What is Quantum computer ?

By Dr.Rupnathji(Dr.Rupak Nath)

Nobel prize2012 , the world most prestigious prize in this planet is given two scientists for giving new concept of quantum optics that is most valuable to invent quantum computer. This quantum computer is totally different from modern computer that we used now-a days for this Nobel prize2012 is given for. Modern digital computer performs task on the data that must be represented in a binary form such as 0 and 1in which change our view and got the prize . Quantum compute, performs operation with the help of quantum properties to increase the computational power. The working operations of a quantum computer is quite different from digital computer that we used. Quantum computer would store information with 1, o, or a quantum superposition of these two states called qbits. The ability of a quantum computer is that it can perform multiple computations simultaneously. As a quantum computer performs its operation by qbits. Qbits do not interact on the traditional nature of computing which is binary system. While traditional computers encode information into bits using binary numbers, either a 0 or 1, and can only do calculations on one set of numbers at once, quantum computers encode information as a series of quantum-mechanical states such as spin directions of electrons or polarization orientations of a photon that might represent a 1 or a 0, might represent a combination of the two or might represent a number expressing that the state of the qubit is somewhere between 1 and 0, or a superposition of many different numbers at once. A quantum computer can do an arbitrary reversible classical computation on all the numbers simultaneously, which a binary system cannot do, and also

has some ability to produce interference between various different numbers. By doing a computation on many different numbers at once, then interfering the results to get a single answer, a quantum computer has the potential to be much more powerful than a classical computer of the same size. In using only a single processing unit, a quantum computer can naturally perform myriad operations in parallel. As we now live in the era of computer so we need more powerful ones and these two scientists give us the way of it and got the world most prestigious Nobel prize2012 .

Realization of a programmable two-qubit quantum processor

The universal quantum computer[1] is a device capable of simulating any physical system[2] and represents a major goal for the field of quantum information science. In the context of quantum information, 'universal' refers to the ability to carry out arbitrary unitary transformations in the system's computational space[3]. Combining arbitrary single-quantum-bit (qubit) gates with an entangling two-qubit gate provides a set of gates capable of achieving universal control of any number of qubits[4, 5, 6], provided that these gates can be carried out repeatedly and between arbitrary pairs of qubits. Although gate sets have been demonstrated in several technologies[7], they have so far been tailored towards specific tasks, forming a small subset of all unitary operators. Here we demonstrate a quantum processor that can be programmed with 15 classical inputs to realize arbitrary unitary transformations on two qubits, which are stored in trapped atomic ions. Using quantum state and process tomography[8], we characterize the fidelity of our implementation for 160 randomly chosen operations. This universal control is equivalent to simulating any pairwise interaction between spin-1/2 systems. A programmable multiqubit register could form a core component of a large-scale quantum processor, and the methods used here are suitable for such a device[9].

Quantum computing: Is it possible, and should you care?
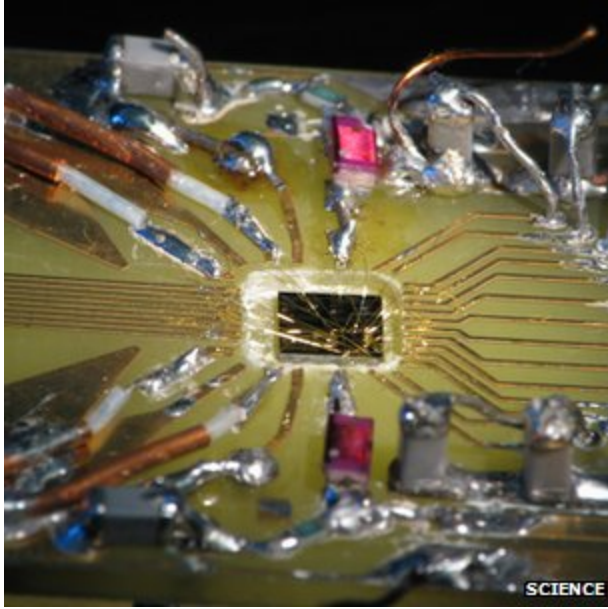
SCIENCE "Qubits" can now be made to do their computing tricks in semiconductors

What is a quantum computer and when can I have one? It makes use of all that "spooky" quantum stuff and vastly increases computing power, right? And they'll be under every desk when scientists finally tame the spooky stuff, right? And computing will undergo a revolution no less profound than the one that brought us the microchip, right?

Well, sort of.

That is broadly what has been said about quantum computers up to now, but it's probably best to pause here and be clear about what is, at this stage, most likely to come.

First things first, though: just what do they do? Many media outlets have dived into the academic literature sporadically to shed some light on the effort.

BBC News has reported that quantum computers "exploit the counterintuitive fact that photons or trapped atoms can exist in multiple states or 'superpositions' at the same time", and "quantum computing's one trick is to perform calculations on all superposition states at once" - plus, other quantum weirdness means the whole business "can then be done 'in the cloud' completely securely".

This week has seen two more advances in the field. In one, a team reporting in Nature describes the first fully quantum network, in which "qubits" - quantum bits, the information currency of quantum computers - were faithfully shuttled between two laboratories.

In another, a team writing in Science says they have "entangled" two qubits - representing the simplest core of a quantum computer - within a semiconductor, materials that standard computer makers are already familiar with manufacturing.

(It has been truly busy recently; the largest ensemble of working qubits was reported on Arxiv in January, and the biggest quantum computer number-crunching feat was published in Physical Review Letters in late March.)

Bet it works

It is all a bit bewildering, so to sum up the state of the field: very small-scale, laboratory-bound quantum computers that can solve simple problems exist; most researchers say the idea of massively scaled-up versions looks perfectly plausible on paper; but making them is an engineering challenge that practically defies quantifying.

Scott Aaronson, an expert in the theory of computation at the Massachusetts Institute of Technology, is one believer in the scaled-up quantum computer. He recently offered a $100,000 prize for a convincing proof that such a device could not be made.

Continue reading the main story

Essence of the quantum advantage
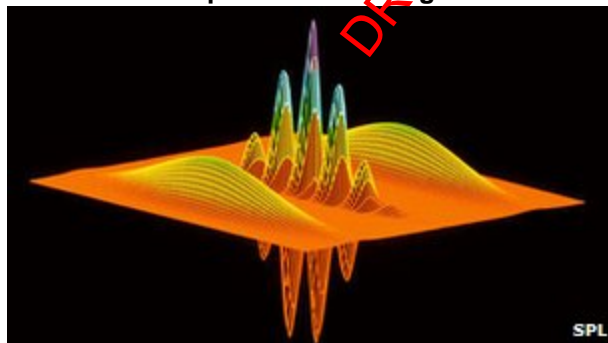
Scott Aaronson, MIT

You frequently hear that quantum computers "try all the possibilities in parallel" - that's a very drastic oversimplification.

We talk about a 30% chance of rain tomorrow - we'd never say there's a negative 30% chance. But quantum mechanics is based on "amplitudes", which can also be negative. If you want to find the probability that something will happen, you have to add up all the amplitudes.

With a quantum computation you're trying to choreograph things such that for a given wrong answer there are all these different paths that could lead to it, some with positive amplitude and others with negative amplitude - they cancel each other out.

For a given right answer, the paths leading to that should all be positive or all negative, and amplitudes reinforce. When you measure it, the right answer should be measured with high probability.

But he has no illusions that it is just around the corner.

"I get kind of annoyed by all the (popular media) articles reporting every little experimental advance," he told BBC News.

"The journalists have to sell everything, so they present each thing like we're really on the verge of a quantum computer - but it's just another step in what is a large and very difficult research effort.

"It was more than 100 years between Charles Babbage and the invention of the transistor, so I feel like if we can beat that, then we're doing well - but that's a hundred years for people to say 'works great on paper, but where is it?'"

More than that, though, even the most optimistic researchers believe that quantum computers will not be a wholesale replacement for computers as we now know them.

The only applications that everyone can agree that quantum computers will do markedly better are code-breaking and creating useful simulations of systems in nature in which quantum mechanics plays a part.

Martin Plenio, director of the Institute for Theoretical Physics at the University of Ulm, Germany, said that "it might never happen that it will be a device that sits here under my desk".

"A quantum computer can do all the things that a classical computer can do, and some of those things it can do much better, faster, like factoring large numbers," he told BBC News.

"But for many questions it's not going to be superior at all. There is simply no point to use a quantum computer to do your word processing."

Quantum add-ons

Others are more sanguine about the utility of what will come out of the current research efforts.

Alan Woodward, a professor of computing at the University of Surrey, cites a couple of recent advances that, to his mind, signify a significant push toward a computer that might sit under his or Prof Plenio's desk.
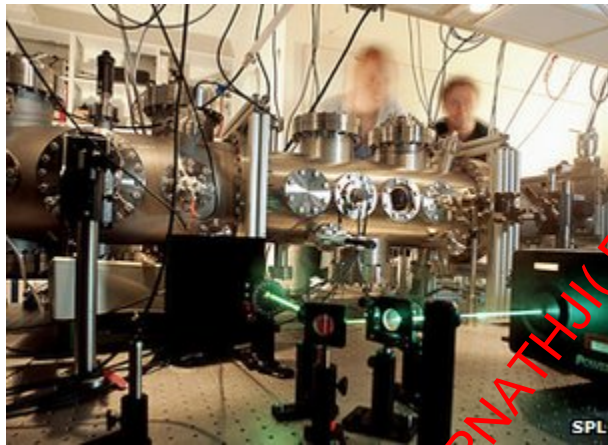
Quantum experiments are still complex and bulky lab-based beasts

Most quantum computers to date have been designed to tackle a single problem, unlike the general-purpose computers we use now. But Prof Woodward says that a report in Nature Photonics in December represents the first "programmable" quantum computer.

And, he said it is significant that an industry giant like IBM is getting into the game; at a meeting of the American Physical Society in March, IBM researchers reported significant advances in just how long they could preserve the quantum information in their qubits.

"Are you going to have a purely quantum computer in five years? No - what you'll have is elements of these things coming out, you always do with technology," he told BBC News.

"In the same way you have a graphics processor card along with a main processor board in a modern computer, you'll see things added on; people will find a means of using quantum computing and the quantum techniques, and that's how I think it'll move forward.

"And those I can definitely see in the five-year period."

Prof Woodward is in the minority in thinking that the consumer market will benefit widely from quantum computers; the problem of course is making predictions about a technology that has, since its inception, always seemed possible but even now is not incontrovertibly achievable.

Dr Aaronson concedes that perhaps the long term may bear out a greater desire and use for it.

"It's hard for me to envision why you'd want a quantum computer for checking your email or for playing Angry Birds. But to be fair, people in the 1950s said 'I don't see why anyone would want a computer in their home', so maybe this is just limited imagination.

"Maybe quantum video games will be all the rage 100 years from now."

Quantum computing could head to 'the cloud', study says
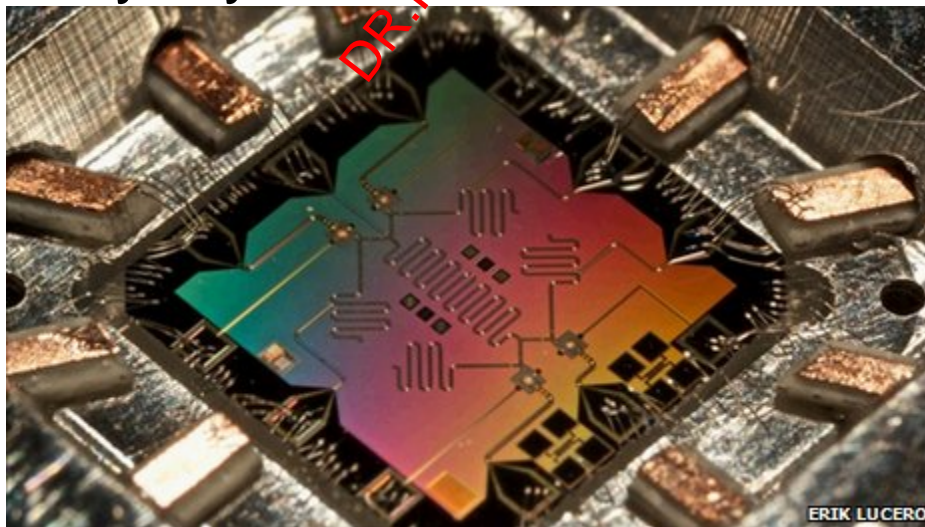
Simple laboratory-based quantum computers may yet find a way to the desktop

A novel high-speed, high-security computing technology will be compatible with the "cloud computing" approach popular on the web, a study suggests.

