that sought material and psychological sustenance from the gods who administered the entirety of both the outer and inner world of man and bore the powers to confer these blessings.

One dimension of the typical altar was an area of 108 units, which was computed with astonishing approximation to conform to the ratio of the distance of the sun and moon from the earth to their own respective diameters, a figure that has been largely confirmed by modern findings, like those from NASA, USA. The design, dimensions and geometry of the typical Vedic altar, as set out in the Shulba Sutras of Baudhayana, the texts that form part of the Kalpa corpus, are as in the following drawing :



The altar is seen to be comprised of two areas, one the Prachinasala, and the other the Maha Vedi, The first area is earmarked for everyday rituals, generally domestic, and the second special rituals, that formed large public events. Different areas called citis were set aside within these two large areas of the altar, for different purposes, and of these the Uttara Vedi was where the main ritual was performed. It came in different shapes and sizes, (Baudhayana lists as many as 21) and is seen as circular in the above picture on the eastern end of the Maha Vedi. It was situated in the east, because, as stated in the Satapatha Brahmana, the gods reside in the east. (Of course the East was where the sun rose, relative to man's own location and perception, though in the totality of Space pervaded as it might be by the gods, the East could have no meaning). The standard unit of measure of length, was the Prakrama, made up of 30 Angulas, as stated in Baudhayana's Shulba Shastra (1-15). The Angula, which literally means finger, itself was defined as the length occupied by 34 grains of Sesamum, where this number was seen to even out small differences in individual grain size and yield a fairly reliable standard unit of length. Clearly, the earliest concepts of counting for any form of quantification may have derived from the fingers, and perhaps the 10 fingers became the fore-runners of the decimal system or numbers.

It is important to note here that though this Shulba is placed early in the first millenium BC, some of the concepts and terms used in them go back to one millenium or more and found in the Rig Veda. The Maha Vedi is a trapezium shaped area, 36 prakrama long with two sides of length 30 and 24 prakrama, making a total area of 972 square prakrama. The original first Vedi was said to be a trapezium, 12 prakrama long with sides of length 10 and 8 prakrama, making for an area of 108 square prakrama, and we have already seen where the figure 108 came from. Beyond this, one needs to note that the basic stipulation was that the size of the Uttara Vedi could be 324, which was one third of 972, the area of the

Maha Vedi, or 108 which in turn, was one third of 324 square prakrama. One also needs to note that the Uttara Vedi's precise compliance of these shape and area stipulations were generated on the ground from right angled triangles with length of their sides conforming to what were later described as Pythagorean triples, number sets like 3-4-5, 12-5-13, 15-8-17 7-24-25 and 15-16-35. (the sum of the squares of two was equal to the square of the third figure in the triple) One had also to note that points to mark lines that enclosed such areas were fixed on the ground with wooden pegs and the distances between them were fixed by ropes with that ended in loops that marked their standard lengths. And finally detailed specifications were prescribed for the sizes, numbers and placement of clay bricks to be used in brick structures of the altars showing a complete grasp of the geometry and three dimensional computation.

The Indian ancients were thus clearly and completely at home with many of the key concepts of mathematics, though it is possible that they used them for their application to specific purposes, particularly religious purposes, rather than as formal stand alone academic disciplines supported by algorithmic proofs, as the Greeks did in the style of Euclid. Their tools were mainly thought and intuition, the outer eye and the inner eye, and at a physical level, simple devices like ropes and pegs which anyone could make or use. They were at home with numbers, integers or fractions, all the way from Zero to Infinity, but they were more clearly concerned with their practical uses for computing length and area, as could be applied to counting cows and horses, or building houses or altars, or demarcating plots of land for crops or making spoked wheels and chariots. They understood and used gravity to stop river flows enough to divert the rising waters into systems of canals, with principles and mechanisms that remain relevant to the present day. One sees references in the Rig Veda to Rhus or artisans engaged in these activities as a profession. In these areas of application, where ratio and proportion became more relevant than mere numbers, geometry seemed to prevail over arithmetic, perhaps because they provided more vivid symbols of the physical relevance, not to speak of the relativities and compulsions of physical existence. Who discovered the numeric triples earlier, Baudhayana or Pythagoras is really irrelevant when we could more charitably see and accept this as the similar progress of the human mind irrespective of time and place. It is the historian and politician who misinterpret or misuse history who are apt to survive and thrive by bringing such issues of time and place of origins into contention.

It would now be useful to provide a broader perspective of the textual basis of the Kalpa discipline. Tradition does not single out any special work in this branch of the Vedanga; but sacrificial practice gave rise to a large number of systematic **sutras** for the several **classes of priests**. A number of these works have come down to us, and they occupy by far the most prominent place among the literary productions of the sutra-period. The Kalpa-sutras, or rules of ritual ceremonial, are of two kinds: (1) the Shrautasutras, which are based on the **shruti**, the Vedas, and teach the performance of the great sacrifices, requiring three or five sacrificial fires; and (2) the Smartasutras, or rules based on the **smrti** or tradition,

which again includes two kinds of treatises: (a) the Grhyasutras, or domestic rules, treating the rites of passage, such as **marriage**, **birth**, **namegiving**, etc., connected with simple offerings into the domestic fire; and (b) the Dharmasutras, which treat of customs and social duties, and have formed the chief sources of the later law-books, the Dharma Sastras. Further, the Shrauta-sutras of the **Yajurveda** include a set of so-called **Shulba-sutras**, i.e. rules of the cord, which treat of the measurement by means of cords, and the construction, of different kinds of altars required for sacrifices. These treatises are of special interest as supplying important information regarding the earliest geometrical operations in India. Along with the Sutras may be classed a large number of supplementary treatises, usually called **Parishishta** on various subjects connected with the sacred texts and Vedic religion generally.

*The Shrauta Sutras (śrautasūtra) form a part of the corpus of **Sanskrit Sutra** literature. Their topic are the instructions relating to the use of the **Shruti** corpus in ritual ('kalpa') and the correct performance of rituals as such. Some early Shrauta Sutras were composed in the late Brahmana period (such as the **Baudhyanana** and **Vadhula Sutras**), but the bulk of the Shrauta Sutras are roughly contemporary to the Grhya corpus of domestic Sutras, their language being late **Vedic Sanskrit**, dating to the middle of the first millennium BCE, generally predating **Panini**). There are Sutra compilations associated with different composers but specific to each of the four Vedas.*

*The Grhya Sutras "domestic **sutras**" are a category of **Sanskrit** texts prescribing **Vedic ritual**, mainly relating to rites relevant to life activities or events like birth, death, marriage etc. . Their language is late **Vedic Sanskrit**, and they date to around roughly **500 BCE**, contemporary with the **Shrautasutras**. They are named after Vedic **shakhas** and are also specific to each of the four Vedas.*

*The Dharma Sutras are **Sanskrit** texts dealing with custom, rituals and law. They include the four surviving written works of the ancient Indian tradition on the subject of dharma, or the rules of behavior recognized by a community. Unlike the later **Dharma Shastra**, the Dharmasutras are composed in prose. The oldest Dharmasutra is generally believed to have been that of **Apastamba**, followed by the Dharmasutras of **Gautama**, **Baudhayana**, and an early version of **Vasishtha**. It is difficult to determine exact dates for these texts, but the dates between 500-300 BCE have been suggested for the oldest Dharma Sutras. The Dharma Sutras are also specific to each of the four Vedas.*

*The **Śulba Sūtras** that deal with laying out the offering ground and **altar** geometry are part of the Shrauta Sutras and are set in both the Krishna Yajur Veda and the Shukla Yajur Veda. The Shulba Sutras are part of the larger corpus of texts called the **Shrauta Sutras**, considered to be appendices to the **Vedas**. They are the only sources of knowledge of **Indian mathematics** from the **Vedic period**. Unique fire-altar shapes were associated with unique gifts from the Gods. The four major*

*Shulba Sutras, which are mathematically the most significant, are those composed by **Baudhayana, Manava, Apastamba** and **Katyayana**, about whom very little is known. The texts are dated by comparing their grammar and vocabulary with the grammar and vocabulary of other Vedic texts. The texts have been dated from around **800 BCE** to **200 CE**,^[2] with the oldest being the sutra that was written by **Baudhayana** around **800 BCE** to **600 BCE**.*

The Baudhayana Shulba Sutra gives the construction of geometric shapes such as squares and rectangles. It also gives, sometimes approximate, geometric area-preserving transformations from one geometric shape to another. These include transforming a **square** into a **rectangle**, an **isosceles trapezium**, an **isosceles triangle**, a **rhombus**, and a **circle**, and transforming a circle into a square.

As an example, the statement of circling the square is given in Baudhayana as :

2.9. If it is desired to transform a square into a circle, [a cord of length] half the diagonal [of the square] is stretched from the centre to the east [a part of it lying outside the eastern side of the square]; with one-third [of the part lying outside] added to the remainder [of the half diagonal], the [required] circle is drawn. (This construction leads to a π value of 3.088)

Likewise, the statement of squaring the circle is given as :

2.10. To transform a circle into a square, the diameter is divided into eight parts; one [such] part after being divided into twenty-nine parts is reduced by twenty-eight of them and further by the sixth [of the part left] less the eighth [of the sixth part]. (This construction leads to a π value of 3.004)

Altar construction also led to an estimation of the **square root of 2** as found in three of the sutras. In one of these it appears as:

2.12. The measure is to be increased by its third and this [third] again by its own fourth less the thirty-fourth part [of that fourth]; this is [the value of] the diagonal of a square [whose side is the measure]. (This computation leads to the result 1.4142)

How did the various geometric procedures originally come to be associated with sacrificial rituals ? There are competing theories about the origin of the geometry that is found in the Shulba sutras, and of geometry in general. Kim Plofker says "Various theories of the 'ritual origin of geometry' infer that the geometrical figures symbolized religious ideas, and the need to manipulate them ritually inspired the development of the relevant mathematics. It seems at least equally plausible, though, that the beauty and mystery of independently discovered geometric facts were considered spiritually powerful, and were incorporated into religious ritual on that account." We may thus now see the fascination of the Indian ancients for space and time, and relationships between shape and size and thought and symbol and how they could represent all facets of human or cosmic existence, must have led them to a congruence of ritual and geometry. The Vedas are indeed replete with use of numerical, astronomical and other data to express relationships, encoded in a surprising number of ways for different purposes. The use of the number 108 to express a cosmic relation for a ritualistic purpose has already been shown. This is but one of many more numbers and numeric and functional relationships. The number of hymns in

books 1, 2, 3 and 4 of the Rig-Veda adds up to 354, the number of days in the Lunar year. Similarly, the total number of hymns in books 4, 5, 6 and 7 is 324, the number of days in the so-called Nakshatra year, being the duration of the sun's stay in 24 of the 27 lunar mansions. One sees a choice of numbers in a cosmically meaningful way is also present in the construction of the Vedic altar, such as the numbers of bricks in each layer being equal to the number of days in given planetary cycles. It involves fairly complicated arithmetic, and shows the kind of concern which the Vedic seers had for the harmony between their own religious practices and the astronomical cycles. That approach led logically to insightful Mathematics based on painstakingly accurate observations and calculations.

THE VEDANGAS FOR THE FIRST TIME READER

CHAPTER – 4 : SHIKSHA – LEARNING – SOUND & THE SYLLABLE

Sound, in the ancient Indian tradition, was considered to the first manifestation of an infinite and eternal existence, a divine vital energy or Prana, in a finite form, bound by space and time. To state this in simpler terms, the vital energy that gave life to man, also created a thought in his mind that in turn generated sound in his mouth, that took the form first, of just sounds, and later of words. The energy initiated a vibration of the vocal cords, which manifested as a simple, single tonal frequency, and changes in the levels of energy created tones of more frequencies. The frequencies themselves fell into pleasing intervals that ultimately constituted the octave of music, which had the added charm of harmony with each higher or lower octave, and without the burden of words and meaning, created the world of music. It should be no surprise that while the Rig Veda built on meaning and word, the Sama Veda built on the sound and music ! And it was inevitable that Time should soon regulate these vibrations in Space through the meter of poetry and the melody and tala of music !

From the tones that carried no meaning, to words that carried meaning was but a short step, accomplished by energy applied to the different anatomical structures of the mouth. The first sound when the mouth was opened became quite naturally, the sound of the letter A or its equivalent in all languages. As the mouth started closing, the sound morphed through the stages of A and U, and when the mouth was closed with the sound continuing, became the hum of the silent M, a sound that retained its capacity for music also ! Here then was the first word “AUM” proclaimed by the Vedas as the very first manifestation of the Divine as the Word ! Of course, the mouth continued to use the different parts of its anatomical structure to give further shapes and stresses to create more sounds. It used the throat, palate, tongue, teeth and lips to create the guttural, cerebral, palatal dental and labial consonants that could then create the basic components of speech, not surprisingly common to virtually every language spoken by man. From this collection of sounds called Aksharas, came the Svaras or vowels and Vyanjanas or consonants of the Sanskrit alphabet. What should surprise the first time reader is that these components were first suggested in the Vedas and clearly defined later by Panini, in India, long before any other culture of the world had anything comparable to show for itself. It is here that the Shiksha Vedanga begins its formulations..

The Shiksha Vedanga forms the traditional science of Phonology and Phonetics and is limited to the sound content of words. The content

structure of sentences is covered by Vyakarana or Grammar. One of the first concerns of the ancient Vedic scholars was how the Vedas should be accurately recited, and to lay down rules that would ensure this for all time. The earliest teachings towards this objective were the Padapāthas, first attributed to Sakalya, a contemporary of Yagyavalkya. The Samhita texts of the Vedas had basic word components joined into compound words by systematic rules of Sandhi, meaning joining, to enable continuous, euphonic rendering of the texts. An approximate analogy to the concept of Sandhi, in the context of English is the distinction of saying “a banana” and saying “an apple”, where the change of the indefinite article “a” to “an” serves a euphonic rendering. This was the first step to establish a wider understanding of the Samhita text through its component words. The Padapātha then led to the compilation of the Pratishakyas which described the correct pronunciation and intonation of Sanskrit and also the rules of sandhi or euphonic combination of words. The Pratishakyas were specific to the Shakhas or schools that were established throughout the country for the preservation and dissemination of the Vedas and these form part of the corpus of Shiksha, one of the six Vedangas. .

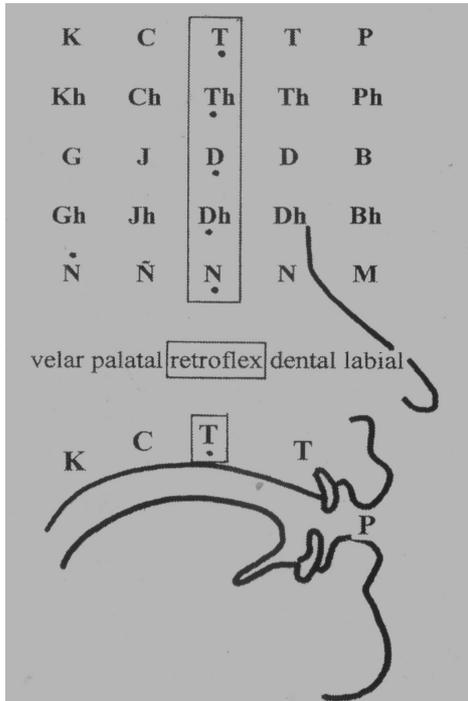
Five Pratishakyas are extant today. The Pratishakya texts are composed in the form of metric verse, or the more condensed form of Sutras. They present the basic structure of Sanskrit by breaking up its words into stems, prefixes and suffixes as aids to their correct pronunciation. They then prescribe different styles of recitation, involving a regulated,, repetitive patterned switching of syllables or words of a text as aids for memorizing and correctly articulating the slokas. This led to rules of sandhi, of how syllable or word sequences could be joined during articulation.

At a level of greater structural detail, the alphabet got developed in terms of the syllable called the Akshara, or “imperishable” unit of sound, comprised of the Vyanjana or consonant and the Svvara or vowel, the former being the body which received life from the latter. One of the most remarkable features here was the presentation of the main Consonants in the Varga structure, a 5 x 5 matrix, as follows. What is interesting is that the pattern of pronunciation of the letters remains the same when pronounced within rows and within the columns of the matrix.

ka	kha	ga	gha	ña
ca	cha	ja	jha	ña
ṭa	ṭha	ḍa	ḍha	ṇa

ta tha da dha na
 pa pha ba bha ma

What is more interesting is that these five groups appear in the same order in which the sounds are generated as they emerge in the vocal passage, as seen in the diagram below, starting with the throat, and through the palate, tongue, and teeth and ending at the lips. This is why they are referred to the gutturals, cerebrals, palatals, dentals and labials respectively. But what is truly remarkable is that these concepts accepted as standard today in modern linguistics, appeared for the first time nearly 3000 years ago in the Shiksha texts of the Vedic corpus in India.



In this matrix, the stress difference between sounds is preserved whether you recite it horizontally or vertically. This was extended and completed with **fricatives** and **sibilants**, **semi-vowels**, and **vowels**, and was eventually codified into the **Brahmi alphabet**, which is one of the most systematic approaches of mapping sound to writing. The varga system was clearly the result of centuries of analysis. In the course of that development, the basic concepts of phonology were discovered and defined

Syllabicity : Traditionally **syllables** (not letters) in Sanskrit are called **Akshara**, meaning "imperishable (entity)", as it were "atoms" of speech. These aksharas are basically classified mainly into two types.

- Svara (pratyahara aC) : **Vowel**
- Vyanjana (pratyahara haL) : **Consonant**

Svara akṣaras are also known as prāṇa akṣara i.e. they are main sounds in speech, without which speech is not possible. We find the same notation used for referring the **Tamil vowels** calling them as Uyir ezhutthu, meaning letters bearing life.

Vyañjana means embellishment, i.e., consonants are treated as embellishment for the vowels to make a language **sonorant**. They are also known as Prāni akshara i.e., they are like a body in which life (svara) is present. We find the same notation used for referring the **Tamil Consonants** calling them as Mey ezhutthu, meaning letters bearing a body. It is only when the consonant is joined by a vowel, when the body is joined by life that articulation becomes possible

Again vyañjana akṣaras are divided into three types : the Sparśa or **Stop** which includes the syllables from Ka to Ma they are 25 in number; the Antastha or **Approximant** which include the syllables ya, ra, la and va; and Ūṣman: or **Sibilant** which include the syllables śa, sha, sa and ha.

It was said that a vowel can be pronounced in 18 ways (3x2x3) in Sanskrit language based on **timing**, **manner**, and **accent** of pronunciation.

Each vowel can be classified into three types based on the timespan of articulation (**morae**). The unit of time is *mātra* (approx. 0.4 second). They are : the Hrasva : **Short vowel**, Eka-mātra; the Dīrgha : **Long vowel**, Dvi-mātra; and the Pluta : Prolated vowel. Each vowel can be classified into two types based on the manner of pronunciation. They are the Mukha : **Oral** and the Nāsika : **Nasal**. Each vowel can be classified into three types based on accent of articulation. This was lost in **Classical Sanskrit**, but used in reciting **Vedic & Upanishadic hymns** and **mantras**. The three types are the Udātta : high pitch; the Anudātta : low pitch; and the Svarita : falling pitch

*According to the Indian linguistic tradition, articulation is analysed by different parameters and features. Generally, in **articulatory phonetics**, the **place of articulation** (also point of articulation) of a consonant is the point of contact, where an obstruction occurs in the vocal tract between an active (moving) articulator (typically some part of the tongue) and a passive (stationary) articulator (typically some part of the roof of the mouth).*

*The passive places of articulation are classified as five. They are:- **Kaṇṭhya** : **Velar**; **Tālavya** : **Palatal**; **ūrdhanya** : **Retroflex**; **Dantya** : **Dental**; and **Ōshtya** : **Labial**. Apart from that, other places are combinations of the above five places. They are:- **Dantōsthya** : **Labio-dental** (Eg: v); **Kantātālavya** : Eg: **Diphthong** e; and **Kantōsthya** : **Labial-velar** (Eg: **Diphthong** o)*

The active places of articulation are classified as three, they are **Jihvāmūla** : **tongue root**, for **velar**; **Jihvāmadhya** : **tongue body**, for **palatal**; **Jihvāgra** : **tip of tongue**, for **cerebral** and **dental**; and **Adhōṣṭa** : **lower lip**, for **labial**

The stress or effort of articulation (Uccāraṇa Prayatna) is of two types for consonants,

(a) Bāhya Prayatna : External effort : these are Spr̥ṣṭa : **Plosive**; Īshat Spr̥ṣṭa : **Approximant**; and Īshat Saṃvṛta : **Fricative**

(b) Abhyantara Prayatna : Internal effort : these are Alpaprāna : **Unaspirated**; Mahāprāna : **Aspirated**; Śvāsa : **Unvoiced**; and Nāda : **Voiced**

Articulation of Consonants then proceeds in a variety of logical combination of components in the two types of effort for articulation.

Modes of recitation : We are now in a position to consider the methods of recitation and memorizing the texts. Students are first taught the samhita pātha, that is the text with **sandhi** applied. Other pāthas include vakya, **pada**, krama, jata, mala, sikha, rekha, dhvaja, danda, ratha, ghana and these could follow the Padāp̥tha. A pāthin is a scholar who has mastered the patha. Thus, a ghanapaathin (or ghanapaati in Telugu) has learnt the chanting of the scripture up to the advanced stage called ghana. Ghanapathins chant the ghana by intoning a few words of a mantra in different ways, back and forth. The sonority natural to Vedic chanting is enhanced in ghana. The padapātha consists of dividing the sentence (vakya) into individual **pada** or words. The kramapatha consists of pairing two words at a time. In Jatapatha, the words are braided together, so to speak, and recited back and forth. The Ghanapatha or the "Bell" mode of chanting is so called because the words are repeated back and forth in a bell shape. The samhita, vakya and krama pathas can be described as the natural or prakrutipathas. The remaining 8 modes of chanting are classified as Vikrutipathas as they involve reversing of the word order. The backward chanting of words does not alter the meanings in the Vedic (Sanskrit) language. The chief purpose of such methods is to ensure that not even a syllable of a mantra is altered to the slightest extent, which has resulted in the most stable **oral tradition** of texts worldwide.

In the jaṭā-pāṭha (literally "mesh recitation") every two adjacent words in the text were first recited in their original order, then repeated in the reverse order, and finally repeated again in the original order. The recitation thus proceeded as:

word1word2, word2word1, word1word2; word2word3, word3word2, word2word3; ...

In the dhvaja-pāṭha (literally "flag recitation") a sequence of N words were recited (and memorized) by pairing the first two and last two words and then proceeding as:

word1word2, word(N-1)wordN; word2word3, word(N-3)word(N-2); ...;
word(N-1)wordN, word1word2

In the most complex form of recitation, ghana-pāṭha (literally "dense recitation"), took the form:

word1word2, word2word1, word1word2word3, word3word2word1,
word1word2word3; word2word3, word3word2, word2word3word4,
word4word3word2, word2word3word4; ...

That these methods have been effective, is testified to by the preservation of the most ancient Indian religious text, the R̥gveda (ca. 1500 BCE), as a single text, without any variant readings.^[3] Similar methods were used for memorizing mathematical texts, whose transmission remained exclusively oral until the end of the [Vedic period](#) (ca. 500 BCE).

The insistence on preserving pronunciation and accent as accurately as possible is related to the belief that the potency of the mantras lies in their sound when pronounced correctly. The shakhas thus have the purpose of preserving knowledge of uttering divine sound originally heard by the [rishis](#). Portions of the [Vedantic](#) literature elucidate the use of sound as a [spiritual](#) tool. They assert that the entire [cosmic](#) creation began with sound: "By His utterance came the universe." ([Brihadaranyaka Upanishad](#) 1.2.4). The [Vedanta](#)-sutras add that ultimate [liberation](#) comes from sound as well (anavrittih shabdāt). Primal sound is referred to as Shabda Brahman - "God as word". Closely related to this is the concept of Nada Brahman - "God as sound". Nada, a [Sanskrit](#) word meaning "sound", is related to the term nadī, "river", figuratively denoting the stream of [consciousness](#) - a concept that goes back to the [Rig Veda](#). Thus, the relationship between sound and consciousness has long been recorded in India's ancient literature. Vedic texts, in fact, describe sound as the pre-eminent means for attaining higher, spiritual consciousness. [Mantras](#), or sacred sounds, are used to pierce through sensual, [mental](#) and [intellectual](#) levels of existence (all lower strata of consciousness) for the purpose of [purification](#) and reach into the spiritual level for its enlightenment. Thus when the disciplines of the Vedangas set out to explain the organic linkage between the Prana or divine energy that initiates life, and its onward emergence through thought and speech into meaning, clearly they enable us to trace this linkage back through this chain and link us to the divine source. This is clearly what Vedanta-sutra 4.22 means when it says

"By sound vibration one becomes liberated". Modern practitioners, like Hans Jenny have claimed, to have demonstrated by experiments that the sounds of Sanskrit phonemes (**aksharas**) have an effect on the mind, intellect, and **auditory** nerves of those who chant and hear them.

Phonology, in the modern understanding, is the systematic use of sound to encode meaning in any spoken human language, or the field of linguistics studying this use. Just as a language has syntax and vocabulary, it also has a phonology in the sense of a sound system. When describing the formal area of study, the term typically describes linguistic analysis either beneath the word (e.g., syllable, onset and rhyme, phoneme, articulatory gestures, articulatory feature, mora, etc.). It is viewed as the subfield of linguistics that deals with the sound systems of languages. Whereas phonetics is about the physical production, acoustic transmission and perception of the sounds of speech, phonology describes the way sounds function within a given language or across languages to encode meaning. The term "phonology" was used in the linguistics of a greater part of the 20th century as a cover term uniting phonemics and phonetics. Current phonology can interface with disciplines such as psycholinguistics and speech perception, resulting in specific areas like articulatory or laboratory phonology

Panini's Shiksha :

Pāṇini's extensive analysis of the processes of **phonology**, **morphology** and **syntax**, in his **Aṣṭadhyāyī**, laid down the basis for centuries of commentaries and expositions by following Sanskrit grammarians. Pāṇini's approach was amazingly formal; his **production rules** for deriving complex structures and sentences represent modern **finite state machines**. Indeed many of the developments in **Indian Mathematics**, especially the **place value** notational system may have originated from Pāṇinian analysis. Panini's grammar consists of four parts:

Śivasūtra: **phonology** (notations for phonemes specified in 14 lines)

Aṣṭadhyāyī: **morphology** (construction rules for complexes)

Dhātupāṭha: list of roots (classes of **verbal** roots)

Gaṇapāṭha: lists classes of primitive **nominal** stems

An important part of traditional forms of phonology has been studying which sounds can be grouped into distinctive units within a language; these units are known as phonemes. If two similar sounds do not belong to separate phonemes, they are called allophones of the same underlying phoneme. For instance, voiceless stops (/p/, /t/, /k/) can be aspirated. In English, voiceless stops at the beginning of a stressed syllable (but not after /s/) are aspirated, whereas after /s/ they are not aspirated. This can be seen by putting the fingers right in front of the lips and noticing the difference in breathiness in saying pin versus spin. There is no English word pin that starts with an unaspirated p, therefore in the English aspirated [p^h] (the [h] means aspirated) and unaspirated [p] are allophones of the same phoneme /p/. This is an example of a complementary distribution. The /t/ sounds in the words tub, stub, but, butter, and button are all pronounced differently in American English, yet are all intuited to be of "the same sound", therefore they constitute another example of allophones of the same phoneme in English.

In ancient India, the Sanskrit grammarian Pāṇini (c. 520–460 BC) in his text of Sanskrit phonology, the Shiva Sutras, discusses something like the concepts of the phoneme, the morpheme and the root. The Shiva Sutras describe a phonemic notational system in the opening part of the Aṣṭādhyāyī. The notational system introduces different clusters of phonemes that serve special roles in the morphology of Sanskrit, and are referred to throughout the text. Panini's grammar of Sanskrit had a significant influence on Ferdinand de Saussure, the father of modern structuralism, who was a professor of Sanskrit. The Polish scholar Jan Baudouin de Courtenay, (together with his former student Mikołaj Kruszewski) coined the word 'phoneme' in 1876, and his work, though often unacknowledged, is considered to be the starting point of modern phonology. He worked not only on the theory of the phoneme but also on phonetic alternations (i.e., what is now called allophony and morphophonology). His influence on Ferdinand de Saussure was also significant.

The world has no more fascinating story than that of the origin of sound from the hour-glass shaped drum, the Damaru, played by Shiva to provide the melodic beat of his celestial dance that unleashed the energy of all Creation. It provided the rhythms of all existence from the heart beat of living organisms to the motions of the Sun and the stars, and all the sounds from which came speech and song.



One detail of the story that is relevant here is that the Siva produced 14 sound sequences from the Damaru that formed the foundations for all beats of dance, all notes of music and all phonemes of speech; that these sounds appeared in Panini's mind and inspired him to set them down as the Siva Sutras at the head of his great work, the Ashtadhyayi, the foundational text of the world's first scientific grammar and all the grammars that later followed. The 14 sound sequences may be seen clockwise from the arrow at the red line on the picture at the above right

Here is a sampling of a few verses quoted from a compilation of 60 verses of Panini's Shiksha that illustrates the fundamental levels at which the subject was treated by him :

अथ शिक्षां प्रवक्ष्यामि पाणिनीयां मतं यथा

शास्त्रानुपूर्व्यं तद्विद्याद्यथीक्तं लोकवेदयोः १

Now, I shall give out the Siksha according to the views of Panini. In pursuance of the traditional lore, one should learn it with reference to the popular and the Vedic languages.

त्रिषष्टिश्चतुःषष्टिर्वा वर्णाः सम्भवतो मताः

प्राकृते संस्कृते चापि स्वयं प्रोक्ताः स्वयम्भुवा ३

That speech-sounds in Prakrit and Sanskrit are sixty three or sixty four, according to their origin, has been said by Brahman (Svayambhu) himself

सोदीर्णो मूर्ध्यभिहतो वक्त्रमपाद्य मारुतः

रर्णाञ्जनयते तेषां विभागः पञ्चधा स्मृतः ९

स्वरतः काललतः स्थानात्प्रयत्नानुप्रदानतः

इति वर्णविदः प्राहूर्निपुर्णं तं निबोधत १०

(The breath) is sent upwards and is checked by the roof of the mouth, attains to the mouth and produces speech-sounds (varnas) which have a five-fold classification, according to their pitch, quantity, place of articulation, the primary effort and the secondary effort. So said those who were versed in (pronouncing) speech-sounds. Learn this carefully.