Quantum computing will use the inherent uncertainties in quantum physics to carry out fast, complex computations.

A report in Science shows the trick can extend to "cloud" services such as Google Docs without loss of security.

This "blind quantum computing" can be carried out without a cloud computer ever knowing what the data is.

Quantum computing has been heralded as the most powerful potential successor to traditional, electronics-based computing.

One of the peculiarities of the branch of physics called quantum mechanics is that objects can be in more than one state at once, with the states of different objects tied together in ways that even Albert Einstein famously referred to as "spooky".

Instead of the 0 and 1 "bits" of digital computing, quantum computing aims to make use of these mixed and entangled states to perform calculations at comparatively breathtaking speeds.

Other quantum trickery comes in cryptography, the art of encrypting data. Data is encoded in delicately prepared states - most often those of single particles of light called photons - and the data cannot be "read" without destroying them.

Quantum cryptography uses this feature to send the "keys" to decrypting messages with high security.

However, the quantum computing approach is still in its formative stages, able to carry out only simple calculations - and quantum cryptography is, for the most part, limited to the laboratory setting.

The world in which both are accessible to consumers has seemed distant.

Cue bits

The new work, by University of Vienna quantum computing pioneer Anton Zeilinger and a team of international scientists, combines the two.

They show that future technology need only come up with a means of making quantum bits, or qubits, at home; the heavy lifting of quantum computing can then be done in the cloud completely securely.
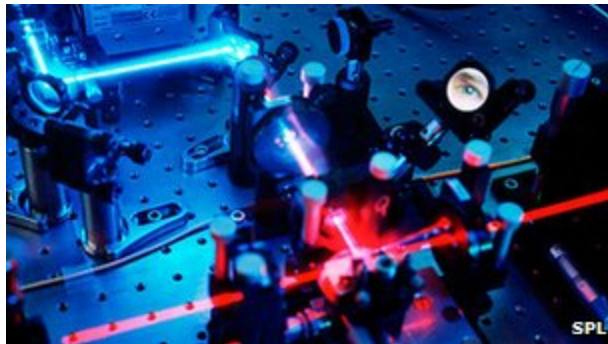
Quantum computing and cryptography equipment is still for the most part restricted to laboratories

A user would send single qubits - each perfectly secure - to a remote computer, along with a recipe for the measurements to be made.

The process is completely clear to the user, for example, finding all the numbers that multiply together to reach the number 2,012 - but because the number 2,012 is encrypted, the instructions appear to be a series of random steps on an unknown number.

The remote computer blindly "entangles" the unknown bits, carries out the steps, and sends the qubits back down the line, solving the problem without ever decoding what is going on.

The team built a system demonstrating that the approach works, using a number of computational steps that might make up future computing scenarios.

Much remains to be developed for a cloud/quantum computing future - first of all, a means to create qubits at home, which could be done with existing technology if there were a consumer demand.

Long-distance quantum cryptography has already been demonstrated in a real-world application: the technology was put to use in elections in Switzerland in 2007 using a custom network of fibres.

More recently, researchers at University College Cork demonstrated that similar quantum information can be sent down the same fibres that bring broadband to many homes around the world.

What is still lacking, and preoccupying quantum physicists around the world, is the workhorse quantum computer itself.

The computer's complexity is steadily rising; results earlier this month suggest the juggling of some 84 qubits simultaneously.

As with the earliest days of more familiar computer technology, however, significant simplification, miniaturisation and a plunge in costs will be necessary before quantum computing becomes a resource in the cloud.

Quantum computing device hints at powerful future
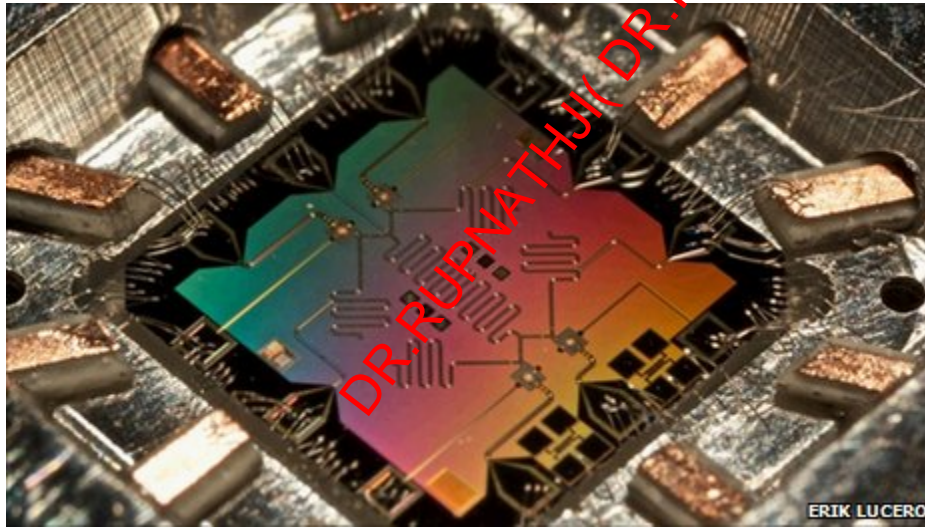
ERIK LUCERO Although comparatively small, the system's "scalable" architecture speaks to a bigger future

One of the most complex efforts toward a quantum computer has been shown off at the American Physical Society meeting in Dallas in the US.

It uses the strange "quantum states" of matter to perform calculations in a way that, if scaled up, could vastly outperform conventional computers.

The 6mm-by-6mm chip holds nine quantum devices, among them four "quantum bits" that do the calculations.

The team said further scaling up to 10 qubits should be possible this year.

Rather than the ones and zeroes of digital computing, quantum computers deal in what are known as superpositions - states of matter that can be thought of as both one and zero at once.

In a sense, quantum computing's one trick is to perform calculations on all superposition states at once. With one quantum bit, or qubit, the difference is not great, but the effect scales rapidly as the number of qubits rises.

The figure often touted as the number of qubits that would bring quantum computing into a competitive regime is about 100, so each jump in the race is a significant one.

 "Start Quote

We're right at the bleeding edge of actually having a quantum processor"

End Quote Erik Lucero University of California, Santa Barbara

"It's pretty exciting we're now at a point that we can start talking about what the architecture is we're going to use if we make a quantum processor," Erik Lucero of the University of California, Santa Barbara told the conference.

The team's key innovation was to find a way to completely disconnect - or "decouple" - interactions between the elements of their quantum circuit.

The delicate quantum states the team creates in their qubits - in this case paired superconductors known as Josephson junctions - must be manipulated, moved, and stored without destroying them.

"It's a problem I've been thinking about for three or four years now, how to turn off the interactions," UCSB's John Martinis, who led the research," told BBC News.

"Now we've solved it, and that's great - but there's many other things we have to do."

Qubits and pieces

The solution came in the form of what the team has termed the RezQu architecture. It is basically a blueprint for a quantum computer, and several presentations at the conference focused on how to make use of it.

"For me this is kind of nice, I know how I'm going to put them together," said Professor Martinis.

"I now know how to design it globally and I can go back and try to optimise all the parts."

RezQu seems to have an edge in one crucial arena - scalability - that makes it a good candidate for the far more complex circuits that would constitute a quantum computer proper.

"There are competing architectures, like ion traps - trapping ions with lasers, but the complexity there is that you have to have a huge room full of PhDs just to run your lasers," Mr Lucero told BBC News.
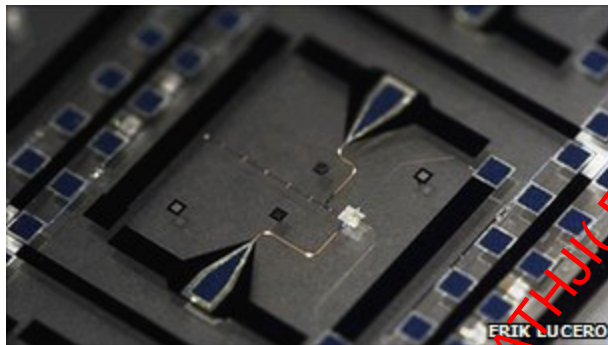
The team has been steadily increasing the complexity of their quantum devices

"There's already promise to show how this architecture could scale, and we've created custom electronics based on cellphone technology which has driven the cost down a lot.

"We're right at the bleeding edge of actually having a quantum processor," he said. "It's been years that a whole community has blossomed just looking at the idea of, once we have a quantum computer, what are we going to do with it?"

Britton Plourde, a quantum computing researcher from the University of Syracuse, said that the field has progressed markedly in recent years.

The metric of interest to quantum computing is how long the delicate quantum states can be preserved, and Dr Plourde noted that time had increased a thousand fold since the field's inception.

"The world of superconducting quantum bits didn't even exist 10 years ago, and now they can control [these states] to almost arbitrary precision," he told BBC News.

"We're still a long way from a large-scale quantum computer but it's really in my eyes rapid progress."

Quantum computer slips onto chips

Researchers have devised a penny-sized silicon chip that uses photons to run Shor's algorithm - a well-known quantum approach - to solve a maths problem.

The algorithm computes the two numbers that multiply together to form a given figure, and has until now required laboratory-sized optical computers.

This kind of factoring is the basis for a wide variety of encryption schemes.

Chips like this one could form the basis for future optical computers

The work, reported in Science, is rudimentary but could easily be scaled up to handle more complex computing.

Shor's algorithm and the factoring of large numbers has been a particular case used to illustrate the power of quantum computing.

Quantum computers exploit the counterintuitive fact that photons or trapped atoms can exist in multiple states or "superpositions" at the same time.

For certain types of calculations, that "quantum indeterminacy" gives quantum computers a significant edge.

While traditional or "classical" computers find factoring large numbers impracticably time-consuming, for example, quantum computers can in principle crack the problem with ease.

That has important implications for encryption methods based on factoring, such as the "RSA" method that is used to make transactions on the internet more secure.

'Important step'

Optical computing has been touted as a potential future for information processing, by using packets of light instead of electrons as the information carrier.

But these packets, called photons, are also endowed with the indeterminate properties that make them quantum objects - so an optical computer can also be a quantum computer.

In fact just this kind of photon-based quantum factoring has been accomplished before, but the ability to put the heart of the machine on a standard chip is promising for future applications of the idea.

"The way people used to make this kind of circuit consumed square metres of laboratory
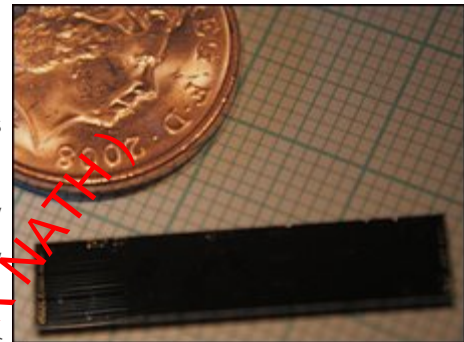
space and took graduate students many months to align," said Jeremy O'Brien, the University of Bristol researcher who led the work.

"Doubling the complexity of the circuit often times turns it from being a difficult task to a practically impossible one, whereas for us to double the complexity it's really straightforward," he told BBC News.

The Bristol team's approach makes use of waveguides - channels etched into the chips that provide a path for the photons around the chips like the minuscule wires in conventional electronics.

While Professor O'Brien said he is confident that such waveguides are the logical choice for future optical quantum computers, he added that there is still a significant amount of work to do before they make it out of the laboratory.

The prototype version, finds the factors of 15 - three and five - a task that the team concedes could be easily accomplished by a child.

"To get a useful computer it needs to be probably a million times more complex, so a full-scale useful factoring machine is still at least two decades away," he said.

"But this is one important step in that direction."

Bridging the gap to quantum world

Scientists have "entangled" the motions of pairs of atoms for the first time.

Entanglement is an effect in quantum mechanics, a relatively new branch of physics that is based more in probability than in classical laws.

It describes how properties of two or more objects can be inextricably linked over "vast" distances.

The results, published in Nature, further bridge the gap between the world of quantum mechanics and the laws of everyday experience.

The "entangled" ions were held in a tiny cavity on an electrode

This is the first time entanglement has been seen in a so-called "mechanical system".

The phenomenon suggests that a measurement performed on one object can affect the measurement on another object some distance away.

❝ **What we wanted to do was to perform this**

It also implies that the behaviour of two separate objects is linked by some unseen connection - an idea that Albert Einstein described as "spooky".

Entanglement could be exploited in future quantum computers, because the inherent probability-based nature of quantum systems means they can compute certain kinds of problems significantly more quickly than current "classical" computers.

The delicate effect has until now been limited to the internal properties of tiny systems - ethereal connections such as the polarisations of a pair of light packets called photons, or the spins of electrons in atoms.

In 2005, clouds of eight atoms were shown to be completely entangled by a group at the Institute for Quantum Optics and Quantum Information in Austria (IQOQI).

However, a pressing question for quantum researchers is when - or if - these spooky effects stop as the number of entangled photons or atoms grows.

"In the scientific community there isn't really a clear answer as to why we don't see entanglement or its effects in our everyday life," said John Jost, a researcher at the National Institute for Standards and Technology (Nist) in the US.

To begin to address that, Mr Jost and his colleagues developed a means to entangle the actual motions of two pairs of atoms: a more tangible and visual property of a system than electron spins and photon polarisations.

"What we wanted to do was to perform this entanglement in the sort of system that people can relate to, a mechanical system that pervades nature everywhere: a vibrating violin string, the pendulum on a clock, the quartz crystal in your digital watch," Mr Jost told BBC News.
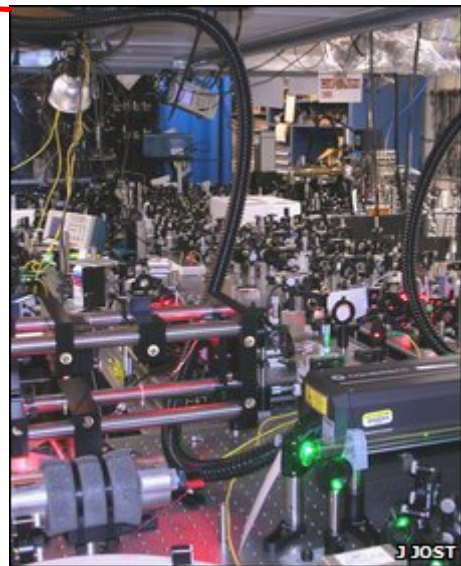
Does entanglement exist outside complicated laser laboratories?

Energetic kick

The intertwining involved four electrically charged atoms, or ions - two beryllium and two magnesium ions. These are prepared in a device called an ion trap that uses electric fields to manipulate the charged particles.

The positively charged ions repel one other, and behave as if they are connected by a spring. This "spring" has a natural resonant frequency, just like a pendulum, which can be excited with the "kick" of a laser of just the right colour.

First, a laser is used to entangle the internal energy states - the "spins" - of the two

beryllium ions.

The four ions are then separated into two pairs, each made up of a beryllium and a magnesium ion four micrometres apart. The pairs themselves are separated by 240 micrometres - just a few hairs' breadths, but an enormous distance in the atomic world.

The magnesium ions are cooled with lasers, which in turn removes excess energy from the beryllium ions.

Further laser pulses then provide an energetic "kick" to ensure the beryllium ions are no longer entangled via their spin states, but are now entangled via their motions.

The entangled pairs move in perfect unison despite their separation distance.

The work closes some of the gap between two directions of research that investigate where the quantum world ends and our everyday, classical world begins.

"We're using a bottom-up approach where you start with a very simple mechanical system; you can imagine that adding more and more ions to this, you could scale it up," Mr Jost explained.

"But there's a whole field of research in so-called nano-mechanical resonators: they're taking the top-down approach, trying to use a tiny beam of atoms - still composed of millions of atoms - and cooling it down until they see these quantum mechanical effects."

The entangled spins become entangled vibrations using laser pulses

IQOQI researcher Christian Roos said: "There is certainly an interest to see two objects in a different kind of entanglement than the one that has been investigated so far" .

"At the moment it's pure curiosity to see how far it can go," he added.

Nothing in quantum mechanics precludes entanglements of larger numbers of atoms, but as the bottom-up and top-down pursuits meet in the middle, researchers might discover there is more to quantum mechanics than they currently understand.

"There are theories that there are mechanisms that are not yet understood that prevent macroscopic systems becoming entangled once they become more massive," Dr Roos told BBC News.

"So from that point of view it's certainly interesting to see entanglement at a very small scale, and then to see whether it is possible to entangle heavier objects."
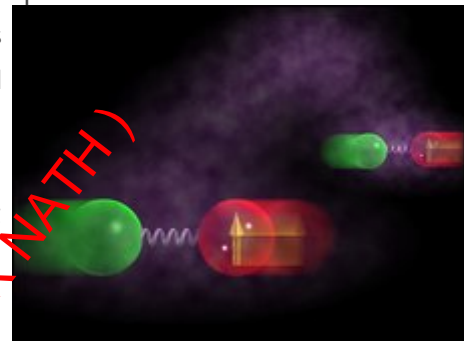
ABOUT SANSKRIT

By Dr.rupnathji(Dr.Rupak Nath)

- ### Evolution of Sanskrit Language

Sanskrit is an ancient and classical language of India in which ever first book of the world Rigveda was compiled. The Vedas are dated by different scholars from 6500 B.C. to 1500 B.C. Sanskrit language must have evolved to its expressive capability prior to that. It is presumed that the language used in Vedas was prevalent in the form of different dialects. It was to some extent different from the present Sanskrit. It is termed as Vedic Sanskrit. Each Veda had its book of grammar known as Pratishakhya. The Pratishakhyas explained the forms of the words and other grammatical points. Later, so many schools of grammar developed. During this period a vast literature -Vedas, Brahmana-Granthas, Aranyakas, Upanishads and Vedangas had come to existence which could be termed as Vedic Literature being written in Vedic Sanskrit.

Panini (500 B.C.) was a great landmark in the development of Sanskrit language. He, concising about ten grammar schools prevalent during his time, wrote the master book of grammar named Ashtadhyayi which served as beacon for the later period. Literary Sanskrit and spoken Sanskrit both followed Panini's system of language. Today the correctness of Sanskrit language is tested upon the touchstone of Panini's Ashtadhyayee.

Sanskrit is said to belong to Indo – Aryan or Indo Germanic family of languages which includes Greek, Latin and other alike languages. William Jones, who was already familiar with Greek and Latin, when came in contact with Sanskrit, remarked that Sanskrit is more perfect than Greek, more copious than Latin and more refined than either. He said – "Sanskrit is a wonderful language". It is noteworthy that though ancient and classical, Sanskrit is still used as medium of expression by scholars

throughout India and somewhere in other parts of the world e.g. America, and Germany. Sanskrit is included in the list of modern Indian Languages in the eighth schedule of the constitution of India.

As per the Indian tradition Sanskrit Language has no beginning and no ending. It is eternal. Self-born God has created it. It is divine. It is everlasting. It was first used in Vedas and thereafter it has been the means of expression in other fields.

Sanskrit has been the source of later languages and literature in India. Pali and Prakrit were first to develop from Sanskrit. Pali was taken as means for exposition of Buddhistic ideas and Prakrit was used for the spread of Jain doctrines. Most of the Buddhistic literature is written in Pali and that of Jain cult in Prakrit. A vast amount of Buddhistic and Jain literature was also written in Sanskrit simultaneously. Prakrit language had different shades in different parts of India. So they were named as Paishachi, Shourseni, Magadhi, Ardha – magadhi and Maharashtri. These Prakrits were used for writing ornate poetry like Gaha Saptashati and Karpur Manjari and also in Sanskrit drama as dialogues of ladies and illiterate characters. From each type of Prakrit various Apabhramsha languages developed bearing the same name as Paishachi Apabhramsha, Shaurseni Apabhramsha and so on. Modern Indian Languages are developed from these Apabhramsha languages.

Hindi, the official language of India, is developed from Shauraseni Apabhransha. It is said that all the modern Indian languages used in north part of India are evolved from Sanskrit and the other Modern Indian Langauges of South India- Tamil, Malayalam, Kannada and Telugu are evolved from the Dravidian family of languages. The South Indian MILs are well enriched and nourished by Sanskrit language.

- ## History of Sanskrit Literature

Sanskrit literature is as vast as the human life. There are four aims of human life which are called Purusharthas. They are Dharma, Artha, Kama and Moksha. Dharma stands for the duties and responsibilities of man. Artha communicates the monetary necessities, Karma stands for the human desires of all types and Moksha is freedom from birth and re-birth and worldly involvement. Any and every literature surrounds these four aims of human life. Sanskrit literature first of all presents Vedas which are the basis for Dharma. Vedas are the root of Dharma. There are four Vedas Rigveda, Yajurveda, Samveda, and Atharvaveda. Brahman granthas explain the Vedic literature and give the detailed process to perform the Yajnas. Aranyakas and Upanishads discuss the internal meaning of the Vedas and the path of renunciation – Moksha Purushartha. Pratishakhyas explain the grammatical issues of the Vedas. Six Vedangas i.e. Shiksha, Vyakarana, Kalpa, Chhandas, Nirukta, and Jyotish help to understand the Vedas. As per the Indian tradition the Veda is not written by any author but in fact it is the respiration of God. Veda has been seen by the seers, the Rishis. Later it was diversified into four Samhitas by the great seer Vyasa. Some Scholars hold that the Vedas were written by different seers and they estimated the time of these writings from 6500 BC to 1500 BC. The rest of the Vedic literature might have been completed before 600 BC.

Valmiki was first to write the worldly poetry; Loka – Kavya. He wrote the Ramayana the great-epic which had the great impact on the later literature. Even today the latest poetry is written on the line of Valmiki. The Ramayana was written in 500BC.

The second epic Mahabharata was written by Krishanadwaipayana Vyasa which is known as encyclopedia of knowledge.

Later the Poets like Kalidasa, Ashvaghosa contributed considerably during the Gupta period. Bharavi, Bhatti, Kumardasa and Magha – all wrote Mahakaavyas.

Harishena and Vatsabhatti were also prominent writers. Some other divisions of the classical literature and some names of the classical writers are: Kalhan and Bilhan in the field of historical Kavyas :Bhartrihari, Amaruka, Bilhana, Jayadeva, Somadeva etc. are famous as lyric poets. The Brihatkatha, Romantic and Didactic Fables, erotic poetry, champu kavyas, works on poetics and anthologies, gnomic and didactic poetry etc. form an unparalled part of Sanskrit literature.

The Scientific Literature covers Lexicography, Metrics, Grammar, Law, Science of Politics, Love, Philosophy and Religion, Medicine, Astronomy, Astrology and mathematics etc.

Though lots of Sanskrit literature has seen the light of the day but still much more Sanskrit literature is lying in the form of manuscripts and waiting for publication. These MSS are kept in general Sanskrit libraries and in houses of Sanskrit Scholars whose successors may know or not know the value of the MSS. This is a huge work to be done.

- **Eminent Sanskrit Authors**

  - **Adikavi Valmiki**

Valmiki is a sage of an excellent power of pen and wisdom. He is called Adikavi since the moment he cursed an hunter on killing Kraunch bird in a totally original chhandas. Narada advised Valmiki to write in the same poetic meter the life and deeds of Rama. Accordingly Valmiki wrote Ramayana, the Adikavya, in seven sections and 24000 couplets full of the most compelling imagery, idioms and metaphors, wisdom and nobility. He gave birth to a unique literary and philosophical masterpiece, one of the greatest works in world literature. Valmiki loved and respected life in all its splendor and diversity, the birds, the trees, the rivers, the seasons, forests and even scientific inventions.