उदात्तश्चानुदात्तश्च स्वरितश्च स्वरात्रयः

ह्रस्वो दीर्घः प्लुत इति कालतो नियमा अचि ११

There are three kinds of (pitch) accent : udāṭṭa, anudāṭṭa and svarita. Among vowels short, long and pluta varieties are distinguished by their time of articulation.

उदात्ते निषादगान्धारावनुदात्त ऋषभधैवतौ

स्वरितप्रभवा ह्येते षडङ्गमध्यमपञ्चमाः १२

Of the seven musical notes, nishāda and gandhāra can arise in the high pitch (udāṭṭa), rishabha and daivata in the low pitch (anudāṭṭa) while shadja, madhyama and panchama have their source in the medium pitch (svarita).

अष्टौ स्थानानि वर्णानामुरः कण्ठः शिरस्ता

जिह्वामूलं च दन्ताश्च नासिकोष्ठौ च तालुउ च १३

The speech-sounds have eight places (of articulation) : chest, throat, roof of mouth (literally, head), root of the tongue, teeth, nostril, lips and palate.

शङ्करः शाङ्करीं प्रादाद्याक्षीपुत्राय धीमते

वाङ्मयेभ्यः समाहृत्य देवीं वाचमितिह स्थितः ५६

Drawing the divine words from the entire domain of speech (vanmaya) Sankara gave this, his science of speech (Sankarim) to the wise son of

Dakshi. This is its basis.

Surely, the ancient Indian tradition, that reached its acme in the work of Panini represents the foundations of all knowledge of world today of the emergence of meaningless sound into meaningful word and the higher structures of language : the entirety indeed, of modern linguistics.

THE VEDANGAS FOR THE FIRST TIME READER

CHAPTER 5 : NIRUKTA – ETYMOLOGY – THE WORD

NIRUKTA is one of the Vedangas which deals with Etymology and is devoted to the explanation of the words of the Vedas and their lexical categories and semantics. It would be interesting to trace the course of development of this discipline over time and across cultures. This would make it abundantly clear and what is now universally accepted, that the Nirukta represents possibly, the oldest and most systematic study of Etymology in the history of mankind.

The word "etymology" derives from the **Greek words** "etumon", meaning "true sense", "logia", meaning "study of", and from "**logos**", meaning "speech". Etymology became a study of the **history of words** and how their form and meaning have changed over time. For languages with a long written history, Etymologists made use of texts in these languages, and texts about the languages, to gather knowledge about how words were used at earlier stages, and when they entered usage in the languages in question. The development of Etymology thus became inevitably linked with the development of Philology, a study of languages over time and across cultures. Etymologists also applied the methods of **comparative linguistics** to reconstruct information about languages that are too old for any direct information to be available about them. By analyzing related languages with a technique known as the **comparative method**, linguists made inferences about their shared parent language and its vocabulary. In this way, **word roots** were found which could be traced all the way back to the origin of, for instance, the **Indo-European language family**.

One of the earliest philosophical texts of the Classical Greek period to deal with etymology was the **Socratic dialogue *Cratylus*** (c. 360 BC) by **Plato**. During much of the dialogue, **Socrates** makes guesses as to the origins of many words, including the names of the gods. "... you know", says Socrates in this dialogue, "that the original names have long ago been buried and disguised by people sticking on them, or stripping off letters for the sake of euphony and the additions are often such that at last no human being can possibly make out the original meaning of the word. and first, remember that we often put in or pull out letters in words and give names as we pleasenor does the addition or subtraction of a letter make any difference so long as the essence of the thing remains in possession of the name" Plato does not appear to subscribe to operation of any principles in the evolution of words - something in sharp contrast, as will become shortly apparent, to the Nirukta of Yaska, to presenting the process as subject to clear-cut rules, showing that he was really the world's founder of Etymology as possessed of the discipline of a science.

Etymology in the modern sense emerges in the late 18th century European academia, within the context of the wider "**Age of Enlightenment**". The first known systematic attempt to prove the relationship between groups of European languages on the basis of similarity of **grammar** and **lexicon** was made by two Hungarians, **János Sajnovics** in 1770, and **Samuel Gyarmathi** in 1799. The origin of modern **historical linguistics** is often traced back to **Sir William Jones**, an English **philologist** living in **India**, who, in 1782 observed the genetic relationship between **Sanskrit**, **Greek** and **Latin**. Jones published his "The Sanscrit Language" in 1786, laying the foundation for the field of **Indo-European linguistics**. The study of etymology in **Germanic philology** was introduced by **Rasmus Christian Rask** in the early 19th century, and taken to high standards with the **German Dictionary** of the **Brothers Grimm**. The philosopher **Friedrich Nietzsche** used etymological strategies to argue that moral values have definite historical relevance, where modulations in meaning in relation to concepts like "good" and "evil" showed changes over time, reflecting which value-system prevailed. From the 20th century on, philosophers like **Jacques Derrida** started using etymologies to free them from the hold of Western **metaphysics** and began an extraordinary commonality binding languages across the cultures of East and West, to suggest a common Indo-European heritage, that is easily recognizable in the following table of names of numbers

THE NAMES OF THE NUMERALS IN NINE INDO-EUROPEAN LANGUAGES

ENGLISH	SANSKRIT	PERSIAN	GREEK	LATIN	LITHUANIAN	CELTIC	GOthic	GERMAN
ONE	EKA	YAK	ELS	UNUS	VINAS	ONE	AINS	EINS
TWO	DVA	DU	DUO	DUO	DVY	DAU	TWAI	ZWEI
THREE	TRI	SIH	TRELS	TRES	TRYS	TRI	THREIS	DREI

FOUR	CATUR	CHAHAR	TERSSARES	QUATTAR	KETURI	CETHIR	FIDWR	VIER
FIVE	PANCA	PANJ	PENTE	QUINQUE	PENKI	COIC	FIMF	FUNF
SIX	SHAT	SHASH	EZ	SEX	SZEZI	SE	SAIHS	SECHS
SEVEN	SAPTA	HAFT	EPTA	SEPTEM	SEPTYNI	SECHT	SIBUN	SIEBEN
EIGHT	ASHTAU	HASHT	OKTO	OCTO	ASZTUANI	OCHT	AHTAU	ACHT
NINE	NAVA	NUH	ENNEA	NOVEM	DEVYNI	NOI	NIUN	NEUN
TEN	DASHA	DAH	DEKA	DECEM	DESZIMT	DEICH	TAIHUN	ZEHN

Etymologists apply a number of methods to study the origins of words, some of which are:

- **Philological** research. Changes in the form and meaning of the word can be traced with the aid of older texts, if such are available.
- Making use of **dialectological** data. The form or meaning of the word might show variation between dialects, which may yield clues of its earlier history.
- The **comparative method**. By a systematic comparison of related languages, etymologists can detect which words derive from their common ancestor language and which were instead later borrowed from another language.
- The study of **semantic change**. Etymologists often have to make hypotheses about changes of meaning of particular words. Such hypotheses are tested against the general knowledge of semantic shifts. For example, the assumption of a particular change of meaning can be substantiated by showing that the same type of change has occurred in many other languages as well.

Etymological theory recognizes that words originate through a limited number of basic mechanisms, the most important of which are borrowing (i.e. the adoption of **loanwords** from other languages); **word formation** such as **derivation** and **compounding**; and **onomatopoeia** and **sound symbolism**, (i.e. the creation of imitative words such as "click"). Often, while the derivation of new words appeared straightforward, this tended to get obscured over time due to sound change or semantic change. Sound change for instance, obscures the fact that that English "bless" is related to "blood", where the former was derivative from the meaning "to mark with blood". **Semantic change** could also occur like the English word "bead" which originally meant "prayer", but acquired its later sense through the use of beads for maintaining a count in prayers. Often combinations of etymological mechanisms occurred when German words "bitte" (please), and "beten" (to pray), and the Dutch word "bidden" (to

pray) got related through both sound and meaning to the English word “bead”. Such combinations of sound change and semantic change make etymological connections difficult to detect by merely looking at the modern word-forms.

English is derived from **Anglo-Saxon**, a **West Germanic** variety, although its current vocabulary includes words from many languages. The Anglo-Saxon roots can be seen in the similarity of numbers in **English** and **German**, particularly seven/sieben, eight/acht, nine/neun and ten/zehn. **Pronouns** are also cognate like I/mine/me and ich/mein/mich or thou/thine/thee and du/dein/dich. However, **language change** has impacted many grammatical constructs, such as the **noun-case** system, which is greatly simplified in modern English; and certain elements of vocabulary, much of which is borrowed from **French**. Though more than half of the words in English either come from the **French language** or have a French **cognate**, most of the common words used are still of **Germanic** origin. Days of the week are derived from old Norse: Monday [Moondæg] Tuesday [Twiesdæg] Wednesday [Wodensdæg] Thursday [Thorsdæg] Friday [Friedæg] Saturday [Saternesdæg] Sunday [Sunnandæg]

When the **Normans** conquered England in 1066, they brought their **Norman language** with them. During the **Anglo-Norman** period which united insular and continental territories, the ruling class spoke **Anglo-Norman**, while the peasants spoke the vernacular English of the time, as well as the native **Celtic languages**. Anglo-Norman was the conduit for the introduction of French into England. This led to many paired words of French and English origin. For example, **beef** is cognate with the modern French *bœuf*, **veal** with *veau*, **pork** with *porc*, and **poultry** with *poulet*. All these cognate words, French and English, refer to the meat rather than to the animal. This relationship carries over into the names for farm animals where the cognate is with modern German. For example swine/Schwein; cow/Kuh; calf/Kalb; sheep/Schaf. An explanation of this variant usage has been that the Norman rulers mostly ate meat (an expensive commodity) while the Anglo-Saxons reared the animals, an explanation that has passed into common **lore**.

The search for meaningful origins for familiar or strange words is far older than the modern understanding of linguistic evolution and the relationships of languages, which has its roots no deeper than the 18th century. The **Sanskrit** linguists and grammarians of **ancient India** were the first to make a comprehensive analysis of linguistics and etymology. The study of Sanskrit etymology has indeed provided Western scholars the basis of both **historical linguistics** and modern etymology. Four of the most famous Sanskrit linguists are:

- **Yaska** (c. 6th-5th centuries BCE)

- **Pāṇini** (c. 520-460 BCE)
- **Kātyāyana** (2nd century BCE)
- **Patañjali** (2nd century BCE)

Though they are not the earliest Sanskrit grammarians, they follow a line of more ancient grammarians of Sanskrit dating back to several centuries earlier. The earliest of attested etymologies can be found in **Vedic literature**, in the philosophical explanations of the **Brahmanas**, **Aranyakas** and **Upanishads**. The analyses of **Sanskrit grammar** of the previously mentioned linguists involve extensive studies on the etymology (called **Nirukta** or **Vyutpatti** in Sanskrit) of Sanskrit words, because the ancient **Indo-Aryans** considered sound and speech itself to be sacred, and for them, the words of the sacred **Vedas** contained a deep encoding of the mysteries of the soul and God.

The Nirukta is attributed to Yāska (**Devanagari** यास्क), a **Sanskrit grammarian** who preceded **Pāṇini** (fl. 4th c. BC), believed to have been active in the 5th or 6th century BC. He is thought to have succeeded **Śākaṭāyana**, an ancient grammarian and **expositor of the Vedas**, who is mentioned in his text. There are references to names of seventeen writers on this subject as having preceded Yaska.

The Nirukta was developed around ancient collections of words referred to as the Nighantu which were possibly the first efforts attempts to explain how certain words get to have their meanings, especially in the context of interpreting the **Vedic** texts. It includes a system of rules for forming words from roots and affixes, and a **glossary** of irregular words, and formed the basis for later **lexicons** and **dictionaries**. It consists of three parts, viz.:(i) Naighantuka, a collection of **synonyms**; (ii) Naigama, a collection of words peculiar to the Vedas, and (iii) Daivata, words relating to **deities** and **sacrifices**.

The Nighantu represents the earliest known attempt at Lexicography in the ancient Indian tradition. It presents a list of words from the Rig Veda, with little or no attempt to provide meanings. It can only be described as Vocabulary, rather than a Dictionary, though it may have been the forerunner of the Kosa or dictionary class of literature. It is not ascribable to any one author, and may have been a corpus developed by several authors, perhaps spanning several generations. More importantly it provided an authoritative basis on which the language – related disciplines of the Vedangas were later built.

The Nighantu has come down in two rescensions, one short and the other a long one. The latter is longer because of listing a few more words, but mainly because of a addition of a lot of explanatory and summarised information. The Nighantu, according to the well documented and scholarly

book by Laksman Sarup, enumerates around 1926 words, listed out under 79 slokas, distributed over 5 Chapters which are set in 3 Kanda sequences with contents as follows :

Sequence 1 : Naighuntaka Kanda covering the first three Chapters dealing with synonyms (different words having the same or similar meaning) ; and these chapters broadly deal with words related to Nature, to Man and to abstract qualities respectively.

Sequence 2 : Naigama Kanda covering the fourth Chapter dealing with homonyms (the same word having different meanings) ; and

Sequence 3 : Daivata Kanda covering the fifth Chapter dealing with the deities.

It is interesting and perhaps natural that the earliest words of languages developed through an imitation of sounds encountered in nature, referred to in the jargon of later linguistics as onomatopoeia. (From the Latin, "to make names"). The first speech was considered **onomatopoeic**, marked by echoic words such as *moo*, *meow*, *splash*, *cuckoo*, and *bang*. The role of onomatopoeia is referred to in several Linguistic theories, variously called the Bow-wow theory, the Ding Dong theory, etc **Linguists** generally begin discussions about onomatopoeia with examples from different languages : the snip of a pair of scissors is "su-su" in Chinese, "cri-cri" in Italian, "riqui-riqui" in Spanish, "terre-terre" in Portuguese, "kritis-kritis" in modern Greek. . . Use of "ding dong" to represent a bell ringing has been immortalized in the "My Fair Lady" song, "I'm getting married in the morning! Ding dong! the bells are gonna chime."

Onomatopoeia may have had a limited influence in the early history of language but of course, must have had little or no influence in the later course of language development. The early onward stages may have seen a development of homonyms, with a small number of available words applied with different meanings to different objects. This would have followed later by a rapid proliferation of a large number of words to attach to different meanings, often to the point of different words sharing the same or meaning or different shades of it. One sees this at an advanced stage in the Nighantu in India, when many other societies in the world may well have been in the bow-wow stage of onomatopoeia.

Yāska takes his authority from the lost text of **Sakatayana**, an early precursor, that etymologically, most nouns have their origins in verbs. An example in English may be the noun "origin", derived from the Latin *originalis*, which is ultimately based on the verb "oriri", meaning "to rise". This view is related to the position that in defining agent categories, behaviours are ontologically primary to, say, appearance. This was also a source for considerable debate for several centuries.

Yāska defines four main categories of words :

1. nāma - **nouns** or substantives
2. ākhyāta - **verbs**
3. upasarga - pre-verbs or **prefixes**
4. nipāta - **particles**, invariant words (perhaps prepositions)

Yāska singled out two main **ontological** categories : a process or an action (*bhāva*), and an entity or a being or a thing (*sattva*). Then he first defined the verb as that in which the *bhāva* ('process') is predominant whereas a noun is that in which the *sattva* ('thing') is predominant. The 'process' is one that has, according to one interpretation, an early stage and a later stage and when such a 'process' is the dominant sense, a finite verb is used as in “vrajati”, (walks), or “pachati”, (cooks).