Very little is known about the personal life of this sage except that before becoming a saint he was earning his livelihood as a decoit. One day Rishi Agastya met him and asked him why he committed such crimes. 'To support my family' replied Mrigavyadha the decoit. 'Will they be sharing your sins also?' questioned Agastya' Mrigvyadha was deeply disappointed when he received the reply in negative by his parents, his wife and the other members of his family. Shocked and under deep sense of remorse, he started meditating and went into Samadhi. Ants built their nests around him and his body took the shape of an ant-hill. God Varuna feeling very much moved by his condition and his austere penance, washed off the mud and cured his wounds. Thereafter he was called Valmiki – arising out a Valmika - an ant hill. God blessed him and called him a sage. The fundamental teaching of the Ramayana is the sanctity of the institution of the family which is society in miniature.

Ramayana is the source of many other works in other Indian Languages like Ramacharitamanasa of Tulsidas in Hindi, the Ramayana in Assamese by Madhava Kandali, Ramayana in Bengali by Krittibas, Ramayana in Marathi by Eknath, Kamba

Ramayana in Tamil by Kamban, Mulla – Ramayana in Telugu by Mulla, Adhyatma Ramayana in Malaylam by Ramanuja Edutachhan and also in many other Indian and foreign languages.

- **Maharishi Veda Vyasa**

Maharishi Vedavyasa is that famous a personality who outstands as a representative of extreme human intelligence and vast ocean like knowledge. He is known to be the grandson of the sage Vasistha and son of Rishi Parashar. He spent his life on Badri fruits only in Badrikashram and thus came to be known as Badarayan. He was born in an island and hence was called Dvaipayana. He was dark in colour and thus acquired the title of Krishna and since he classified the available knowledge of Veda into Samhitas, he got the title of Vedavyasa. His mother was Satyawati.

Vyas not only compiled the Samhitas but also the eighteen Puranas. He also wrote Brahma Sutras and the Bhagwat Puranam – the touch-stone of human knowledge. He wrote Mahabharata the great epic which is known as the encyclopedia of knowledge. It has been written in Mahabharata itself that one who knows the Vedas with all its Vedangas and Upanishads but does not know Mahabharata cannot be called a learned scholar (Mahabharata, Adiparvan, 2.235). This epic is not only a story of the battle between two groups of cousins but is an excellent code of moral conduct. It is a treasure house of anecdotes, subhashitas and a grand treatise on conflict management.

It is said that Vyas dictated the script of Mahabharata to Ganesh who wrote it on bark leaves by breaking one of his tusks. Vyas is also a prominent figure in the Mahabharata. He was the father of Dhritarashtra, Pandu and Vidura.

Vyas was born on Shukla Purnima of Ashadha month which is worshipped even today in Indian homes as Guru Purnima. He is worshipped as Guru because of his

greatness and vastness of knowledge. It is said that this whole world is pervaded by Vyasa (Vyasochchhishtam Jagat Sarvam) and there could definitely be no better an adjective for him.

- **Kalidasa**

Kalidasa has been the national poet of India and the brightest star in the firmament of Indian Poetry for the last two thousand years. He has been unanimously acclaimed as the greatest Sanskrit poet. His genius has been acknowledged, appreciated and admired by poets, critics and the literary public alike. Kalidasa enjoys a high rank among global poets like Dante, Goethe, Shakespeare etc. Scholars are of different opinions regarding his date. Different theories place him anywhere between 200 BC to 600 AD. Tradition mentions Kalidasa as a contemporary and court poet of King Vikramaditya who founded an era known after his name, commencing with 57 B.C. Hence, most of the scholars opine that Kalidasa flourished in First Century B.C.

<u>Works</u>

There are about 41 works which are attributed to Kalidasa but the following seven world famous works are undoubtedly composed by him: two Lyric Poems: *Ritusamhara* and *Meghaduta;* two Mahakavyas : *Kumarasambhavam and Raghuvamsham;.* Three Plays: *Malavikagnimitram, Vikramorvashiyam and abhijnanashakuntalam.*

Ritusamhara, a lyrical poem appears to be the first work of the young poet. Here, the natural, scenic and floral beauty of six seasons, viz., *the grishma (summer), varsha (rainy), sharad (autumn), hemanta (dewy), shishira (winter) and vasanta (spring)* is picturesquely described.

Kalidasa has introduced a new genre of lyrical poetry by composing *Meghaduta* in *Mandakranta* meter, wherein an exiled love-- lorn yaksha at mountain Ramagiri delivers his sandesha-message to his beloved darling residing in Alakapuri (in mountain Kailasa) through a cloud – messenger. On the pattern and imitation of *Meghaduta* more than one hundred *Sandesha-Kavyas* have been composed mostly in *Mandakranta* metre but none equals *Meghaduta.*

In *Kumarasambhava,* the poet has described the penance of Parvati to win Shiva's love, their wedlock finally resulting in the birth of Kumara Karttikeya, the warrior god who killed demon Taraka.

In Raghuvamsha, the poet has dealt with the heroic deeds of the solar dynasty of the ancient Indian barons in 19 cantos. It begins with the description of King Dilipa and ends with the narrative of Agnivarna. It abounds in beautiful descriptions and narratives, to name a few, go-seva by Dilipa, Raghu's digvijaya, Indumati-svayamvara, Aja-vilapa, etc.

Malavikagnimitram is an intrigue drama which is based on the love-story of Malavika and King Agnimitra. *Vikramorvashiyam* is based on the love story of the celestial nymph Urvashi and King Pururavas. Abhijnana-shakuntalam is the best amongst all the plays written in Sanskrit till today. Its plot has been taken from Mahabharata and Padmapurana. Kalidasa through his fancy and adeptness in introducing new elements in the main plot, adds the episode of the curse on Shakuntala by sage Durvasas which lends additional charm to the love-story of Shakuntala and King Dushyanta. This also elevates the character of the hero.

Kalidasa, a peerless poet *par excellence,* was acquainted with and affluent in various systems of Philosophy, several schools of religious beliefs Law and Polity, Economics, Dramaturgy, Erotics, sixty-four arts including music and fine arts, Zoology and Plant-science too. Numerous references to all the aforementioned *vidyas* are so efficiently included in his works that they bring forth the high expertise of the poet.

Kalidasa's poetic genius has brought Sanskrit poetry to the highest elegance and refinement. His style is pure and chaste. It is unartificial and marked by brevity, simplicity of expression and easy flowing language characterise his works. His writings are adorned with similies unparalleled for their charm and appropriateness. He is a poet of Nature. He has delineated everything related to culture and society prevalent in his times. According to one eulogy while once the poets were being counted, Kalidasa (as being the first) occupied the last finger. But the ring-finger remained true to its name (*anamika* = nameless), since his equal has not yet been found (by whom it could be occupied).

This truly testifies his popularity and sovereignty. Numerous honours and titles have been conferred upon him, viz. Kavikulaguru, Kavikulashiromani, Dipashikha Kalidasa, the Shakespeare of India, etc. Kalidasa is capable of winning the heart of any connoisseur of literary taste on earth. He, through his writings is a true representative of India and Indian culture.

DR.RUPNATHJI(DR.RUPAK NATH)

- **Bhasa**

Bhasa was the first great dramatist whose complete dramas are now available to the world. In the year 1910, Mahamahopadhyaya T. Ganapathi Shastri of Travancore discovered a collection of 13 plays with a similarity of expression and construction and declared them as the compositions of one single author, Bhasa. It is certain that this well known dramatist was a predecessor of Kalidasa. The greatest Sanskrit poet Kalidasa mentions his name with respect in the prelude to his first drama, the *Malavikagnimitram.* Some scholars place him in 2nd or 3rd century A.D. between Ashwaghosha and Kalidasa. Probably Bhasa was a devotee of Lord *vishnu.*

Bhasa derives his plots from the great epics, *Ramayana* and *Mahabharata,* from the Purana *Shrimadbhagavata* and most probably from *Brihatkatha* of Gunadhya. The thirteen plays of Bhasa are as follows:

The one act plays, based on Mahabharata are – *Pancharatram, Dootavakyam, Madhyamavyayogam,* D*utaghatotkacham, Karnabharam* and *Urubhangam*.

Dramas, based on Ramayana are - Praitimanatakam and Abhishekanatakam, one is based on Shrimadbhagavatam is Balacaritam and the others based on Brihatkatha are Pratijnayaugandharayanam and Svapnavasavadattam. Avimarakam and Daridracharudattam are based on Lokakathas.

Bhasa was a born-dramatist. He has presented various models of Sanskrit drama, such as *Prakarana* and Bhana (one act play) etc. In all his small dramas, the poet has succeeded in making them extraordinarily dramatic.

Bhasa's *Svapnavasavadattam* is a masterpiece of Sanskrit literature. According to Acharya Rajashekhara, *Svapnavasavadattam* was the only drama which proved itself

non-combustible in the fire of criticism. *Svapnavasavdattam*, means 'the Dream of Vasavadatta who meets her husband Udayana in a dream'. The plot has probably been taken from the Brihatkatha of Gunadhya. From the point of view of stage-performance, Bhasa's plays are magnificent.

- **Harsha**

Harsha, also known as Harshavardhana, the second son of Prabhakarvardhana and younger brother of Rajyavardhana ruled a large empire in Northern India from 606 to 647 A.D. He was an orthodox Hindu but later became Buddhist convert. Emperor Harsha himself was a great scholar who patronised and sponsored many poets like Banabhatta and Mayura. We come to know his life-history from the famous work *Harshacharitam c*omposed by Banabhatta, the foremost Sanskrit prose writer.

Harsha is the composer of three Sanskrit works : Nagananda, Ratnavali and Priyadarshika. The first one is a *nataka* whereas the remaining two are *natikas.*

The Nagananda is a play in five acts which describes the self-sacrifice of Jimutavahana, prince of Vidyadharas. Besides the main theme, there is an interesting sub-plot in the drama in which hero's love for Malayavati has been depicted.

The Ratnavali, Harsha's masterpiece is a *natika* in four acts which deals with the story of the union of king Udayana and Ratnavali, daughter of the king of Ceylon.

Later dramaturgists like Dhananjaya etc. regard *Ratnavali* and *Priyadarshika* as standard Sanskrit dramas.

The Priyadarshika is also a *natika* in four acts, having for its theme the union of Udayana and Priyadarshika, daughter of King Dridhavarman. In both these dramas, there is not only a similarity of subject matter and form but also a reminiscence of Kalidasa's *Malvikagnimitram.* The noteworthy feature of the Priyadarshika is the effective introduction of a play which is technically called *garbhanka,* as an integral part of the action.

Numerous illustrations from both the *natikas Ratnavali* and *Priyadarshika* have been amply cited by later dramaturgists and are popular amongst teachers and students of drama and dramaturgy.

- **<u>PANINI</u>**

Panini is, today, recognised all over the world as the greatest model of human intelligence. Though India had a long tradition of grammarians but the final codification of Sanskrit language is ascribed to Panini only whose grammar has remained normative for its correct usage ever since. Panini's Ashtadhyayi is the oldest complete grammar available but the maturity, depth, and brevity, as found in it, is a proof in itself that this work is a link in the long chain of grammatical works. Panini himself has mentioned the names of ten grammarians – Apishali, Kashyapa, Gargya, Galava, Chakraverman, Bharadwaj, Shakatayana, Shakalya, Shonaka and Sphotayana.

Panini's Ashtadhyayi contains 4000 sutras presented in eight chapters of four quarters each. It is remarkable that the text has come down to us intact without any interpolation. *Ashtadhyayi* is written in *sutra* style. A sutra has to be brief, precise and unambiguous. The sutras have to be interpreted within their shared context. Thus sutra is not an independent statement. Panini's many sutras contain references to a living

speech. He has discussed the peculiarities in the usage of the language by easterners and northerners.