But this characterization of Noun / Verb is inadequate, for some processes may also have nominal forms (e.g. "He went for a walk"). For this, Yāska proposed that when a process is referred to as a 'petrified' or 'configured' mass (*mUrta*) extending from start to finish, a verbal noun should be used, e.g. *vrajyā*, (a walk), or “pakti”, (a cooking). These concepts are related to modern notions of **grammatical aspect**, the *mUrta* constituting the **perfective** and the *bhāva* the **imperfective** aspect. Yāska also gives a test for **nouns** both concrete and abstract : nouns are words which can be indicated by the pronoun “*that*”.

As in modern **semantic theory**, Yāska views words as the main carriers of meaning. This view that words have a primary or preferred ontological status in defining meaning, was fiercely debated in the Indian tradition over many centuries. The two sides of the debate may be called the *Nairuktas* (based on Yāska's *Nirukta*, **atomists**), vs the **Vaiyākaraṇas** (grammarians following Panini, **holists**), and the debate continued in various forms for twelve centuries involving different philosophers from the **Nyaya**, **Mimamsa** and **Buddhist** schools.

In the *prātishākhya* texts that precede Yāska, and possibly *Sakatayana* as well, the gist of the controversy was stated cryptically in *sutra* form as “*saṃhitā pada-prakṛtiḥ*”. According to the atomist view, the words would be the primary elements (*prakṛti*) out of which the sentence is constructed, while the holistic view considers the sentence as the primary entity, originally given in its context of utterance, and the words are arrived at only through analysis and abstraction. This debate relates to the atomistic vs holistic interpretation of linguistic fragments. A very similar debate is raging today between traditional **semantics** and **cognitive linguistics**, over the view whether words in themselves have semantic interpretations that can be composed to form larger strings. The cognitive semantics view is that words constrain meaning, but the actual meaning can only be construed by considering a large number of individual contextual cues.

It is interesting to see how the discipline of Etymology developed in later centuries, especially in the West, before they discovered how much their perspectives had been anticipated by the ancient Indian tradition an in a depth that greatly influenced the onward Western development.

CHAPTER – 6 : VYAKARANA –GRAMMAR & SYNTAX – THE SENTENCE

“Modern linguistics acknowledges it as the most complete generative grammar of any language yet written, and continues to adopt technical ideas from it.”
(Kiparsky, 1994 on Panini’s Ashtadhyayi)

“The descriptive grammar of Sanskrit, which Panini brought to its perfection, is one of the greatest monuments of human intelligence and an indispensable model for the description of languages.” (Bloomfield, 1929)

The view of grammar of the young reader of today is conditioned by a great distaste created by having to learn, without understanding, the narrow world of the eight parts of speech as taught in school through Wren & Martin’s classic text-book of Grammar. To them, it might be a formidable challenge to look at Panini even from a distance. This book attempts to remove that school-time fear and bring to the first time reader some of the more fascinating aspects of grammar and its relation to language and knowledge, in terms of the basics of how we get to know all that we know.

The **Sanskrit** grammatical tradition of Vyākaraṇa (व्याकरण) is one of the six **Vedanga** disciplines. It has its roots in late **Vedic India**, and virtually canonized in **Aṣṭādhyāyī**, the famous work of **Pāṇini** (ca. 4th century BCE). The impetus for linguistic analysis and grammar in India originates in the need to establish a strict interpretation for the **Vedic texts**. The work of the earliest Indian grammarians has been lost; for example, the work of **Sakatayana** (roughly 8th c. BCE) is known only from cryptic references by **Yaska** (ca. 6th-5th c. BCE) and **Panini**. One of the views of Sakatayana that was to prove controversial in coming centuries was that most nouns are etymologically derivable from verbs. In his monumental work on **etymology**, Nirukta, Yaska supported this claim based on the large number of nouns that were derived from verbs through a derivation process that became known as krit-pratyaya, in relation to the nature of the **root morphemes**. Yaska also provided the seeds for another debate, whether textual meaning inheres in the word (Yaska’s view) or in the sentence (see Panini, and later grammarians such as **Prabhakara** or **Bhartrihari**). This debate continued into the 14th and 15th c. CE, and has echos in the present day debates over semantic construction.

Panini’s Ashtadhyayi, which is said to have eclipsed all other contemporary schools of grammar, mentions the names of eleven schools

of Sanskrit grammar that preceded it. The scholars representative of these schools are ; **Aindra**; **Śākaṭāyana** ; Āpiśali (Pan. 6.1.92) ; Śākalya ; Kāśakṛtsna ; **Gārgya** ; Gālava (Nir. 4.3) ; Kāśyapa (Pan. 8.4.67) ; Senaka (Pan. 5.4.112) ; Sphoṭāyana (Pan. 6.1.123) ; Candravarmaṇa ; Kuṇaravāḍava (Pan. 3.2.14; 7.3.1) There is no surviving evidence of any of these schools that predates Panini except for **Yāska's Nirukta**. Yāska was a grammarian in the tradition of Śākaṭāyana who predated Panini by about a century. In Yāska's time, nirukta, "etymology", was in fact a school in opposition to vyakarana, "grammar" According to the niruktas or "etymologists", all nouns are derived from a verbal root. Yāska defends this view and attributes it to Śākaṭāyana. Yāska also reports the view of Gārgya, who opposed Śākaṭāyana and held that certain nominal stems were 'atomic' and not to be derived from verbal roots. Of the remaining schools, we know only what Yaska, Panini and later authors attribute to them, their original works being lost. Śākalya is held to be the author of the **padapatha** of the **Rigveda** (a word-by-word analysis of the mantra text). Some important Post-Panini Commentators and Schools included **Kātyāyana** (linguist and mathematician, 3rd c. BCE); **Patanjali** (linguist and Yoga Sutras, 2nd c. BCE) ; The **Nyaya** school; The **Mimamsa** school; **Kumarila Bhatta** (7th c. CE); **Prabhakara** (7th c. CE); and **Bhartrhari** (c. 6th c. CE).

Panini was the first grammarian known to human history to take stock of all the pre-existing knowledge set out in the Vedas and the allied Vedic corpus, and a host of his grammarian predecessors, and compile them into a full fledged, scientific discipline. And taking stock of the language content of the Vedic corpus, he presented the subject of Vyakarana or grammar as a treatise covering both the theory and structure of language in its full spectrum ranging from sound, speech and meaning to language. Some of these components were analysed and codified in considerable detail in the other Vedangas.

Pāṇini's extensive analysis of the processes of **phonology**, **morphology** and **syntax**, in the **Aṣṭadhyāyī**, laid down the basis for commentaries and expositions by Sanskrit grammarians who followed in later centuries. Pāṇini's approach was amazingly formal; his **production rules** for deriving complex structures and sentences are indeed reflected in the development of modern disciplines of linguistics and the structures of modern computer languages. Panini's grammar consists of four parts:

- **Śivasūtra**: **phonology** (notations for phonemes specified in 14 lines)
- **Aṣṭadhyāyī**: **morphology** (construction rules for complexes)
- **Dhātupāṭha**: list of roots (classes of **verbal** roots)

- Gaṇapāṭha: lists classes of primitive **nominal** stems

Panini presents the Sanskrit language in terms of a total of Sutras, or rules regulating every aspect of the language's structure and usage, regarded by the highest scholars of the world today, as a masterpiece of brevity yet astonishing in the elegance and comprehensiveness of structure. At its base, the language rests on 42 letters or varnas, comprised of nine 9 vowels (5 simple and 4 diphthongs) and 33 consonants (25 stops or sparsas, arranged in 5 groups (ka-cha-ta-tha-pa) + 3 semi-vowels (ya-ra-la-va) + 4 sibilants (ss-sh-sa-ha). There are, in addition, 2 nasal sounds (anusvara and anusasika) and a hard h (visarga). The minimum unit of utterance is the phoneme or syllable (akshara). The vowels may be articulated short (hrasva) long (dhirga) or prolated (pluta) and may be nasalized (anunasika) or not (ananunasika) and may vary in pitch in three ways (udatta–acute, anudatta-grave or mixed (svarita-circumflex) The consonants likewise present features depending on where and how they are articulated in the mouth. All these features of articulation have already been elaborated and illustrated in Chapter 4.

Now Panini goes on to group all these sounds and enumerate them under 14 Sutras known as the Pratyahara-Sutras or Mahesvara-Sutras or more popularly as the Siva Sutras as set out in the following table. The objective here is to provide a concise body of rules governing the changes in their sounds, called morpho-phonemic changes. These are the changes in shape and sound that arise from derivation or inflection, the changes that occur from the declension of nouns (such as number, gender, case etc) and conjugation of verbs (such as tense, mood etc), and when they combine to form the next level of units of sound and phoneme sequences which constitute the Sabda or Word, which then aggregate into the Pada and finally the Vakya or the Sentence.

Words are divided into four classes : nama, (nouns and adjectives) akhyata, (verbs) upasarga, (prefixes, like pra- or pari- used with verbs, verbal derivatives and nouns showing verbal activity) and nipata (indeclinables like na, iva, ca, etc which have no gender and number and used as adverbs, conjunctions etc and dispense with case endings). Nouns and verbs are enumerated in the Ganapatha and Dhatupatha parts of the Ashtadhyayi while the Upasarga and Nipata are listed in the main Sutrapatha itself. Formation of the Pada from the Sabda, called pada-siddhi, forms the central part of morphological / grammatical construction through a conjunction of two parts of that transform the Sabda into the pada, the prakriti (base) and the pratyaya (affix). The rules that regulate the changes at these conjunctions, the rules of Sandhi, form the heart of Panini's grammar. We may now examine how the rules are structured and operate.

The *Shiva Sutras* (IAST: śivasūtrāṇi; Devanāgarī: शिवसूत्राणि) or Maheshvara Sutras (Devanāgarī: महेश्वराणि सूत्राणि) are fourteen verses that organize the phonemes of the Sanskrit language encoded as complex rules in short, mnemonic verses that is typical of the ancient *sutra* style, designed by the ancients, not only as aids for memorizing them, but also preserving them over time. The fourteen sutras are as set out below in IAST and Devanagari. (IAST referred to above stands for International Alphabet Of Sanskrit Transliteration adopted as a standard for loss-less romanization of Indic scripts by the International Congress of Orientalists, in Geneva in 1894, and adopted with extensions by the National Library of India, Kolkata, while also comprizing a sub-set of the International Standard ISO 15919)



IAST	Devanāgarī
1. a i u ṅ	१. अ इ उ ण् ।
2. ṛ ḷ K	२. ऋ लृ क् ।
3. e o ṅ	३. ए ओ ङ् ।
4. ai au C	४. ऐ औ च् ।
5. h y v r Ṭ	५. ह य व र ट् ।
6. l ṅ	६. ल ण् ।
7. ñ m ṅ ṇ n M	७. ञ म ङ ण न म् ।
8. jh bh ṅ	८. झ भ ञ् ।
9. gh ḍh dh Ṣ	९. घ ढ ध ष् ।
10. j b g ḍ d Ś	१०. ज ब ग ङ द श् ।
11. kh ph ch ṭh th ca ṭ t V	११. ख फ छ ठ थ च ट त व् ।
12. k p Y	१२. क प य् ।
13. ś ṣ s R	१३. श ष सर् ।
14. h L	१४. ह ल् ।

Each verse consists of Sanskrit phonemes followed by a single 'dummy letter' or *anubandha*, conventionally rendered by capital letters in Roman **transliteration** or the Halant in the Devanagari rendering, as at the end of two columns of each row in the above table. This allows Pāṇini to refer to groups of phonemes as *pratyāhāras*, which consist of a phoneme-letter ending with an *anubandha* (and often, with a vowel *a* to aid pronunciation) and signify all of the intervening phonemes. Pratyāhāras are thus single syllables, but they can be **declined** (see Aṣṭādhyāyī 6.1.77 below). Hence aL refers to all phonemes (because it consists of the first phoneme *a* and the last *anubandha* L). For example, aC refers to vowels (i.e., all of the phonemes before the *anubandha* C; *a i u ṛ ḷ e o ai au*). Or again, haL refers to consonants, and so on. Note that the *anubandha* Ṇ occurs twice in the list, which means that you can assign two different meanings to pratyāhāra ending in a Ṇ (including or excluding *ṛ*, etc.); in fact, both of these meanings are used in the Aṣṭādhyāyī. On the other hand, the pratyāhāra haL is always used in the meaning "all consonants". The Shiva Sutras put phonemes with a similar **manner of articulation** together (so **sibilants** in Row 13 : *śa ṣa sa R*, and **nasals** in Row 7 : *ñ m ṅ ṇ n M*). Economy (**Sanskrit**: *lāghava*) is a major principle of their organization.

From these 14 verses, a total of 281 pratyāhāras can be formed: $14*3 + 13*2 + 12*2 + 11*2 + 10*4 + 9*1 + 8*5 + 7*2 + 6*3 + 5*5 + 4*8 + 3*2 + 2*3 + 1*1$, minus 14 (as Pāṇini does not use single element *pratyāhāras*) minus 10 (as there are 10 duplicate sets due to *h* appearing twice); the second multiplier in each term represents the number of phonemes in each. But Pāṇini uses only 41 pratyāhāras in the Aṣṭādhyāyī (with a 42nd introduced by later grammarians, ra Ṇ = r l). Finally Panini derives his entire body of rules that regulate the changes in derivation and inflection of the nouns and verbs that involve use of these pratyāhāras.

We may consider a few illustrative examples :

In Panini Rule 6.177 where the sutra reads “iko yanachi” prescribes that when vowels *i*, *u*, *r* and *l* when followed by *a*, *l*, *u*, *r*, *l*, *e*, *o*, *ai* and *au*, they are replaced respectively by *y*, *v*, *r*, and *l* eg *aapari + aptam* becomes *aparyaptam*.

In Panini Rule 8.4.40, where the sutra reads “sto sachunascuh” causes the consonant conjunction *sat + citta* to become *saccitta*

Likewise, to consider changes in a nasal terminal element, we have in Panini Rule 8.4.45, where he the sutra reads “yaro anunasike”, the conjunction of *jagat + nathah* becomes *jagannathan*.

Let us finally look at a mind-boggling example from the Bhagavad Gita verse (V-8) which joins the words :

पश्यन् - शृण्वन् - स्पृशन् - जिघ्रन् - अश्नन् - गच्छन् - स्वपन् - श्वसन्

to form the single Pada :

पश्यञ्शृण्वन्स्पृशञ्जिघ्रन्अश्नङ्गच्छन्स्वपञ्श्वसन्

Be it noted that these rules that arise from derivation or inflection are referred to Sandhi or junction or transition a change in meaning and sound at the point of change and the change of sound is dictated by considerations of euphony, a musical quality that is pleasing to the ear. Both the pleasing poetic meter and the musical quality of a recitation of a Vedic mantra, apart from the meaning content and intent, are thus integral features the Sanskrit language and its Vedic usage, and all these features come through clearly and in such phenomenal detail in the related Vedangas. All that we can do is stand before this colossal corpus created by the Indian ancients in silent awe.

THE VEDANGAS FOR THE FIRST TIME READER

CHAPTER 7 : CHANDAS – POETRY - RHYTHM

What could Time and Space, the central concerns of the ancients that span the content of the Veda and Vedanga texts have to do with Chandas which refers to the meter of poetry ? The simple answer is that texts are composed of sounds as words, which, in poetry and song, occupy a length or duration in space and time, in patterns referred to as meter and tala.