The starting points of this great work are the famous *Maheshwara Sutras* in which the sounds have been broadly divided into three categories – *Swara*, *Antastha* and *Vyanjana*. These sounds have been presented in a remarkably scientific system.

Panini's contribution towards formation of words is superb. He catagories the words in two main groups i.e. '*Subanta*' and '*tinganta*', and bases the verb forms on ten lakaras, three persons and three numbers, Thus every root can be conjugated into ninety inflectional forms and could take care of almost all the modes, aspects and voices. Similarly every *Subanta* could have theoretically twenty four forms based on eight cases and three numbers. The roots are grouped into ganas and the members of a particular gana constitute similar forms. The nouns are declined according to the last varna in a particular gender, Panini believes that the total sentence is an indivisible unit (*Vakyaikyah)* and the word is lame without its usage in a sentence. Sometimes nouns are also used as verbs. There are separate rules governing case - endings regarding the relationship of subject with the object and with other words used in the sentence. Panini's Ashtadhyayi has been the sole refuge for later grammarians like Katyayana, Patanjali and many others.

As regards the personal life of *Panini*, it has been gathered from various external sources that the names of his parents were *Panin* and *Dakshi*. He was
born at Shalatur village near Peshawar and pursued his studies at Takshashila University. His date could be fixed anywhere in 500 B.C. The saying that 'Sanskrit is best fitted for Computer' owes its origin to the great sage Panini.

- **Patanjali**

The word Patanjali has been explained as Patantyah Anjalaya yasmai i.e. one for whom the hands are folded as a mark of respect. Patanjali has been regarded as a great sage and referred to by many names such as Gonardiya, Phani, Adhipati, Sheshraja etc. According to a legend, he is considered to be an incarnation of Sheshanaga. Patanjali was an expert of at least three branches of Sanskrit studies namely yoga, vyakarana, and ayurveda. An ancient verse regards him as a sage who cleansed dirtiness of mind with yoga, of speech with grammar and of the body with ayurveda. Thus Patanjali contributed immensely towards the science of meditation, science of language and science of medicines.

Patanjali's Yogasutra is the main basic work of Ashtangayoga Philosophy. The eight angas are Yama, Niyama, Asana, Pranayama, Pratyahara, Dharana, Dhyana and Samadhi. 'Yoga' is the control of the senses and the states of chitta. When the mind becomes pure, the chances of its being ruffled by external disturbances are generally reduced.

Patanjali's Mahabhashya is yet another milestone. It is the first and oldest existing commentary on the Ashtadhyayi of Panini. Dealing with 1228 rules of Panini, it has remained supremely authoritative and furnishes the last and final word in all cases of serious doubts ever raised over grammatical issues. Katyayana wrote a number of vartikas to supplement Paninian rules but Patanjali proved their futility and supported Panini. In short, it is an encyclopedic work of this branch. In addition to this, it is flooded with brilliant quotations the number of which may exceed 700. The whole discussion is presented in conversational style of question – answer or objection – refutation etc. It is quite evident that Sanskrit was the spoken language at that time. The theory of gravitation has first been explained in Mahabhashya only.

The work on medicines Nidan sutras or Samvediya-Nidan Sutras is also accepted as the real contribution of Patanjali to the science of medicines.

Some other works attributed to him are Mahanada, Charak – parishkara, Siddhanta – sarawali, paramartha – sar and lok shastra.

Patanjali belonged to a place called Gonarda which could be Gonda Pradesh of U.P.or a part of Kashmir. Nothing is known about his parentage. He received his education at Takshashila and taught students at Pataliputra. If Patanjali is accepted as contemporary to king Pushyamitra then he may be placed around second century B.C.

- **Adi Shankaracharya**

Adi Shankaracharya was not just a philosopher or a scholar. In fact he was a man of amazing energy combining in him a mystic, a saint, a scholar, a poet and above all a practical reformer and an able organizer.

Shankara was born in Kalady village in Kerala. Various evidences prove his date as 509 BC to 477 BC. His mother Aryamba was a pious devotee of Lord Shiva. His father Shiv Guru left him when he was only three years old. At the age of five only he had studied all the Vedas and Vedangas. Staying at Gurukul, he went to beg alms from a house. The lady was so poor that she could only give a dry Amla and she felt very sorry for it. Shankara prayed to Goddess Lakshmi who showered gold coins in the shape of Amla. This stotra a known as Kanakadhara stotra. At the age of seven he returned from Gurukul and wanted to renounce the world, but his mother denied. He entered a river and shouted that a crocodile had caught him and would only release him if he is permitted to renounce the world. The helpless mother granted him the permission for

renunciation with the promise that he would perform her last rites. Thus Shankara left and on the way crossed rivers, hills, forests, towns, meeting varied personalities and limitless varieties of the creation experiencing the Brahman-the ultimate reality in every tiny living and non-living creature. He came across a cave in which Govinda Bhagwadpad was deeply engrossed in Samadhi. The cave was on the bank of the river Narmada and its flooding waters started entering the cave. Shankara adjusted a pot in such a way that the water could not enter the cave. Ultimately Govinda initiated him into Sanyasa and taught him the four Mahavakyas – Tat tvamasi, Prajnanam Brahma, Aham Brahmasmi and Ayamatma Brahma. Here Shankar attained Siddhis through Yoga and meditation and obtained super natural powers.

From here he visited Kashi and from there went to Badari Dham and wrote the Brahmasutra Bhashya. From here he was proceeding towards Kedar – ashram where he saw Kumarila Bhatt trying to immolate himself in fire as a revenge for his own act of denying the existence of God. Kumarila requested Shankar to meet Mandan Mishra and make him his disciple who will propogate the philosophy of Vedanta. Unable to save Kumarila, Shankara went to Mandana Mishra's house and defeated him and his wife Sharda in Shastrartha. Acharya Mandan Mishra got engrossed in the propagation of Vedanta. From here Shankar proceeded towards Shri Shailam. Here he got the news of his mother's death and true to his promise, he went and performed her last rites. To establish geographical, historical and spiritual integrity in India he established four mathas in four directions of the country – Jyotirmath in North, Govardhan Math at Puri in east, Shringeri Matha in Karnataka in south and Dwarika math in Gujarat in west and established Kanchi Kamakoti Peetham at Kanchi as his abode.

Shankara in the short span of his life (only 32 years), wrote Bhashya on Upanishad and Gita. He also composed 240 stotras, prakaran granthas, introductory books such as Upadesh Sahasri, Vivek Chudamani, Aparokshanubhuti etc., in all eighty books in number.

He spent his last moments in the worship of Bhagwati Kamakshi at Kanchipuram and left his body at the young age of thirty two only.

Not only the land of India but also the entire world today bows before Adi Shankara's wisdom, intellect and the principles that he enunciated and the empire of spirit that he established. In fact, he is the brightest luminary in the galaxy of ancient Indian thinkers. In fact he was the first torch-bearer of national integration functioning on the intellectual, philosophical and religious plans, trying to bring about a perfect unity of thought all over India.

- **Kalhana**

Kalhana is one poet who composed the first and the best historical Kavya Rajatarangini which portrays the history of Kashmir. It has covered the entire period of developments from 1300 B.C. to 1150 A.D.

Rajatarangini contains eight tarangas (wave). He has surveyed the royal collections with the kings, puranas, various inscriptions, anthologies, seals and coins to make his work more and authentic. The Kavya starts with one King Govinda of 1300 BC and contains the most authentic chronological descriptions of various prominent incidents. He has not only mentioned the qualities of the kings but also their immoral acts as well. The main objective of this work is the propagation of morality. He has appreciated the prevalent religious tolerance in the various sects of Kashmir. Hindus and Muslims worked together without ever having a tinge of enmity. He has specially opposed the kings who ever tried to disturb this unity. He has bitterly criticized the greedy priests, indisciplined soldiers and wicked officials. He has showered praises on the pious ambitions of Rani Chidda.

This poetic work contains beautiful figures of speech and is written mostly in Anushtubh meter.

Kalhana was a resident of Kashmir. His father Champak was a true follower of King Harsha of Kashmir. After the assassination of the King, Champaka left politics and thus Kalhana also was deprived of the royal grace.

Kalhana was a Shaiva but also appreciated Buddhism. He started writing this work in 1148 AD and completed it in nearly three years.

He has spared no pains in collecting the precious material and evidences. He deserves all credit for being the composer of such an excellent historical Mahakavya.

- **Jaideva**

Jaideva is an extremely popular lyric poet and his famous Geeti Kavya Geeta Govinda has influenced the later poets, painters and dancers to base their performances on this beautiful work. This Kavya describes the pious love of Radha and Krishna which represents the bondage of Atman with Paramatman. Jaideva was a devotee of Krishna. He has described Krishna and Radha leelas in such a beautiful language that every syllable of it resounds musically when recited. It abounds in rhythmically matching groups of words. Even the long compounds can be tuned perfectly to create a soft musical effect. Every song is composed in fixed Raga and tala. These songs are sung in the whole of India at special occasions and festivals. It is the best lyric Kavya of Sanskrit Literature. It has a beautiful combination of poetry and dialogues which gives it a dramatic effect. Some western scholars treat it as musical drama.

Jaideva was a poet in the court of Raja Laxman Sen of Bengal who flourished in 12th Century A.D. His work has touched the heart of every Indian Bhakta of Krishna.

- **Well-Known Literary works**

  - **Children's Fables**

Fables are the tales written for innocent children to impart knowledge of politics, economics, worldly wisdom and other day today gimmicks. Their theme is the attainment of three ends of life i.e. Dharma, Artha and Kama and not Moksha. They are in narrative form and usually the animals and birds feature in them. They have been made up to behave and speak like human beings. There is a main story and other short stories are interwoven into it. These highlight human follies and weaknesses. Generally the whole story is in prose but the moral or the lesson derived from them is usually given in verses.   In Sanskrit literature Panchatantra and Hitapadesh are the most popular works of this style.

Panchatantra

Panchatantra is the oldest work available in its original form. On the basis of internal and external clues its time can be fixed as 300 BC. It has been largely influenced by the Arthashastra of Kautilya.

Vishnusharma is the author of Panchatantra. It was written by him to instruct the three dull Princes of King amarkirti of Mahilaranya. As the name itself denotes Panchatantra is divided into five chapters – 'Tantra'. 'Tantra' means the secrets. Five secrets of good administration, kingship and worldly wisdom have been expounded with the help of the animal fables. There is a quaint humour in these fables because the animals are made to discuss dharma, gods, myths, legends, politics, economics, ethics etc.

These five tantras are Mitrabheda (separation of friends), Mitrasamprapti (union of friends), Kokolukiya (peace and war), Labdhapranasha (loss of what is gained). And aparikshitkarakam (doing things without pre-examination). Each division of Panchatantra has its main story but many others have been interwoven to prove the main one. The whole story of Panchatantra is in prose but the moral of the story has been given in the form of verses.

The language of Panchatantra is very easy and simple. The sentences are very small and easy to understand. The figures of speech used are Anuprasa, Upama, Rupaka, Utpreksha etc.

The truth of life given here is true for all places and for all times.

The Panchatantra is very popular not only in India but in other countries also as is evident from its 250 editions written in about fifty languages in and outside India.

Hitopadesha

The most important of all the editions of the Panchatantra is Hitopadesha. It is full of good advice imparted through stories. It has been written by Narayan Pandit in about 1400 AD. under the patronage of King Dhawalchandra of Bengal. The poet himself has accepted that Hitopdesha is based on Panchatantra.

Panchatantra has five 'Tantras' but Hitopdesha has only four – Mitralabha (wining of friends), suhridbheda (loss of friends), vigraha (war) and sandhi (peace). Here the order of the first two chapters has been reversed and third chapter of Panchatantra has been divided into two and in these two chapters the contents of the Vth chapter have been inserted. Out of forty three stories in Hitopadesha twenty five have been drawn from Panchatantra.