Let us pause here a little, with a consideration of Numbers as a measure of these dimensions of space and time, the interval markers of Space and Time . And let us begin with the following unusual definition of Numbers, : “Numbers are figures of speech”. This definition rests on an interesting play on its words. Figures may be understood literally as entities that are enumerators or descriptors of quantity and also as figures of speech, or metaphors that are enumerators or descriptors of quality, or activity or experience. The number One may be variously applied to speak of One apple or One Minute or One Foot, or perhaps the One Ultimate Reality ! The number Two may refer to Two Apples or the Two Opposites that characterize all of existence. So too, do all the numerals from Zero to Nine that enable us to use our fingers as a calculator adapted to the decimal system of numbers, while also serving as a descriptor of many things.

Three is a favourite number in the ancient texts. The triple is a set of three numbers. A set like 3, 4 and 5 are not mere numbers, but express a mathematical relationship that can be expressed in arithmetic, algebra or geometry. The ancients used the triangle as a Yantra or a symbol representing a facet of existence. They also used words in sets of three like the Divine Trinity Brahma-Vishnu-Siva that symbolize Creation-Preservation-Destruction, or the triple word Mantra-Yantra-Tantra to symbolise the convergence of Word-Object-Action, all descriptors of different facets of Existence. An interesting word triple that is relevant here is ChandaSara-MantraSara-TantraSara that is descriptive of the Universal Mother in the Lalitha Sahasranama. The word Sara means essence and hence these three words describe Her as the Essence of Poetry-Word-Action. The word Mantra is a rendering of the Word that constitutes much of the Vedas, translates as that which protects the Mind, can be equally well considered to represent the Mind, insofar as the Word is a product of the Mind.

But how does a reference to Poetry come into all this ? The point here is that the Word of the Veda is set in Chandas, or poetic meters and the two are so inseparable that the Vedas are themselves often referred to as Chandas. But be it noted here that Chandas has well defined Space-Time dimensions to it. The Word of the Veda occupies a strictly prescribed length of Space and a length of Time. Poetry imposes a strictly regulated

use of Time, with rules for the number of its syllables, and the patterns of the alternation of their lengths and stresses. The foot is not only a limb with which we traverse distance. It is also a measure of distance traversed by every step we take, and also the distance traversed by a line of music or poetry. It is these facets of music and poetry that add quality to the words that they clothe, and it is this essence of beauty that is personified by the word triple that describes the Universal Mother in Her Sahasranama. Nor is Chandas the exclusive domain of the Universal Mother. Be it remembered too, that in the Bhagavad Gita, (X-35) Krishna proclaims, that among the highest forms of all Existence, He is also Chandas, the essence of the Gayathri Mantra. To the ancients, then, the entirety of Existence was woven in the warp and weft of Space and Time.

We may now examine some of the ways in which the subject of Chandas was addressed by the ancients. While *Chandas* (छंदः), the study of Vedic meter, is one of the six *Vedanga* ("limb of the vedas"), no treatises dealing exclusively with Vedic meter have survived. The basic rules go back as far as the explanatory Vedic texts known as the *Pratisakhya*s (see Chapter - 4). The oldest work preserved is Pingala's *Chandas Shastra*, dating back to the period of transition from Vedic to Classical Sanskrit poetry. Later sources are the *Agni Purana*, based on the *Chandas Shastra*, Chapter 15 of Bharata's *Natyashastra*, and Chapter 104 of the *Brihat-Samhita*. These works all date to roughly the *Early Middle Ages*. Later related works are the *Vritta Ratnakara* of Kedarabhata,, the *Suvrittatilaka* of Kshemendra etc, dating to the 14th century or later.

At the outset, it may be noted that the Rishi composers of the Vedas considered themselves to be Kavis or Poets. Poetry was therefore implicit in their use of words, with attention to brevity, beauty and depth of meaning within a strict adherence to patterns of meter. The words had the number and syllabic content of a line set, with an alternation of their length, stress and modulation that made them as musical as poetic. A verse had to be set in a meter, divided into a set number of *Padas*, comprised in turn, of syllables. In most of Sanskrit poetry the primary determinant of a meter is the number of syllables in a unit of verse, called the *pāda* ("foot"). The common meters were : the *jāgatī*, with 4 *padas* of 12 syllables, the *triṣṭubh*, with 4 *padas* of 11 syllables, the *virāj* with 4 *padas* of 10 syllables, the *anuṣṭubh*, with 4 *padas* of 8 syllables; and the *gāyatrī*, with 3 *padas* of 8 syllables. A *rik* is a stanza of typically three or four *padas*, with a range of two to seven found in the corpus of Vedic poetry. Stanzas may mix *padas* of different lengths, and strophes of two or three stanzas are common.

Meters of the same length are distinguished by the pattern of *laghu* ("light") and *guru* ("heavy") syllables in the *pāda*. They can be summarized thus :

1. A syllable is *laghu* if its vowel is *hrasva* ("short") and it is followed by at most one consonant before another vowel is encountered, provided the single consonant is not an *anusvara* ('ṃ') or a *visarga* ('ḥ'). (These two exceptions apply to word-final syllables only, as neither of them ever precedes a vowel directly.)
2. All other syllables are *guru*, either because the vowel is *dīrgha* ("long"), or because the *hrasva* vowel is followed by a consonant cluster or an *anusvara* or a *visarga*.
3. The *hrasva* vowels are the short monophthongs: 'a', 'i', 'u', 'ṛ', 'ṝ'
4. All other vowels are *dīrgha*: 'ā', 'ī', 'ū', 'ī̄', 'e', 'ai', 'o' and 'au'. (Morphologically, the last four vowels are actually the diphthongs 'ai', 'āi', 'au' and 'āu', as the rules of *sandhi* in Sanskrit make clear. So, while an original 'ai', for example, had been shortened to an 'e' sound in practice, it was still to be treated as long metrically.)

The time duration of syllables was in units called "morae", *laghu* syllables counting as one unit, and *guru* syllables as two units. The standard unit of grouping, analogous to the "foot" of Western prosody, is four morae (four *laghus*, two *gurus*, or a *guru* and two *laghus*).

The rules distinguishing *laghu* and *guru* syllables go back as far as the auxiliary Vedic texts known as the *Pratisakhya*s. Standard traditional works on meter are *Pingala's Chandaḥśāstra* and *Kedāra's Vṛttaratnākara*. Originally there were apparently no constraints on permissible patterns of long and short syllables, the principle being purely quantitative. Vedic prosody innovated a number of distinctive rhythms:

The last four syllables of a *pada*, termed the cadence by Indologists, are usually in iambic (a short-long syllable alternation) or trochaic (a long-short syllable alternation). This is mainly a strict alternation in the penultimate and antepenultimate syllables, as the final syllable can be of either weight. A caesura is found after the fourth or fifth syllable in *triṣṭubh* and *jagatī* *padas*, dividing the *pada* into an opening and break before the cadence. The break very often starts with two short syllables. The opening shows an iambic or trochaic tendency in keeping with the cadence, though the first syllable can be of either weight, the alternation being in the second and third.

There was thus considerable flexibility in Vedic metrical usage in comparison with the strict metrical canons of later Classical Sanskrit prosody. Versification in Classical *Sanskrit poetry* is of three kinds.

1. Syllabic verse (akṣaravṛtta): meters depend on the number of syllables in a verse, with relative freedom in the distribution of light and heavy syllables. This style is derived from older Vedic forms, and found in the great epics, the [Mahabharata](#) and the [Ramayana](#).

2. Syllabo-quantitative verse (varnavṛtta): meters depend on syllable count, but the light-heavy patterns are fixed.

3. Quantitative verse (mātrāvṛtta): meters depend on duration, where each verse-line has a fixed number of [morae](#), usually grouped in sets of four.

[Pingala](#) in his [Chandaśāstra](#) propounded the term [Gaṇa](#) (Sanskrit, "group") for the pattern of light and heavy syllables in a sequence of three. Pingala's method described any meter as a sequence of gaṇas, or triplets of syllables, plus the excess, if any, as single units. There being eight possible patterns of light and heavy syllables in a sequence of three, this scheme called for ten descriptive elements in all. With each of these ten, Pingala associated a letter, allowing the meter to be described compactly as an [acronym](#). His encoding scheme was as follows :

- The units:

- l: a "light" syllable (L), called *laghu*
- g: a "heavy" syllable (H), called *guru*

- The gaṇas:

- m : H-H-H, called *ma-gaṇa*
- y : L-H-H, called *ya-gaṇa*
- r : H-L-H, called *ra-gaṇa*
- s : L-L-H, called *sa-gaṇa*
- t : H-H-L, called *ta-gaṇa*
- j : L-H-L, called *ja-gaṇa*
- bh: H-L-L, called *bha-gaṇa*
- n : L-L-L, called *na-gaṇa*

Pingala's order of the gaṇas, viz. m-y-r-s-t-j-bh-n, shows a striking correspondence to standard modern [binary](#) representation, when each sequence is read right-to-left with H=0 and L=1.

The word *yamātārājabhānasalagāḥ* (or *yamātārājabhānasalagaḥ*), invented by medieval commentators, is a **mnemonic** for Pingala's *gaṇas*, using the vowels "a" and "ā" for light and heavy syllables respectively with the letters of his scheme. In the form without a grammatical ending, *yamātārājabhānasalagā* is self-descriptive, where the structure of each *gaṇa* is shown by its own syllable and the two following it. The mnemonic also encodes the light "la" and heavy "gā" unit syllables of the full scheme.

- *ya-gaṇa*: ya-mā-tā = L-H-H
- *ma-gaṇa*: mā-tā-rā = H-H-H
- *ta-gaṇa*: tā-rā-ja = H-H-L
- *ra-gaṇa*: rā-ja-bhā = H-L-H
- *ja-gaṇa*: ja-bhā-na = L-H-L
- *bha-gaṇa*: bhā-na-sa = H-L-L
- *na-gaṇa*: na-sa-la = L-L-L
- *sa-gaṇa*: sa-la-gā = L-L-H

Most of classical Sanskrit poetry is of the varṇavṛtta type, also called akṣarachanda. Stanzas are *quatrains* of four pādas (verses), with the metrical structure of each pāda completely specified. In some cases, pairs of pādas may be scanned together as the *hemistichs* of a *couplet*. It is then normal for the pādas comprising a pair to have different structures, to complement each other aesthetically. Otherwise the four pādas of a stanza will have the same structure. While the *Mahabharata* has various types of versification, an overwhelming proportion of the stanzas (all but about 0.2%) are akṣaravṛtta (free syllabic). Within this majority, 95% are *shlokas* of the *anustubh* type and the rest are *tristubhs*.

One can thus see that the compilation of the Vedas in verse rested on what are possible the earliest and most scientific principles of poetic composition know to the world and practically anticipated all developments of poetry of all other and later cultures of the world. It is simply astonishing that the Rig Veda should show such a remarkable convergence of the highest of thought, and deepest of meaning, set the choicest of words and conforming to the greatest beauty of poetic aesthetics.

THE VEDANGAS FOR THE FIRST TIME READER

CHAPTER 8: SEMANTICS – COMMUNICATION & MEANING

The extensive attention to various aspects of Linguistics in the foregoing chapters opens up several wider areas of interest that also have an intimate bearing on different levels of communication and meaning that found extensive attention in ancient Indian tradition, and were symbolized by the word triad, the Mantra, Tantra and Yantra. These may perhaps be described as the Linguistics in the perspective of Metaphysics, that science which treats of the deeper psychological or philosophical principles underlying the world of physical existence. Mantra uses Words to go beyond their literal meaning, while Tantra uses Actions and Yantra uses Objects to embody and communicate meanings that lie beyond the reach of Words at levels of experience and understanding far beyond those of our physical existence. In other words, a world of metaphysics. While a discussion of these topics takes us beyond the Vedangas proper, it would be both useful and appropriate to look at several other ancient texts that are both contemporaneous and relevant to the same purposes.

When we consider going beyond the word and language we need to start with Mantra where the word itself provides an appropriate take-off point. When need first to consider the fact that the Mantra is a construct that rests on words, but often do not point directly or clearly to meaning. They seem to use words more for its sound content to convey a different level of esoteric meaning that we may not be able to comprehend readily. For instance, is AUM to be taken as a word meaning the first manifestation of physical existence, or a primordial sound that puts us in resonant contact with the divine. We may here take a specific example of the Panchadasakshari Mantra which has special significance in the worship of Lalitha Devi, the Universal Mother. Its text is reproduced below, and the reader may find it is interestingly poetic, but forbiddingly esoteric. It would indeed be so to all but the initiate. It is considered a holy mantra of enormous power, a power that clearly derives from the hold its inner meaning exercises on the devotee :

क ए ई ल हीं । ka ē ī la hrīm .

ह स क ह ल हीं । ha sa ka ha la hrīm.

स क ल हीं । sa ka la hrīm .

This Panchadsakshari Mantra, as its name indicates, has its 15 letters distributed over three lines or sections, which are respectively called the Vagbhava Kuta, the Kamaraja Kuta and the Shakthi Kuta. When a sixteenth letter which is implicit in this Mantra is indicated explicitly, the Mantra is referred to as the Shodashakshari. The 15 (or 16) component letters and their three groupings carry a multi-faceted symbolism. The three groups

each have an identifying letter (ऐं ह्रीं सौः) and these refer to the face, the torso and lower part of the body of the Devi, and these are directly referred to in specific Names of the Lalitha Sahasranama. Other Names in the Sahasranama also refer to the corresponding Chakras or vital energy centres of the human body or as graphically represented in the Sri Chakra Yantra that is special to worship of Lalitha Devi, and thereby establish what might be called a living triple linkage between the Devi, the Sri Chakra and the devotee, reflected in the Names Mahamantra, Mahatantra and Mahayantra.

Again when go beyond the word to the realm of numbers and mathematics we seem to be entering a new realm of symbol and meaning. Arithmetic lets us express quantities from the very small to the very large. The number '5' by itself tells us nothing. We have a little more meaning when we say '5 apples' but the meaning becomes complete when we say 'I have 5 apples' So is the case with Geometry that lets us relate to tangible size and shape. But when we go to Algebra, we go into the realm of the intangible where the symbol x may be any anything or any quantity; where the equation $y = f(x)$ may express any computation applied to the value x that would give us the resulting value y ; or where the equation $e = mc^2$ expresses a profound working principle of the cosmos that relates mass to energy. To the stranger in mathematics, all this is babble, but to ear of the mathematician it music, while for the scientist, this is the realm of truth, of true meaning.

Next let us . proceed to realms that are even more intangible. Let us take the sound modulations prescribed for recitation of Mantras or the musical rendering of the Sama Veda Mantras, which are credited with being vehicles of power extending beyond literal meaning. What then could the content and intent be in the Mantra and what is the meaning that its sounds are really communicating ? When we go beyond the word, to the realm of music, of pure sound, we clearly experience specific auditory impacts, beginning say, from the deep sonorous monotone chanting of AUM and going on to the three tonal levels of chanting of the Sama Veda. Yet, are we here in another word-neutral realm of communication operating through a language and alphabet of a different genre ? It should be even more interesting to the reader to shift attention from the word content of the

Vedas to more or less contemporaneous texts that addressed the non-language communication media of song and dance.

Pride of place in this regard belongs to the Natya Shastra of Bharata Muni from whom the ancient Indian tradition of Music and Dance is traced, and who is placed in time between 200 BC and 200 AD. His work in turn is said to come from an older tradition, of what is referred to as the Gandharva Veda, said to have been provided by Brahma as an annexure to the Sama Veda, and said to contain 36000 slokas and described as the Fifth Veda, and that was meant for the lay, rather than the learned. The story goes that enchanted by Bharata Muni's first play, Śiva himself, the lord of the Cosmic dance, sent his disciple Tandu to teach Bharata the authentic principles of dance, which Bharata included in the chapter "Tandava Lakshana" of his work, the Natya Shastra. Bharata Muni evolved ten basic postures of the body, nine of the neck, thirty-six of the hand, and thirteen poses of the head—postures that required the disciplined use of the entire body and all of its potential for expression. Various schools of dance have elaborated on these principal postures, each of which blossoms into an exactly coordinated repertoire of associated hand, facial, eye, foot, and total body movements synchronized to the rhythm of intricate instrumental and vocal music to communicate a "telling" story.

The Natya Shastra has a text of 6000 slokas and treats of all the arts of dance, drama and music in astonishing technical detail. There is considerable attention to the communication of meaning through every possible mode of expression. These involve concepts of bhava and rasa which give colour and impact to the communication. There is here a whole world of communication of meaning through not only sound and word, but of thought, action and feeling through bodily movements, poses, gestures, and facial expressions. These are physical expressions laden with overlays of bhava and rasa, form and essence, colour and taste to enrich the communication. When one considers these different representations of thought, action and feeling, one begins to see the significance of the Vedic constructs of the Mantra, Tantra and Yantra as vehicles of great power

Bharata established the Shadja, as the first defining note of the musical scale, where Shadja means "six", that refers to its giving birth to the remaining six notes together with which it forms the octave, and makes the Grama or basic scale of music. Could these seven notes be indeed a reference to "the meeting together of the seven noisy birds" in the Rig Veda (X-71-3) Bharata's formulations provide the foundations for Indian classical music system of today, though of course, the intervening centuries since then have seen a great deal of sophistication and development. The chief innovation of course, is a shift from the Grama where the Shadja has a fixed absolute frequency level, to the Raga where the Shadja can be fixed at any level that suited the singer. Music could then be set in a variety of octaves of different frequencies, making for the same musical patterns and impacts by different musicians with different

voice endowments and impretative and innovative skills. The development of the Raga scheme reached its acme with the Venkatamakhin's Melakarta Raga scheme dating back to the 17th. Century, which prevails in South India to the present day. In this scheme the octave is made of 12-note level comprised of 7 tones and 5 half-tones, which, in different 7-note combinations, yields the number of 72 standard Ragas. The order positions assigned to the Ragas in this interestingly derived from an old numbering system called the Katayapa scheme where number values were mapped to the letters of the Sanskrit alphabet arranged in four groups beginning with the letters ka, ta, ya and pa as below :

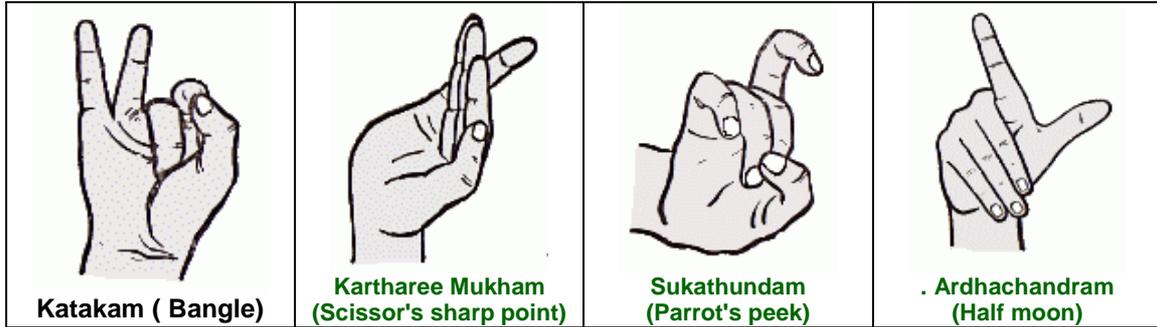
1	2	3	4	5	6	7	8	9	0
ka	kha	ga	gha	~ma	cha	Cha	ja	jha	~na
Ta	Tha	Da	Dha	Na	ta	tha	da	dha	na
pa	pha	ba	bha	ma					
ya	ra	la	va	Sa	sha	sa	ha		

For example, **Harikambhoji** raga starts with syllables Ha and ri, which have numbers 8 and 2 associated with them. Reversing them we get 28. Hence Harikambhoji is the 28th Melakarta raga.

When we come to the medium of dance, we find the Mudra or a dance pose is a physical action frozen in time, that expresses an object or an activity or a quality, that replaces a whole string of words with as much if not greater impact than the word itself, indeed side-stepping the need for the word altogether. Consider the following sample examples of Mudras and the meanings they communicate, of the Bharata Natya dance form, as prescribed in the Natya Sastra.

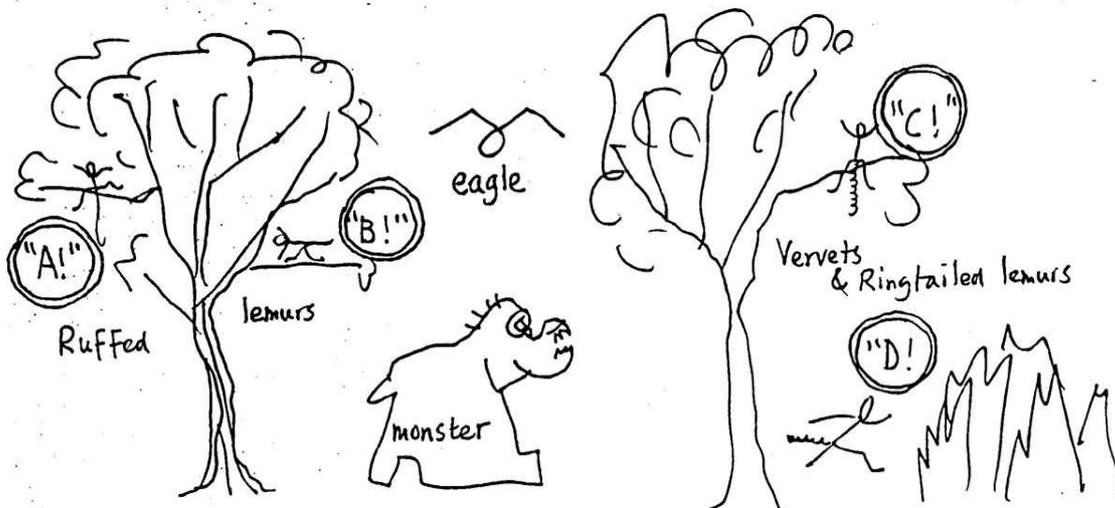
<p>Tripataka (Tree-pah-tah-ka)</p> <ul style="list-style-type: none"> • on forehead : putting on a crown • crossed over chest : saluting elders 		<p>Utpalapadma</p> <ul style="list-style-type: none"> • asking 'who are you?' • prohibiting something 	
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It would be interesting also to consider examples of the following images of basic Mudras of Kathakali, the dance form of Kerala, very similar to the dance forms prescribed by the Natya Shastra but shaped by other local texts like the "Hasthalakshana Deepika". There are 'Asamyutha Mudras' (that is shown using single hand) and 'Samyutha Mudras' (mudras shown with both hands) in each of a total of 24 Basic Mudras, making a total of 470 symbols used in the Kathakali tradition.



Modern studies of Linguistics tend to take the investigation of human Communication and Language, and Word and Meaning, forward by examining whether the experience of primitive cultures or even non-humans can give us a better understanding of these issues. Interesting studies have been undertaken of communication between birds and animals, to see whether there is evidence of mere Darwinian adaptation to the environment or whether there are indications of an unfolding of inherent creative potentials. The latter factor is seen quite clearly in the unique capacity of humans to take language beyond the limited needs of communication to reach into the vast vistas of shared knowledge. In the case of animals, while they seem to stop short at communication for the purposes of survival, there are some interesting common principles that seem to work. Birds for instance, seem to use a limited stock of sounds by the same processes of repetition and recursion to generate a wider variety of bird song, much as humans do more extensively though words or musical notes. The interesting thing about contemporary studies is the range of innovative investigative techniques used to study the possibility of the different modes of communication of non—humans, serving as vehicles of meaning.

The following is an charming sample of these studies from a paper by the noted Sanskritist, Frits Staal showing how different types of monkeys have advanced the use of sound only up to the stage of developing specific calls to communicate to their fellows in situations of danger. Vervets and Ringtailed-lemurs are highly terrestrial are able to escape into trees and may therefore respond to predators by escape on the ground or in the trees. Their close relatives the Ruffed lemurs live mostly in trees and are therefore more likely to escape into trees rather than on the ground. The following figure illustrates how the calls uttered by the Vervet or Ruffed lemur, shown as A and B, and the calls that Ringtailed lemurs shown as C and D could carry diiferent meanings :



A may mean: "Monster!" or "I warn you that there is a monster!"

B may mean: "Eagle!" or "I warn you that there is an eagle!"

C may mean: "Monster!" or "I warn you that there is a monster!" or alternatively, "Escape into the trees!"

D may mean: "Eagle!" or "I warn you that there is an eagle!" or alternatively, "Take cover in the underbrush!"

It seems possible that conflicting escape tactics in the case of the Vervets could have led to the evolution of functionally different referential alarm calls, corresponding to words of humans. This pointed to language generated by reasons of functional necessity rather than Darwinian natural selection. Language evolved, says Staal, because humans, even though they may have descended from the trees, were able to use their hands and mouths for a far wider range of purposes, especially speech to serve new vast vistas of knowledge. Humans took language beyond the basic needs of communication, but went on to creation of words that identified objects ("pure references" in the jargon of linguistics) and then building words into sentences to convey meaning or "referential knowledge" of the world around them.

On the role of truth in the function of words and sentences, it would be interesting here to note Aristotle's statement that sentences of referential knowledge could be true or false, but referential words remained neutral. Would there be an element of truth in the sounds that non-humans make? Are they just words, which carry no element of truth that sentences do? In other words, do non-humans not have the wider concern for knowledge that humans have? One study showed that that vervet monkeys utter different alarm calls when they see eagles, leopards and snakes; they do not give eagle alarm calls when they have seen leopards or *vice versa*. They respond in the same way to play-back recordings of these calls. One specific call would be equivalent to the sentence, "Look out, here is a

snake”, but it could well be “Run, a snake is approaching”. There could be a small element of truth in each call. Yet in the human setting, the reach of a word or a sound is much more complex. A single human sound, like a shriek, or an exclamation “Wow !” may mean different things and elicit different responses in different contexts. What the sound means, in other words, what is the truth it conveys, changes with the context. This surely indicates how far language has advanced in humans into the realms of knowledge, from a world of objects, to a wider world of contexts, represented by sounds, words or sentences as expressions of truth. Was Aristotle’s comment then an early echo in Greece, of a concern with the concept of truth which occupies a central position in language as a vehicle of knowledge in the Indian tradition and figures as a central concern in all the Vedas and the Vedangas.

Let us now consider the following example of the relationship of word to meaning from a different perspective :

Take the following five letters :

A P P L E

If these five letters were considered and articulated separately, they would be mere sounds carrying no meaning. But put the letters together and you get the word **APPLE**, which when articulated conveys the following image in your mind of the word and the object it represents :



Now put the word into a sentence :

I LIKE TO EAT AN APPLE

Now you have several letters joined together to form several words, and together forming a sentence conveying an image in your mind of an action and an object, conveying a complete meaning.

In the above narrative, you see that we are progressing from a letter with no meaning, but bearing a potential for meaning, that can grow through a word to a sentence with a progressive increase of meaning. If you follow the above sequence in the reverse order you see a decreasing content of meaning. But the important point is that the letter that you start with has a

small element that has apparently has no meaning but does have a potential to grow into wider meaning and finally complete meaning.

Now let us make a quantum jump to another level of abstraction : The above sentence, if represented in braille, looks like this :



I LIKE TO EAT AN APPLE

What you now have in the braille alphabet is a single dot that generates all three levels of communication with corresponding meanings, the letter, the word and the sentence. So obviously a dot too has the same potential as a letter to communicate meaning. Suppose we take this line of argument beyond the dot, to its minute limits, namely, the point, with its geometric definition as a circle with a diameter of zero. We then refer to this point, for want of a better word, by the word 'nothing' or the word 'zero'. But its potential still remains. We may then conceive of a minute germ of sound bearing a minute germ of meaning with the potential to develop progressively into the larger forms of speech and thought expressed as words and sentences. Did not we not have modern physics tell us of a similar point of existence, the electron, that marks that origin where matter disappears, but remains as energy, with a potential for aggregation into more matter or more energy in newer forms with added meaning.

Modern epistemology which deals with the sources of knowledge and modern semiotics which deals with signs or symbols, look at thought, word or meaning developing in this way, but this is precisely the way of thinking of the Indian ancients. These were remarkable methodologies of men like Yaska and Panini, Patanjali and Bhartrhari who were at once Linguists, Grammarians and Philosophers all rolled into one. These were disciplines, never assigned a separate and unique identity as in modern times, and though their contexts were broadly recognized by the Vyakaranikas or Grammarians and the Darshanikas, or Philosophers, they were always inter-meshed into a common over-arching visualization of one ultimate truth.

THE VEDANGAS FOR THE FIRST TIME READER

CHAPTER 9 : LANGUAGE & KNOWLEDGE

It is interesting to see how the Indian approached an understanding of language by an intensive observation and analysis of how it evolved from within the human mind, while the Western approach arrived at more or less the same conclusions from an intensive observation of the external world. The following brief summary of a perceptive essay entitled “ “ by the distinguished Sanskrit scholar, Frits Staal. who straddled the knowledge of both East and West, would be of special interest to the modern first time reader. Staal tells us how modern Science has looked at language through its development from sound, through word, sentence and meaning, and how this process has evolved across different forms of life, human and non-human. He quotes extensively from a wide range of scientific studies that describe how the evolution of sound into different forms of communication by non-humans was shaped by different objectives and methods, specific to their needs and faculties. Their development would therefore appear to have stopped short at the level of communication of some knowledge limited to serve their purposes of survival. It would therefore be clear that development across the species followed essentially the same principles and sequences, up to that point, after which, however, the humans simply forged ahead with the development of language, to serve far wider purposes of knowledge to which their faculties and activities led them.

These wide ranging explorations of the external world by modern science into the possible origins of the species and the possible origins of their languages, are certainly fascinating. But Staal now takes us back 25 centuries to have a close look at the corresponding explorations of the internal world of the human mind in India, and how these led human language to a level of perfection in the Sanskrit language (The word “Sanskrit” itself means “Done to perfection”). The level of sophistication reached by then was such that it needed a whole battery of sciences, the Vedangas, to explain, describe and preserve the language of the Vedas. The level of sophistication reached by the world’s first grammar of Panini, can be readily recognized by one of its verses (Panini 3.3.161) which lists the different forms that the that a verb in the optative mood could take so many shades of meaning, as illustrated by Staal in the examples below : (The optative means injunction, invitation, permission, respectful command, deliberation, or request).

(a) injunction: "You should go to the town";

(b) invitation: "Please eat here";

(c) permission: "You may sit here";

(d) respectful command: "(Please) teach my son";

(e) deliberation: "Should I study the Vedas or logic?"

(f) request: "May I get a meal?"