Hitopadesha is a manual of politics for Kings in internal and foreign policy. It has many portions which are an embodiment of deep rooted political knowledge. Here the influence of Kamandaka's Nitisara is evident.

The language of Hitopadesha is simple end easy flowing without any embellishment yet it is forceful and effective.

Hitopadesha has been much more popular in India and Europe and has been translated in many Indian and foreign languages.

- **Sanskrit Drama**

Drama or 'Naatya' is considered as a most beautiful part of Sanskrit literature. The earliest forms of dramatic literature in India are represented by Samvada – Suktas (hymns which contain dialogues) of Rigveda. Bharata muni is the founder of the Science of music and dramaturgy. His *Natyashastra,* with an encyclopedic character, is the earliest known book on Sanskrit dramaturgy. The first chapter of *Natyashastra* relates to the origin of drama. The gods under the leadership of Indra, expressed their desire for some sort of drishya (enjoyable by the eye) Shravya (delightful to the ear) and Kridanaka (entertainment to fulfil the desire). Brahma created a fifth Veda – *Natyaveda,* taking the elements from four vedas – Pathya (dialogue or text) from Rigveda, gita (music) from *Samaveda,* abhinaya (acting) from Yajurveda and rasa (emotions) from *Atharvaveda.* Amritamanthan and Tripurdaha were the first two plays, which were staged on the occasion of Flag-ceremony of Indra.

Bharatmuni and his disciples brought this art on the earth from heaven.

'Rupaka' is the general term in Sanskrit for all dramatic compositions. 'Natya' is another wider term for the drama. Sanskrit dramaturgy has classified dramas into two types the major and the minor ones (uparupaka). The rupak is divided into ten classes – Natak, Prakarana, Bhana, Prahasana, Dima, Vyayoga, Samavakara, Vithi, Anka, and Ihamriga. There are eighteen classes of uparupakas. Most important of them are Natika, Sattaka and Trotaka.

Vastu (the plot), neta (the hero) and rasa (the sentiments) are the essential constituents of a drama or rupak. The plot of a rupak may be borrowed from history or tradition, or may be fictitious or mixed. The characteristic features of the Sanskrit drama, are –

(i) Absance of tragedy – Sanskrit drama never has a sad ending. It is a mixed composition, in which joy is mingled with sorrow. Love is the main theme of most of the dramas and vidushak is the constant companion of the hero in his love affairs.

(ii)   The interchange of lyrical stanzas with prose dialogue.

(iii)   The use of Sanskrit and prakrit languages. Sanskrit is employed by the heroes, kings, Brahmanas and men of high rank, Prakrit by all women and men of the lower classes.

(iv)   Every Sanskrit play begins with a prologue or introduction, which opens with a prayer – nandi and ends with Bharata – vakya.

The best productions of the Sanskrit are the compositions of the great dramatists – Bhasa, Kalidasa, Bhavabhuti, Shudrak, Vishakhadatta and Rajeshekhar.

- **Sanskrit Poetry**

Sanskrit is the oldest language of the world. Since Sanskrit literature has come down to us through oral tradition called the Shruti Parampara, the maximum number of works are in poetry only. Starting from the Rigveda, the earliest document in world literature, there is a continuous flow of Sanskrit works in poetry. The three Vedas – Rik, Sama and the Atharva are composed in verses. The Upanishads are all written in poetry form. Our great epics Ramayana in 24000 couplets and Mahabarata in one lakh couplets are in verses only. All the eighteen Puranas, Vishnu, Bhagwatam, Narad, Garud, Padma, Varah, Brahma, Brahmanda, Brahma Vaivarta, Markandeya, Bhavishya and Vaman, Shiva, Linga, Skanda, Agni, Matsya and Kurma are composed in verses.

The puranas are followed by the great Mahakavyas. Buddacharitam and Saunderananda are earliest in this line written by Ashvaghasha. Kalidasa's Raghuvansham and Kumarsambhavam are the great works of world fame. Bharavi's

(6th cent. A.D.) Kiratarjuniyam in eighteen cantos is famous for its depth of expression. Bhatti's Ravanavadham (6th cent. A.D.) in 22 cantos excels in the use of grammar rules. Kumardasa's Janaki Haranam in 20 cantos is based on Ramayana.

Magha's Shishupal-vadham has influenced all the later poets by his excellent usage of words. He flourished in 7th century A.D. Shriharsha's Naishadhiyacharitam is based on a story from Mahabharata. It is said that the glow of stars like Bhairavi and Magha faded down on the rise of the sun like Naishadha Kavya.

There is a long series of other Kavyas like Ratnakar's Harivijaya, Kshemendra's Dashavataracharitam, Shrikanthacharitam by Mankha and many others.

The historical works also are available in verses. The famous ones are Vikramankadevacharitam by Bilhan, Rajatarangini by Kalhan, Kumarpalacharitam by Hemchandra and many others.

A huge amount of literature exists in the form of Khanda Kavyas, Giti Kavyas, Muktakas and stotra – kavyas. The famous ones are Ritusamhar and Meghadootam by world famous poet Kalidasa, Geeta Govinda by Jaideva, Bilhana's Chaur-panchashika, Bhartrihari's Shatakatrayam, Amaru-shatakam, and stotras by Adi Shankaracharya and Pushpadanta.

Even in ancient times there was a long tradition of story telling. There are voluminous works in the form of collection of stories written in verses. In Panchatantra and Hitopadesha, the morals of the stories have been written in verses.

The most popular works are Brihat Katha Manjari by Kshemendra containing 7500 verses, Kathasaritasagara by Somadeva written in 24000 couplets, Vaitala-pancha-vimshtika available in both the forms i.e. poetry and prose.

A third form of literature came into existence known as champu kavyas written in mixed style of prose and poetry. Some of the works are Yashastilakchampu, Bharata champu etc. More than 500 champu kavyas are available till date. The greatest speciality of Sanskrit Literature is that topics like law, medicine, astronomy, grammar, poetics, politics, mathematics, philosophy etc have also been written in verses only. Some of the renowned works are the various Smrities (law), Charaka-samhita, Sushruta Samhita (medicines), Aryabhatiyam(astronomy), Arthashastra (political economy), Sahitya-darpanam, Rasagangadhara, Dhvanyaloka (poetics) and Natyashastra (dramaturgy) etc.

The flow of Sanskrit poetry continues till date. Some of the famous poets of the 21st century are Srinivas Ratha, Ramakant Shukla, Satyavrata Shastri, Bhaskaracharya Tripathi, Shrikrishna Semwal, Om Prakash Thakur, Ganesh Dutt Sharma and many others. Annual Kavi Sammalens are organized by Rashtriya Sanskrit Sansthan and the various other Sanskrit Academies of India.

- **Vedas**

'Vedas' are the most ancient literary compositions in the world literature. They are the treasure-house of Indian civilization, culture and philosophy. The word 'Veda' means 'knowledge'. It has been derived from root vid 'to know' to exist, to gain, to think etc.' It is through the Vedas that we learn about the extra-ordinary ways to attain the desired ends to avoid the undesirable ones. The Vedas are the treasure chest of knowledge in which each and every subject has been dealt with extensively be it philosophy, theosophy, ecology, astrology, astronomy, science or poetics. That is why it has been rightly said 'sarvjnanamayo hi sah'.

Vedas approach nature not as an object of enjoyment and exploitation but as 'Mother Goddess' Vedic seers believed in universal brotherhood and fraternity. According to the vedic thought, the entire cosmos is teleological, purposive and goal oriented. The built in Rita sustains controls and directs the entire world. The Vedas emphasize participatory living in a community. Move together. Speak with one voice. Try to understand each others mind-advise the Vedas . Vedic messages are universal in nature.

The most important texts are the four collections which are called the 'vedas' or the 'samhitas'. They are four – Rigveda, Samveda, Yajurveda and Atharvaveda respectively.

o **Rigveda**

The Rigveda Samhita is the oldest and the most important one in Vedic Literature. As is evident from its name itself, it comprises the glorification of various gods. These gods represent natural and cosmic phenomena which have been idolized as Gods.

The priest of Rigveda is known as 'Hota' because his main function is the invocation of these deities. These invocations are known as hymns, mantras or richas.

Rigveda is globally accepted to be the oldest literary work yet no definite date has been ascribed to its scripting. According to some scholars it has been scripted between 1200 and 1000 B.C. while according to others, this period is between 4000 and 2500 B.C.

Although twenty one recensions of Rigveda have been mentioned yet only five are more popular – Shakala, Vashkala, Ashvalayana, Sankhyayana and Mandukayana.

Out of these five also, only Shakala is available. According to Shakala recension, 10600 hymns of the Rigveda have been divided into 1028 suktas which further have been divided in ten mandalas. II to VII mandalas are the oldest ones and are similar in many ways. They have been named as 'Family Books (Parivarika Pustakas)' because they are attributed each one to a family of seers. They are Gritsamada, Vishwamitra, Vamdeva, Atri, Bhardwaja and Vasistha. Both I and VIII mandalas have some similarities and some dissimilarities also. Hence the first mandala has been put just before the 'Family Books' and the VIII just after them. In IX mandala all the suktas have been offered to soma. The X mandala is relatively later. 'Who is the creator of this creation, how was it created, what was the material out of which it was created, what becomes of us after leaving this mundane world' all these philosophical queries have been dealt with here. There are some suktas which throw ample light on the beliefs, traditions and customs of the Vedic Aryans.

The Rigvedic religion was originally polytheistic but gradually it became monotheistic. Indra being the god of power, rain and also the synonym of the sun was the most important. Next comes Agni who is the priest and the mediator between men and gods. Some of the other gods and goddesses who have been eulogized are Soma, Savitr, Surya, Rudra, Mitra, Varuna, Vishnu, Ushas, Vak etc. In fact these were the divine manifestations of one great power only.

Vedic Aryans had very practical and optimistic approach towards life. There was no idol worship in those days.

'E-kam sad viprah bahudha vadanti' i.e. the truth is one but is called by many names.

- o **Yajurveda**

Yajurveda is the veda of 'yajush'. Yajush means worship and sacrifice. It contains sacrificial formulas in prose . This Samhita was meant for 'Adhvaryuh', the priest who was responsible for the sacrificial fire and carrying out of the ceremonies.

Just as the main function of 'Hota' the priest of Rigveda is to invoke various gods similarly to perform ritual ceremonies practically for those gods was the sole responsibility of 'Adhvaryuh' the priest of the Yajurveda. If the Rigveda is theory, Yajurveda is practical. If the Rigveda is related to knowledge, the Yajurveda is related to action. 'Which mantras should be chanted for achieving the desired object, what type of offering should be offered, how big and of what shape should be the altar, all this practical knowledge is the subject matter of Yajurveda .

The Vedic yajna has both an inner and outer form. The outer form involved the priests and offerings. The inner rituals proceeded through speech, mind-breath, and soul and thus was a matter of yogic practice and meditation. Yajna was considered to be the naval of the universe, the central point of the whole cosmos.

In fact all the three Vedas are complementary and interdependent. The Rigveda contains the mantras offered to various gods, the Samveda teaches how to chant them correctly with proper high & low notes while the Yarjurveda explains the sacrificial acts accompanying the same. Thus Rigveda is related to knowledge, the Samveda to devotional sentiments and the Yajurveda to action.

Patanjali , the author of Mahabhashya has made a mention of one hundred recensions of Yajurveda but presently only six are available. Yajurveda has two divisions -krishna (Black) and shukla (White). Taittiriya, Maitrayani, Kathaka & Kapishthala belong to Black Yajurveda while Kanva and Madhyandina are related to the white Yajurveda.

White (shukla) Yajurveda is mostly used in northern part of India and Black (Krishna) Yajurveda is more popular in southern part of India. Shukla Yajurveda is known by the name of Vajasaneyi Samhita also. It has forty chapters which describe different 'yajnas' in detail. 34th chapter is the famous shivasankalpasukta, while the 40th chapter is popularly known as Ishopanishad.

It is noteworthy that the main theme of Yaujrveda is to expound different sacrificial acts. The mantras are mainly from the Rigveda but the explanations pertaining to sacrifices are in prose. Moreover , the whole mantra has not been drawn, only a part of it has been taken like 'Agnaye Swaha', 'Indraya Swaha'. From the Shataraudriya of Shukla Yajurveda started the tradition of eulogizing one god by different names. Yajurveda emphasizes the moral and the social responsibilities for a human being and from here starts the ecology .

Thus the place of Yajurveda is very important in Vedic literature.

o **Samveda**

Samveda means 'Veda of chants' . It is a collection of hymns largely drawn from the Rigveda which have been given a musical mode. Hence Samveda is a system of melodious chanting of vedic hymns . The vedic hymns are fruitful only when chanted in rhythm with proper high and low notes called 'swara' It is the vibrations created that give value to the hymns. It has been rightly said that musicology is synonymous to sama 'gitishu samakhaya' moreover, the priest of Samveda is called 'Udgatri' a singer, who pleases the gods with melodious hymns of Samveda. The use of 'Jagati ' & 'Gayatri' metres derived from the root gai-to sing also justify the conclusion.

Samveda is said to have one thousand recessions 'Sahsravartma Samvedah' but today only three- Kauthum, Jaiminiya & Ranayaniya recessions are available out of which the 'Kauthum' is the most popular.

Samveda has two divisions- purvarchika and Uttararchika. Total mantras are 1875. Except seventy five mantras all have been taken from the Rigveda. There are 650 mantras in Purvarchika divided in six 'Prapathkas'. The first five ' Prapathakas' are called 'Gramgana' while the last and the sixth is called 'Aranyagana.

Uttararchika has 1225 mantras divided in four hundred songs. Each song has three mantras in average. According to the other division 'Uttararchika' has been divided in nine ' Prapathakas' which have twenty one chapters. Each sukta further has 2-3 mantras.

Mantras are uttered together with their swaras. Each swara of each letter in the veda is fixed and maintained. Thus the text could be preserved for generations together. For all swaras, the basis is sound (nada) which can be characterized with variance –

high, low and middle tone. The pronunciation of the letters are based on six factors - varna, swara, matra, balam, sama and santana.

There are seven musical notes- Shadaja (Sa), Rishabha (Re), Gandhara (Ga), Madhyama (Ma), Panchama (Pa), Dhaiwata (Dha), and Nishada (Ni)

To convert the hymns of the Rigveda into melodious melodies of the Samveda, some changes are made called 'Samavikara'

The importance of Samveda is immense. It is the main origin of musicology. In fact gandharvaveda which has given birth to about sixteen thousand musical notes and their modifications has been deduced from Samveda only. In fact music is the living symbol of Vedic civilization.

o **Atharvaveda**

Atharvaveda is the fourth and the last Veda. It stands apart from other Vedas in as much it lays more emphasis on expounding the means essential for making the life comfortable and happy.

Atharvaveda contains a collection of hymns, magic spells and incantations that represent the beliefs, faiths, traditions, conservations and customs of the masses. It contains a very high level of scientific knowledge also. Love for the country and mother earth is reflected in many suktas.

The Atharvaveda means the Veda of the Atharvas or the knowledge of magic formulas. 'Atharvangirasa' is the oldest name for Atharvaveda which means the veda of Atharvas and Angirasas. The hymns of the first part relate to prevention and cure of

diseases warding off natural and supernatural ills, gaining of health, strength and success while the other part relates to subjugation, seduction, eradication etc.

Atharvaveda is mentioned to have nine recensions by Acharya Patanjali but today only two are available- Shaunaka and pippalada. The former is more popular for all practical purposes.

The Atharvaveda consists of about 6000 mantras divided in 730 Suktas which further have been arranged in twenty 'Kandas'. About 1200 mantras have been taken from the Rigveda. All the hymns of twentieth 'Kanda' have been picked from the Rigveda.

Some of the special Suktas of this Veda are 'Bhaishajyani Suktas' in which number of diseases, their signs and symptoms and treatments have been given. The 'Aayushya Suktas' contain prayers for long life and sound health. In 'Paushtika Suktas' there are prayers for the welfare and prosperity of farmers, businessmen, cattle grazers, labourers etc. and for the safety of the animals also. In fact the Veda contains medicinal treatment, surgery, yajna-therapy, naturopathy, mantra and tantra therapy and mani-bandhan therapy.

'Shringara Suktas' also called the 'Prasada Suktas' are prayers for providing safety from fear, thwarting evils and having the blessings and happiness. In 'Prayashchita Suktas' are the mantras for expiation of evils, mistakes committed in 'Yajnas' and festivals while 'Strikarmani suktas' have the mantras for developing the love and affection between husband and wife, ensnaring the beloved with the help of herbs and mantras and for destroying the co-wife. These are called 'Premsuktas' also .

In 'Rajkarmani suktas', as the name itself denotes, are the hymns for the victory of Kings . They describe their duties, law and judiciary, warship, weapons etc. The

'Philosophical Suktas' mention 'Brahma, Virat Brahma, Maya, Ishwara, monotheism, rebirth etc.

In the Atharvaveda for the first time the earth has been honoured and praised as mother 'Mata Bhumih putroham Prithivyah'. It expounds the social institutions like celibacy, household austerity etc.

Thus Atharvaveda Samhita being related with the practical life of human beings is very much significant. Atharva Veda is rightly called the Bhishag veda and Ayurveda has been regarded as a sub system of Atharvaveda only.

o **Brahmana Granthas**

Brahamana Granthas occupy an important place in Vedic literature. They are indispensable for understanding Vedic culture, religion and philosophy. Their importance can be realised by the very fact that like the Vedic Samhitas, 'Brahmanas' also have been termed as Veda- 'Mantra brahamanatmako vedah'.

'Brahman' this word has been derived from Brihu – vardhane – to increase. These are the books that explain in great details the significance and importance of the rituals given in the Vedas. Although there are cosmological myths, tales, legends still 'yajna' is the sole theme. They deal with the science of 'yajna' describing its ceremonies, discussing its values and speculating on its origin and significance. Geometry and mathematics had a ritual origin where the earth was represented by a circular altar and the heavens were represented by a square alter. The rituals consisted on conversions of the circle into square of identical area.

Like the Vedas, no definite date can be assigned to Brahmanas also. However, it can be said that they were composed before the rise of Buddhism i.e. 500 B.C. as

Buddhism is the reaction to the ills in ritual practices. Hence all the Brahmanas must have been composed much before 600 B.C.

All the four Vedic Samhitas have their own Brahmanas. Two Brahmana Granthas Aitareya and Kaushitaki or Sankhyayana are attached to Rigveda. Tandya Mahabrahman or Panchvinsha, Shadvinsha, Adbhuta and Jaiminiya belong to Samveda. In fact Shadvinsha Brahman is only a completion of Panchavinsha which consists of 25 chapters while the last part of Shadvinsha Brahmana is called Adbhuta Brahmana. Shatpatha Brahmana belongs to white (shukla) yajurveda while Taittiriya is attached to Black (Krishna) Yajurveda, Gopatha is the Brahmana Grantha of Atharvaveda.

The essential contents of all the Brahmanas are almost the same. There are two main divisions of the contents of these –vidhi and arthavada. Vidhi means rule, regulations. This part describes the rituals and the fruit received therefrom while Arthvada is the explanatory portion and recommends the rituals. Deep rooted symbolical meaning of the mantras has been expounded with the help of myths and legends.

The most special feature of the Brahmanas is the utmost emphasis laid by them on 'Yajna'. Yajna is supposed to be the most important action, 'yajno vai shreshthatamam karma'. The beauty and the greatness of these 'granthas' lies in connecting the sacrificial formulas with the sacrificial rite by pointing out on one hand their direct relation and on the other their symbolical connection with each other.

The society was divided into four castes – Brahmin, Kshatriya, Vaishya and Shudra Brahmins signified the academicians were respected as equivalent to gods because of their functions as teacher, philosopher and seeker of knowledge. The Kshatriyas were the defendants, the Vaishyas were traders and earned money for the

country while shudras have been described as 'Tapas' which perhaps symbolizes the physical labour.

The etymologies given by the Brahmana granthas are very important and significant from the point of view of Philology and Grammar.

Because of the numerous myths and legends having marvellous poetic beauty the Brahmana granthas occupy a unique place in Vedic Literature. The Philosophical thought and cosmological knowledge of these books is significant.

Thus the Brahmana Granthas are important not only for understanding the Vedas but are indispensable from theological, geographical, cultural, philosophical, political, historical and social point of view as well.

o **Aranyakas**

The four Vedic Samhitas, Brahmana Granthas, Aranyakas and Upanishads are the integral part of Vedic Literature. They are interdependent and complimentary to each other. Aranyakas are the links between the Brahmanas and the Upanishads. Here the subject matter of Brahmanas has been explained in the style of the Upanishads meaning thereby that the rituals have a spiritual basis. Thus a perfect co-ordination has been established by the Aranyakas between the path of action (Karmamarg) and the path of knowledge (Jnanamarg). They are representative of transitory period as they gave a philosophical and spiritual explanation of yajna and all the things related to that.

Aranyakas were read and taught in the forests away from the villages. Just as the Brahmanas contain and explain the rituals and ceremonies for a householder (grihastha) similarly the Aranyakas explain the laws and rituals for those who have gone into Vanaprastha - the third 'ashrama' according to the Indian culture. Here the secrets and

mysticism of the yajnas have been elaborated tastefully. They throw light on the duties of the priests also.

Sometimes it becomes quite difficult to differentiate between Aranyakas and the Upanishads because of their very close similarity.

Just as the Vedas have the Brahmana Granthas attached to them, similarly the Aranyakas are also attached to the Vedas. Undoubtedly Arnyaka literature must have been very large but today only eight Aranyakas are available. Aitereya and Sankhyayana belong to Rigveda. Samveda also has two Aranyakas – Jaiminiyopanishadaranyaka and chhandogyaranyaka. Brihaddaranyaka, Kanva Brihadaranyaka and Madhyandin Brihadaranyaka are that of white (shukla) Yajurveda and the Taittariyaranyaka is that of Black (Krishna) Yajurveda. Atharvaveda does not have any Aranyaka Grantha.

Thus the Aranyakas are the basis of the philosophy that developed later in the Upanishads in the form of expounding monotheism, Brahman, Atman, knowledge etc.

Vedangas ans Sutra Literature

The four Vedas, Brahmanas, Aranyakas and the Upanishads all together constitute the sacred revealed literature of India. Towards the end of the vedic period some literature was written in sutra style. 'Sutra' means strings. All the works written in this style on various subjects are one uninterrupted string of short sentences twisted together in the most concised form. Brevity is the great object of this style.

The works which have been written in sutra style proved to be very useful in understanding the Vedas. That is why they were named as 'Vedangas' also i.e. the

studies accessory to the Vedas. Thus the Vedangas are representative of Sutra literature. They are six – Shiksha, Kalpa, Vyakarana, Nirukta, Channdas and Jyotish.

Shiksha

Shiksha (Phonetics) explains the proper articulation and pronunciation of vedic texts. There are six parts of Shiksha – letters (varnas), accent (swara), time consumed in articulating vowel (matra), effort (bala) Melodius chanting of mantras (sama) and conjugation of letters (sandhi). If some mistake is committed in any of the above six, instead of giving the desired result it can prove to be disastrous as well.