Staal takes us now all the way from the Panini, whom he describes as the greatest linguist of antiquity, to Noam Chomsky, acknowledged as today's father of modern linguistics, but who in turn, acknowledges his concept of generative grammar to be founded on the grammar of Panini. Tracing the course of modern linguistics, leading to the work of Chomsky, Staal starts with the questions of Selection and Evolution, and with the specific question, was language selected for Knowledge or Communication? And he starts with the charming answer given by Jacob Grimm (one of the Grimm brothers who authored the famous fairy tales) to the question, Did God speak Hebrew? Grimm responded gently that if God spoke language, *any* language, we must assume that he had teeth, but since teeth were not created for speech but for eating, we must assume that he also ate, and this leads to so many other undesirable assumptions that we better abandon the idea altogether. Grimm's view was seen to be quite consistent with the later finding of Darwin, whose "Origin of the Species" was published eight years later in 1859, that any feature or organ selected for one reason may be used for another. It holds for the mouth as well as the ear, that exquisite instrument that, in the words of Staal, "enables us not only to listen to symphonies but identify *dentals* such as *t* and *d*, produced by the teeth, *velars* such as *k* and *g*, produced by the throat, etc. But the hearing apparatus within the ear was not selected for any such reason. It is a result of the growth of the skull in early mammals that caused a bone of the reptilian jaw to migrate to the ear".

If one were to start with the general idea that language uses *sounds* to express *meanings*, this implies that there must be at least two components of linguistics: *phonology* and *semantics*. A third, *syntax*, would also appear to come into play. The first major contribution of Noam Chomsky was to show that syntax is independent from phonology and semantics. But, says Staal, while syntax continued to be analysed, derived from and stated in terms of rules, right from the time of Panini or even his predecessors, Chomsky made another radical departure, showing that the formal properties of syntax may be derived from more abstract principles. If syntax and phonology, then, were different and therefore sprang from different evolutionary antecedents, how did this affect the question, was language selected for knowledge or communication? Chomsky emphasized that language is not primarily for communication but serves other functions such as the expression of knowledge, thought or ideas. The word "communication" had no meaning in the absence of an audience, or with an audience that was completely unresponsive. Chomsky's

emphasis on language as a cognitive system and means for the expression of truth continues a European tradition initiated over a hundred years earlier by Wilhelm von Humboldt. Chomsky's development of these ideas within a contemporary scientific framework has shaped modern linguistics and psychology and led to new disciplines such as the cognitive sciences.

Chomsky says evolutionary theory is, no doubt, informative about many things, but it has little to say, as of now, about questions of origins of faculties and functions. Staal quotes Chomsky extensively that "the answers may well lie not so much in the theory of natural selection as in molecular biology, in the study of what kind of physical systems can develop under the conditions of life on earth and why, ultimately because of physical principles. It surely cannot be assumed that every trait is specifically selected. In the case of such systems as language, or wings, for example, it is not easy even to imagine a course of selection that might have given rise to them. A rudimentary wing, for example, is not "useful" for motion but is more of an impediment. Why then should the organ develop in the early stages of its evolution? In some cases it seems that organs develop to serve one purpose and, when they have reached a certain form in the evolutionary process, become available for different purposes, at which point the process of natural selection may refine them further for these purposes. It has been suggested that the development of insect wings follow this pattern. Insects have the problem of heat exchange, and rudimentary wings can serve this function. When they reach a certain size, they become less useful for this purpose but begin to be useful for flight, at which point they evolve into wings. Possibly human mental capacities have in some cases evolved in a similar way. Take the human number faculty. Children have the capacity to acquire the number system. They can learn to count and somehow know that it is possible to add one indefinitely. They can also readily acquire the technique of arithmetical calculation. If a child did not already know that it is possible to add one indefinitely, it could never learn this fact. The ability to count is not "more of the same" but entirely different in character".

Chomsky has thus gone further than any other student of language, in discovering, establishing and formulating abstract principles from which the formal properties of language can be derived. Nothing illustrates these principles better than the emergence of formal artificial languages such as those underlie or generate the structures of computer languages. A critical principle here is an incontrovertible way of expressing truth, resting on the rigid binary logic that an expression or statement must be true or false, a logic that is represented by the values 1 or 0, and which can be directly represented in computers through the electrical states of ON or OFF. It is no wonder that the work of Chomsky has led to all contemporary studies on theoretical linguistics have increasingly taken on the look treatises on algebra. The statement $y = f(a,b)$ is as much a mathematical statement as a computer instruction : it is the same as the natural language statement that says "Apply operation 'f' to the values 'a' and 'b' and assign the result

to 'y' ", where 'a' and 'b' be could be any of several values (operands) and 'f' could be any of several operations (operators), and 'y' could, by virtue of the '=' symbol, be assigned the resulting value (the truthful result).

The fact that the Natural Languages that are spoken by humans render themselves unsuitable for direct application to computers on this very principle because they employ expressions and statements are so fraught with ambiguity, if not absolute falsehood. Of course this is inevitable in the context of human experience, which is simply not binary, not just black and white, but an enormous range of shades of grey, rendered even more complex by enormous range of shades of different colours, and where inferences may not necessarily be true ! To use a computer then, the human has to reduce his own language usage through a set of rules to to a computer language with its own clearly defined usages of syntax and semantics. Indeed developing such Artificial Languages from Natural Languages calls for a complete set of rules that steps logically through all the ambiguities of the latter to reach results or statements of incontrovertible truth. The great contribution of Paninni was to establish such a phenomenal base of nearly 4000 rules to govern usage of the Sanskrit of his time, primarily to establish a strong and permanent foundation for the understanding and preservation of the Vedic corpus of Knowledge. But his work was recognized by Chomsky to provide a framework of principles from which any language, Natural or Artificial, could be derived, This was a work for which the oldest grammarian of the world was held in in the greatest awe and admiration by the greatest linguist of the modern world of today.

THE VEDANGAS FOR THE FIRST TIME READER

CHAPTER – 9 : LANGUAGE & KNOWLEDGE

It is interesting to see how the Indian ancients approached an understanding of language by an intensive observation and analysis of how it evolved, from within the human mind, while the Western approach arrived at more or less similar conclusions from an intensive physical observation of the external world. The following points from a perceptive essay entitled by the distinguished Sanskrit scholar, Frits Staal, who straddled the knowledge of both East and West, would be of special interest to the modern first time reader. Staal tells us how modern Science has looked at language through its development from sound, through word, sentence and meaning, and how this process has evolved across different forms of life, human and non-human. He quotes extensively from a wide range of scientific studies that describe how the evolution of sound into different forms of communication by non-humans was shaped by different objectives and methods, specific to their needs and faculties. Their development would therefore appear to have stopped short at the level of communication of some knowledge limited to serve their purposes of survival. It would therefore be clear that development across the species followed essentially the same principles and sequences, up to that point, after which, however, the humans simply forged ahead with the development of language, to serve far wider purposes of knowledge to which their faculties and activities led them.

These wide ranging explorations of the external world by modern science into the possible origins of their languages, are certainly fascinating. Science was basically concerned with explanations for the phenomena of the physical world with a view to establish their truth. But it soon became apparent that normal natural languages were not quite adequate for the expression of truth about what lies behind the appearances, however well-constructed by formal rules, they might be. The languages of classical science, Greek, Latin, Sanskrit, Chinese and Arabic were formal, but not formal enough to trigger a global scientific revolution. But they contributed to the origin of algebra which introduced a new step of language evolution but in an entirely unprecedented direction (Staal 1995). That is what Galileo had in mind when he declared that the book of the universe is written in the language of mathematics. The so-called European scientific revolution depended on the artificial language of algebra, and this marked the beginning of formal, artificial languages that would meet the exacting needs of scientific truth.

The European scientific revolution would not have spread as wide and fast as it did, if mathematicians like Euler had not translated Newton's cumbersome Latin, and obsolete Euclidian methods and unwieldy formalizations into simple algebraic equations that everybody could learn to understand.. The spectacular results of the so-called exact sciences are largely due to mathematization. The adoption of an artificial language for the expression of a fundamental truth, set out in a mathematical equation, is not just an abbreviation of what may be expressed through a natural language; it possesses a structure that may be called linguistic or syntactic but is totally different from the syntactic structure of natural language. It preserves the mathematical property that Chomsky called "discrete infinity" and still rests on sentences that must be true or false. But it does not consist of a subject and predicateIt lacks gender, mood, aspect or tense and does not refer to "I" or "you." And yet, this grammar of artificial languages developed from the syntax of the natural, incorporating other symbolic systems such as expressions for numbers. The functional expression $f(x)$, for example, may in some simple cases be interpreted as "x is f", which may in turn be read as a subject-predicate sentence.

The formal languages of mathematics have replaced natural language in all the so-called exact sciences, and is now spreading to embrace the human sciences, including linguistics. Although Chomsky seems to have gone further in deriving the formal properties of natural language from abstract principles than anyone else so far, there is a prehistory to it, In the European tradition, in the formalization of natural language, starting from Aristotle. An interesting anticipation of Chomsky dates back to 1660 when two British grammarians, Arnauld and Lancelot, stated : "... this marvellous invention of composing out of 25 or 30 sounds that infinite variety of expressions, which, whilst having in themselves, no likeness to what is in our mind, allow to disclose to others its whole secret, and to make known to those who cannot penetrate it, all that we imagine and all the stirrings of our soul"

But Staal now takes us back 25 centuries to have a close look at the corresponding explorations of the internal world of the human mind in India, and how these led human language to a level of perfection in the Sanskrit language. (Incidentally, the word "Sanskrit" itself means "done to perfection") The level of sophistication reached by then was such that it needed a whole battery of sciences, the Vedangas, to explain, describe and preserve the language of the Vedas. The level of sophistication reached by the world's first grammar of Panini, can be readily recognized by one of its verses (Panini 3.3.161) which lists the different forms that the that a verb in the optative mood could take so many shades of meaning, as illustrated by Staal in the examples below : (The optative means injunction, invitation, permission, respectful command, deliberation, or request).

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Staal takes us now all the way forward from Panini, whom he describes as the greatest linguist of antiquity, to Noam Chomsky, acknowledged as today's father of modern linguistics, but who himself acknowledges his own work to be inspired by the grammar of Panini. Tracing the course of modern linguistics, leading to the work of Chomsky, Staal starts with the questions of Selection and Evolution, and with the specific question, was language selected for Knowledge or Communication ? And he starts with the charming answer given by Jacob Grimm (one of the Grimm brothers who authored the famous fairy tales) to the question, Did God speak Hebrew ? Grimm responded gently that if God spoke language, *any* language, we must assume that he had teeth, but since teeth were not created for speech but for eating, we must assume that he also ate, and this leads to so many other undesirable assumptions that we better abandon the idea altogether. Grimm's view was seen to be quite consistent with the later finding of Darwin, whose "Origin of the Species" was published eight years later in 1859, that any feature or organ selected for one reason may be used for another. It holds for the mouth as well as the ear, that exquisite instrument that, in the words of Staal, "enables us not only to listen to symphonies but identify *dentals* such as *t* and *d*, produced by the teeth, *velars* such as *k* and *g*, produced by the throat, etc. But the hearing apparatus within the ear was not selected for any such reason. It is a result of the growth of the skull in early mammals that caused a bone of the reptilian jaw to migrate to the ear".

If one were to start with the general idea that language uses sounds to express meanings, this implies that linguistics must rest on at least two components of linguistics: phonology and semantics. A third, syntax, would also appear to come into play, but the question is When and Why. The first major contribution of Noam Chomsky was to show that syntax is independent from phonology and semantics. But, says Staal, while syntax continued to be analysed, derived from and stated in terms of rules, right from the time of Panini or even his predecessors, Chomsky made a radical departure, showing that the formal properties of syntax may be derived from more abstract principles. If syntax and phonology, then, were different and therefore sprang from different evolutionary antecedents, how did this affect the question, was language selected for knowledge or

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(operands) and 'f' could be any of several operations (operators), and 'y' could, by virtue of the '=' symbol, be assigned the resulting value (the truthful result).

The fact that the Natural Languages that are spoken by humans render themselves unsuitable for direct application to computers emerge from this very principle, because they employ expressions and statements that are so fraught with ambiguity, if not absolute falsehood. Of course this is inevitable in the context of human experience, which is simply not binary, not just black and white, but an enormous range of shades of grey, rendered even more complex by enormous range of shades of different colours, and where inferences may not necessarily be true ! To use a computer then, the human has to reduce his own language usage through a set of rules to a computer language with its own clearly defined usages of syntax and semantics. Indeed developing such Artificial Languages from Natural Languages calls for a complete set of rules that steps logically through all the ambiguities of the latter to reach results or statements of incontrovertible truth.

The modern approach to the design of Computer Languages is through setting all instructions and data to be processed in a computer in the standardized structure of the Backus—Naur Form, proposed by John Backus in 1959, and later amended by Peter Naur, for the design of computer language ALGOL. A typical BNF representation of a [U.S. postal address](#) is thus :

```
<postal-address> ::= <name-part> <street-address> <zip-part>

    <name-part> ::= <personal-part> <last-name> <opt-jr-part> <EOL>
                | <personal-part> <name-part>

    <personal-part> ::= <first-name> | <initial> "."

    <street-address> ::= <house-num> <street-name> <opt-apt-num> <EOL>

    <zip-part> ::= <town-name> ", " <state-code> <ZIP-code> <EOL>

    <opt-jr-part> ::= "Sr." | "Jr." | <roman-numeral> | ""
```

This translates into English as:

- A postal address consists of a name-part, followed by a street-address part, followed by a zip-code part.
- A name-part consists of either: a personal-part followed by a last name followed by an optional "jr-part" (Jr., Sr., or dynastic number) and end-of-line, or a personal part followed by a name part (this rule illustrates the use of [recursion](#) in BNFs, covering the case of people who use multiple first and middle names and/or initials).
- A personal-part consists of either a first name or an [initial](#) followed by a dot.

- A street address consists of a house number, followed by a street name, followed by an optional **apartment** specifier, followed by an end-of-line.
- A zip-part consists of a **town**-name, followed by a comma, followed by a state code, followed by a ZIP-code followed by an end-of-line.
- A opt-jr-part consists of "Sr." or "Jr." or a **roman-numeral** or an empty string (i.e. nothing).

The great contribution of Panini was to derive from the language corpus of the Sanskrit of his time, virtually a meta language comprised of nearly 4000 Sutras in much the same way as Backus-Naur form has done for the natural languages of today, paving the way to put them to use on computers. One may harken back at this point to the examples given in Chapter 6 of Panini's rules in encoded form for the constructions of syllables, words and sentences. It would be of special interest to the reader today to know that Panini's Ashtadhyayi is today available as a fine Computer Software package, called the "Ganakashtadhyayi" developed Dr. Shivamurthy Swamiji, a remarkable modern scholar who is also the religious head of the Taralabalu Brihannutt, Sirigere, Karnataka. (The package is available as a free download on the Internet at www.taralabalu.org) While Panini's objective was primarily to establish a strong and permanent foundation for the understanding and preservation of the Vedic corpus of Knowledge, his work was recognized by Chomsky as clearly providing a framework of principles from which any language, Natural or Artificial, could be derived. Here then, was a unique example of a work of the oldest grammarian of the world that was held in in the greatest awe and admiration by the greatest linguist of the modern times !

THE VEDANGAS FOR THE FIRST TIME READER

CHAPTER - 10 : PERCEPTION - TRUTH & REALITY

The Indian ancients referred to Truth and Reality by a single word, Sat or Satya. The Western tradition seems to prefer use of the word Truth to Reality as more appropriate to the context of Science which was the focus of their concerns. It is possible that in contradistinction, the Indian approach may have considered Reality as better referring to their concerns over Knowledge, in respect of which their approach had a wider sweep. Their perspectives addressed Knowledge in terms of an over-arching Existence that presented man's inner and outer world as an indivisible continuum of a Reality that was Infinite and Eternal, and that the best that man could do to understand this Reality was only through finite bits of this Reality symbolized by the word. The early scholars started looking at the word of the Veda as something that originated from the intuitive, perceptive mind of the Seer. The word became a vehicle of meaning, that lent itself to articulation in speech, to enable a sharing of all that it was intended to convey. The mind then, clearly bore the faculty, that could just with a thought, initiate the chain of inner events that culminated in the spoken word. The ancient scholars reflected deep on these inner sequences and considered the pure sound emerging in the shape of Sabda, the Word, from One Ultimate Reality called the Sabda Brahman. The Sabda carried the creative energy to shape an intent or meaning into a word and transfer its energy to the vocal chords and cause the word to be articulated. The meaning could come from a recall of an earlier experience stored in their original words, or a new thought or a new experience or meaning, and clothe it in one of the older words, creating new meanings for the same word, or create a new words derived from the old words or create new words altogether.

Here then was a panorama that unfolded in the awesome reaches of the minds of the ancient Rishis, which they reduced to the concept of the "One that becomes the Many", which the ancient Rishis reduced to one word "AUM", and Uddalaka Aruni put into the three words of the Great Saying, the Mahavakya, "Tat Tvam Asi". If words are meant to convey meaning, there could clearly be no higher meaning than Reality. Through the ages, man has engaged relentlessly in the search for Reality, and the Indian ancients came as close to it as words would permit, yet at a point, they were quick to add that words were not adequate to state or describe it.

Modern philosophy is said to commence with the French philosopher Rene Descartes (1596-1650). His famous and oft-quoted words on the subject of Existence, in his original Latin are “Cogito ergo sum”, which translates as “I think, therefore I am” It would be interesting to know that he was anticipated by more than 4000 years earlier by the profound words in Sanskrit of the Indian Sage Uddalaka Aruni, “Tat Tvam Asi”, which literally translates as “That Thou Art” but in effect means “You exist because you are part of That which always exists” These words occur in the Chandogya Upanishad in an interesting discussion of far-reaching significance between the Sage Uddalaka Aruni and his son Svetaketu. With several examples the Sage explains to his son how all that exists and is perceived, ultimately comes from one essence, one Truth, that cannot be so perceived. He bids his son to bring him a fruit from the nearby banyan tree, break it and see what is inside. When Svetaketu does so, and says he finds small seeds, the sage bids him break one seed and see what is inside. Svetaketu does so, he says he finds nothing in it. The Sage then explains that it is not nothing, but something that cannot be seen – it is a subtle essence from which springs the seed, and ultimately grows into the big tree that they behold. It is not ‘nothing’, says the Sage, it is something for which we use the word ‘That’, simply because we have no word that can ever describe it. It is not ‘nothing’ that leads to the seed and the tree, continues the Sage, but something that leads to all that exists, including you and me. The words “Tat Tvam Asi” or “That Thou Art”, with which the Sage concludes several examples, are words described as the Maha Vakya or Great Saying, that echoes down the ages, representing its highest wisdom offered by India. The Chandogya Upanishad verse (6.8.17) reads thus in Sanskrit :

स य एषोऽणिमैतदात्म्यमिदं सर्वं तत्सत्यं स आत्मा तत्त्वमसि श्वतककेतो न इति

भूय एव मा भगदान्विज्ञापयत्विति तथा शोभ्येति तथा होवाच ।।

Questions like “What is existence ?”, or “Who is this ‘I’ that asks this question ?” have of course, been at the centre of reflection of the highest thinkers across all cultures and through the ages. A charming story is told of the Chinese philosopher Chuang Tzu (Name : Zhuangzi : born 369 BC) that he was found one day in a state of great distress. Questioned on the reason, he said he had just dreamt that he was a butterfly. Told that that was no reason for distress, he replied, but in his dream, the butterfly in turn, had a dream that it was Chuang Tzu. He was therefore distressed at not being sure whether he was Chuang Tzu dreaming that he was a butterfly, or a butterfly that was dreaming that it was Chuang Tzu. One popular thinker of the present day, Eckhart Tolle, answers the question, “Who am I”, by saying, you are what you are Now, this present moment, not what you were a moment ago, which is a memory, or what you will be a moment later, which is a hope – in short, you are not the many different

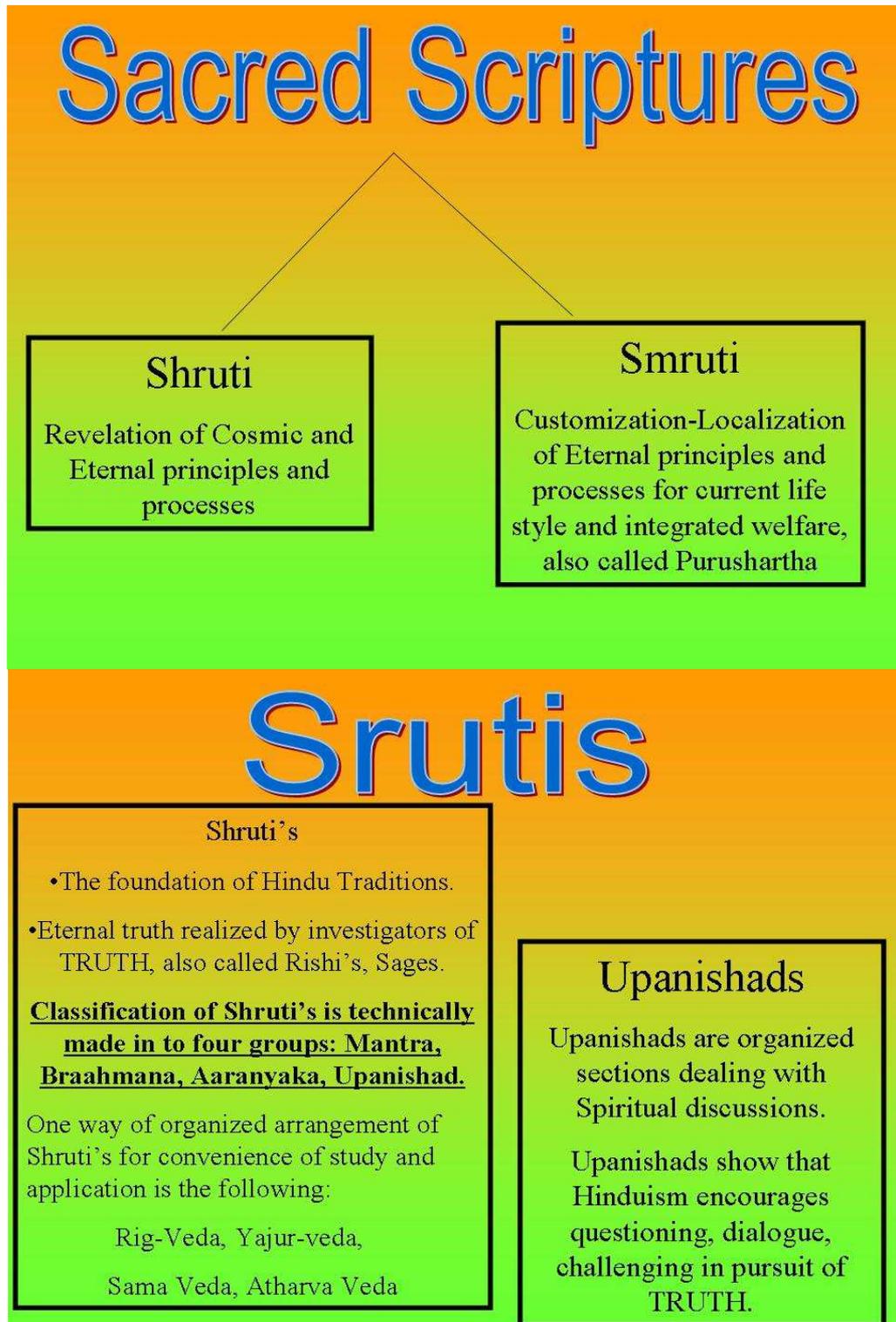
things that your mind makes you out to be, shaped by memories and hopes, but one real thing that is in the present you are always in, not the unreal things of the past or the future, that are creatures of the mind.

Sound as the first manifestation of the Divine and its proliferation into innumerable words, philosophically stated as the One becoming the Many, becomes the central concern of the Philosophy of Language. Here then is a vast spectrum of existence in sound, stretching all the way from the Eternal to the Transient, and the Infinite to the Finite, that has been bridged and brought into our consciousness and understanding and sensory reach, and expressed by the word to express every experience of our external and internal world. It thus became possible for the highest of human experiences of the ancient Rishis to be set down in the Vedas in words that they ascribed to the Divine, and for a succession of scholars to elaborate and explain the esoteric meaning of words of the Vedas in the simpler words of the Vedangas, that could be understood by and provide guidance to men of lesser spiritual, intellectual or mental endowments.

Elaboration and explanation is by no means easy and required incisive investigation and effort by minds gifted with deep insight and analytical skills of the awesome calibre of scholars like Yaska, Panini and Patanjali. It meant tracing the origin and course of words as they emerge from the thought and throat of man, how they acquire their structure of language and accomplish their purpose of communication of meaning and Knowledge. These great pioneers laid the foundations for every shade of linguistic discipline, of Phonology, Phonetics, Etymology, Syntax and Semantics, and built a vast super structure of the science of Linguistics that embraced and articulated every shade of experience ranging from the simplest physical facts to the highest philosophical truths.

One of the many consequences of this proliferation, driven by analytical methods of astonishing acumen, was the classical schism between the Darshanikas and Vaiyakaranikas, the philosophers and the grammarians, who sought exclusive jurisdictions in their areas of thought, but nevertheless had inevitably to borrow concepts from each other, clearly because areas of thought could not easily be demarcated to serve any claims of exclusivity. Even today, the philosopher at one end of the spectrum, insists that the ultimate Reality is beyond words, while the grammarian at the other end, insists that the Word itself is the Reality, leaving us to wonder what they mean by what they say.

ANNEXURE – 1 : OVERVIEW OF THE SACRED TEXTS OF INDIA



Major Upanishads

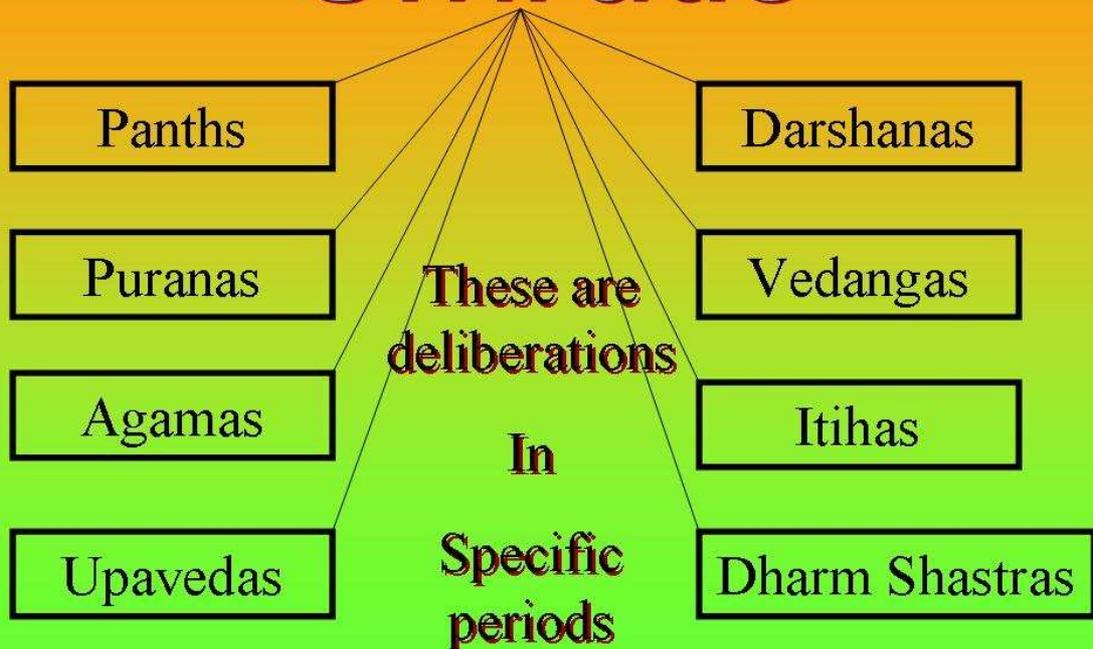
Ten Upanishads are considered as major texts in view of their indepth coverage of the specific aspects, the mentioning of these works by many spiritual masters.

This does not mean other upanishads are less important. Each text has its own significance.

Ten major upanishads: Isha, Kena, Katha, Prashna, Munda, Mandukya, Taittiriya, Aitareya, Chandogya, Bruhadaranyaka.

Issues deliberated in Upnaishads: Prime cause of Universe , Prime driving force of the universal activities, life, death, Post death life? , Spiritual meditation practices.

Smrutis



Puranas Panths

Jainism

Buddhism

Sikhism

These are resources which help to identify specific formats of customization.

There is a list of Puranas – numbers ranging from 18 to 46 /108.

The common message in all Panths and Purana's:

Sin= Causing Pain and suffering to others, blocking spiritual progress

Punya = Helping to get freedom from suffering/pain, progress spiritually

Agamas

Shakta

Shaiva

Jain

Vaishnava

Upavedas

Shilpa

Architecture

Dhanur

Defense

Gandharva

Music

Ayur

Medicine

Darshanas

Vaisheshika

Kanada

Science of logic,
futility of maya

Nyaya

Gautama

Logical quest for
god, phases of
creation

Yoga

Patanjali

Practice of
meditation and
samadhi for
renunciation

Sankhya

Kapil

Eliminate physical
and mental pains
and receive
liberations

Vedanta

Veda Vyas

Explains the divine
nature of soul, maya
and creation

Mimansa

Jaimini

Explains vedas are
eternal and divine

Vedangas

Vyakarna

Sanskrit Grammar

Nirukta

Vedic Dictionary

Shiksha

How to pronounce
vedic mantras

Chanda

Poetic Stanzas

Jyotisha

Astrology,
Astronomy

Kalpa Sutra

Rules related to
performance of
vedic religion

Itihas

Ramayana

Valmiki

Life history of Sita and Rama teaching ideal values

Mahabharat

Ved Vyas

Story of Padavas, Kauravas and Sri Krishna

Dharma Shastras

Manu Smriti

Yajnavalkya Smriti

Parashara Smriti

Other Smritis

Brihaspati, Daksha, Gautama, Yama, Angira, Yogishwar, Pracheta, Shatatapa, Samvarta, Ushna, Shanka, Likhita, Vishnu, Harita, Atri

Continued on next slide.

Dharma Shastra

Upasmritis

Narada, Pulaha, Garga,
Pulastya, Shaunaka, Granu,
Boudhayana, Vishwamitra
...etc.

Tirukural

Tamil Shavite
Behavior, Conduct, Ethics.

Niti Shastra

Chanakya, Vidura, Shukra.

Artha Shastra

Kautilya Economics,
Politics, Law.

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Documents
Template: C:\Documents and
Settings\KRISHNASWAMY\Application
Data\Microsoft\Templates\Normal.dot
Title: THE VEDANGAS
Subject:
Author: N.Krishnaswamy
Keywords:
Comments:
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