Pratishakhyas are the oldest representatives of the Vedangas. Different recensions of the four Vedas had different ways of pronouncing the Vedic texts and these variations were recorded in pratishakhyas. Some of the other Shiksha granthas are Narada Shiksha, Yajnavalkya Shiksha, Vyas Shiksha etc. but Panini Shiksha is the most perfect grantha of Shiksha.

o **Rituals (Kalpa)**

These are the rules for the sacrificial rituals in a concised, perspicuous and connected manner. The theme of this Vedanga is to study the correct ways of performing rituals. There are four components of Kalpa Sutra (i) Shrauta Sutras are related to the yajnas propounded in the Vedas (shruti) (ii) Grihya Sutras contain not only the rituals of a householder but also the ceremonies starting from conception upto the funeral rites (iii) Dharmasutras provde rules for the conduct of life. They are mainly concerned with the duties of people (iv) Shulva sutras - Shulva means a measuring rope. The sutras are related to the making of the geometrical calculations necessary for the proper construction of the altar. There are six shulva sutras available but the oldest

is Baudhayana Shulva sutras which contain the so-called Pythogorean theorem. It was necessary that the areas of various alters must match with the standard shyenchiti altar.

o **Grammar (Vyakarana)**

The analysis and the determination of the Vedic words is the main function of this Vedanga. Hence it is very important since it clarifies and helps in understanding the difficult hymns of the Vedas and safeguards them from distortions.

The words have been classified into four categories – Nama (nouns and pronouns), Akhyata (verb), Upasarga (prefix) and Nipata (indeclinable).

o **Etymology (Nirukta)**

The words which could not come within the reach of grammar have been discussed and explained by Nirukta. Thus it is complementary to grammar.

The Nirukta of Yaskacharya is the most important. In fact Nirukta is a commentary on Nighantu, a collection of difficult words occurring in the Vedas but it is not available today.

The main and the most significant contribution of Nirukta is to give the etymological meaning of every word.

o **Meter (Chhandas)**

Chhandas is important for the purity and the melodious chanting of the Vedic hymns. According to Acharya Katyayana a fixed number of letters is called – Chhandas.

In Vedas there are seven meters – gayatri, anushtubh, pankti, jagati, Brihati, Ushnik and Trishtubh. Further there are many divisions and sub divisions of these meters depending on the increase and decrease of letters.

The chhandashastra of Pingala is the oldest and most perfect grantha on meters which deals with both vedic and the classical meters.

o **Jyotish (Astronomy and Astrology)**

To get the desired results of a yajna it is very important that it should be performed at auspicious time on auspicious day, paksha, month etc. Jyotish determines the right time for rituals. It is called the eye of Vedas. It contains useful information about the movements of various planets, their sizes, the eclipses and their effect on human beings.

Today only one book called Vedang Jyotish is available. Lagadha is supposed to be its author. Later quite a few commentaries were written on this book.

- **Upanishads**

The Upanishadas are the fountain heads of Indian. Philosophy, the treasury of the highest knowledge. They are called the '*Vedanta*' which means the conclusion (*anta*) of the Vedas because with the Upanishads concludes the earliest sacred literature of India i.e. the Vedic literature. The Upanishads impart that knowledge which leads man from falsehood to truth, from darkness to light and from death to immortality.

The word Upanishad means to sit near the teacher and attain knowledge. The Upanishad vidya destroys the ignorance, perverts the miseries and leads to union with *Brahma* i.e. the freedom from the vicious circles of birth and rebirth.

The Upanishads were not composed at one particular date, but in any case their composition was completed before 600 B.C. They are regarded as the record and outcome of academic disputations and transactions of the great sages of the upanishadic period. The entire teaching of the rishis, kings, philosophers have been made available to us through various samvadas. These dialogues were held at the celebrations of great sacrifices at the samiti or Parishads arranged by King – philosohers such as Janak. The ashramas also served as the philosophical laboratories to discover the spiritual and the highest truth of life.

Like *Brahmanas* and the *Aranyakas*, *Upanishads* are also attached to the four vedas. There is a large number of Upanishads but eleven of them are masterpieces. They are Aitreyopanishad of the *Rigveda*, *Kena* and *Chhandogya* of the *Samveda*, *Isha* and *Brihadaranyaka* of white (*Shukla*) *Yajurveda*, *Katha*, *Taittiriya* and *Shvetashwatara* of the Black (*Krishna*) *Yajurveda* while *Prashna*, *Mundaka* and *Mandukyopnishad* belong to the *Athrvaveda*.

In the Upanishads *Brahma* has been described not as an object or human being but as all powerful, eternal, endless divine power which is within everybody and is known as *Atman*. *Atman* can not be achieved by sense organs or mind. It can be realised only and that too within oneself. Various allegories, parables, and analogies have been profusely utilized to unravel the mysteries of the Highest Self i.e. the famous allegory of yaksha has been used in Kenopanishad to illustrate the superiority of Brahman to all its manifestations. *Atman* can be known by controlling the mind and the sense organs through continuous meditation over a period of time. This *Atman* is identical with Paramatman. 'A*ham Brahma Asmi*, *Tat Tvam Asi*, Jivaiv *Brahm Naparah*' are boldest expressions (*Mahavakyas*) of the Upanishads.

Brahma is all pervasive ' *Ishavasyamidam Sarvam*'. He creates, supports and withdraws all again into itself. That is why it is that from which everything is born, by whom everything is supported and in when everything merges back. Brahma becomes known to one who knows one's own self. But to know one's own self one has to get detached from all worldly pleasures because both of these are diametrically opposed and can never meet like two parallel lines. One more point which has been emphasised in the Upanishads is that a man gets birth according to the 'Karma' done by him in previous births.

Undoubtedly, the Upanishads lay much emphasis on morality. One has to fulfil his social responsibilities towards parents, teachers, gods and guests. The '*Yajna*' is not the end (*Sadhya*) but means (*Sadhan*) to attain Brahma. Austerity (*Tapa*), control over oneself (*Dama*) and good actions (*Karma*) have been said to be the means to self realization and the truth is its abode.

The sole purpose of the Upanishads is to attain Liberation (*Moksha*) – the freedom from death and birth but this is achieved through knowledge only - '*Vidyayamritamashnute*' one attains knowledge when one realises that one's body and

sense organs are different from the Atman as they are perishable but the Atman is not. After knowing this one becomes free from all bondages. Upanishads are thus the most valuable gems of Indian Philosophy which would live for all times and provide solace to soul and mind in the wilderness of the advancing cultures and civilizations.

- <u>Epics</u>

  o **<u>Ramayana</u>**

Ramayana (the path of Rama) is both a work of art and the mirror of a perfect human soul. This unique piece of poetry flowed from the pen of Valmiki at a time when no kavya had yet been written in any form. Hence it is called Adikavya and its author Valmiki the Adikavi. Ramayana starts with the outburst of a curse against a hunter for killing a male bird while it was courting its partner. This outburst is considered by the creator as an indication of the power of the poet to create a poem of deep human compassion for the fullness of life. This epic played the role of guide for the poets and artists of later periods. The characters of Ramayana deserve individual study in view of their varied natures. Rama is a personification of Dharma because of the perfection of his human qualities and self sacrificing nature, never violating the laws of truth and merit.

Ramayana was composed in Sanskrit by the poet Valmiki and its present form consists of 24,000 couplets divided into seven kandas. The epic enjoys such great popularity that its recitation is considered an act of great merit. Many of its translations are themselves great works of literary merit including the Ramcharit Manas of Tulsidas, Tamil version of Kamban, Bengali version of Krittibas etc. Throughout north India, the events of this story are enacted in the form of Ram Leela. In South India both the epics Ramayana and the Mahabharata even today make up the story of Kathakali dance – drama of Malabar. Ramayana events are favourite subject of Mughal, Rajasthani and Pahari paintings.

The story also spread in various forms throughout Southeast Asia especially Cambodia, Indonesia and Thailand, being chosen as themes of traditional Japanese, Balinese Theatre, dance and shadow play. Incidents from Ramayana are carved on

many Indonesian monuments. In Thailand even today the king is called King Rama and the main highways as King Rama Roads.

Ramayana also provides glimpses of the great scientific inventions in the form of bridges which were lifted up and dropped when needed. Many descriptions are examples of excellent town-planning, engineering, building of bridge over the sea, aeroplanes in the form of Pushpaka Vimana in which Rama came to Ayodhya alongwith Sita, Hanuman and other war heroes. Researches are being conducted on the composition of Jrimbhaka – astra which could make the whole army fall into a deep slumber.

Ramayana displays a code of ideal human rights. Rama does not believe in capturing Lanka but infact makes Vibhishana take over the power. Rama believes in removing enmity and establishing virtues. Hence, it is said that Ramayana Katha will flourish in this world till the existence of mountains and rivers on earth.

○ **Mahabharata**

Mahabharata, the largest epic in the history of mankind is one of the two major epics of India, the Ramayana and the Mahabharata. It is termed as vishvakosha i.e. encyclopedia of wisdom because of its high literary merit and religious inspiration. It is an exposition on Dharma – a code of conduct including the proper conduct of a king, a warrior, of a man living in times of calamity and also of a person seeking to attain emancipation from rebirth.

This epic contains one lakh couplets (1,00,000) devided into 18 parvans to which a supplement has been added called Harivamsha (Geneology of God Hari i.e. Vishnu). The traditional author is the sage Vyasa who perhaps compiled the existing material that reached its present form about 400 A.D.

The epic describes events that took place in Bharata around 5000 BC. The story revolves around the five Pandavas, sons of deceased king Pandu and one hundred sons of blind king Dhritarashtra. Due to blindness Dhritrashtra was passed over as King, on his father's death, in favour of his brother Pandu. This feeling of jealousy further sprouted in innumerable forms although he was made the king when Pandu renounced the kingship to become a hermit. Enmity forced Pandavas to leave the kingdom at the time of their father's death. They returned to some years of prosperity in a divided kingdom but were again forced to return to the forest for 12 years when Yudhishthira lost his kingdom in a game of dice with Duryodhana – the eldest of Kauravas. The feud culminated in a great battle in the field of Kurukshetra (north of modern Delhi in Haryana State) in which only five Pnadavas, Draupadi and Lord Krishna survived.

The main story covering about one fifth of the total work is interwoven with many other famous episodes like Nala-Damayanti, Savitri – Satyawan, Shakuntala – Dushyanta etc., descriptions of places of pilgrimages, myths, moral precepts, geneological accounts of ruling dynasties and a notional history of creation. There is a totality of life as it is lived here and now and yet there is a firm human will to transcend it and enter the realm of eternity.

The epic contains references to invaluable war strategies and missiles which are being researched in modern times. The description of Brahmastra and its after – effects match the description of modern deadly nuclear weapons. It is said that it does not rain for twelve years at the place where Brahmastra is used. Modern researchers have found that the radio-activity of Kurukshetra is still two and a half times greater than that of other areas. Technology in architecture, construction -engineering, tunneling and construction of highways was astonishingly advanced as we read about laksha-griha, tunnel from palace to the forest, royal palace built by Mayasur and the layout of town Indraprastha.

Some of the sections of this epic have become famous as separate texts such as Narayaniyam (Book XIII), the Bhagvadgita (Both VI), the Anugita (Book XIV), Vidur Niti and Harivamsha in which Krishna is identified with Lord Vishnu and other avataras are also described.

This gem of our cultural heritage has been further carried over not only in works after works in Sanskrit but also in all the other Indian languages, languages of Burma, Malaysia, Thailand, Combodia, laos and many others. The story gained such immense popularity that its various incidents have been portrayed in stone, notably in sculptured reliefs at Angkorwat and Angkor Thom in Combodia and by many Indian miniature painters.

Thus it has served as a thematic source for many a poems, dramas, novels and even Television serials. It is said that in Dharma, Artha, Kama and Moksha, whatever is written here may be found elsewhere but that which is not here cannot be found any where else.

➢ **The Bhagwadgita**

The Bhagwadgita is an immensely important religious philosophical treatise of universal wisdom. Its central message is to call for the development of all that is potential in human personality. It forms a part of the Bhishma Parva of Mahabharata. It comprises of only 700 shlokas but the range of its content is enormous. Gita goes far beyond the ethical question with which it begins, to consider broadly the nature of God and the means by which man can know him. It beautifully harmonizes the philosophy of action, devotion and knowledge. A familiar verse compares the Upanishad to a cow

and Krishna to the milkman who milks the nectar in the form of this Gita with the calf Arjuna beside him.

Gita teaches us to do selfless service to all without consideration of their religion. The truly learned person looks upon all with equanimity, whether it be a saint, or evil doer or even an animal. He wants us to be active and not passive and idle.

Krishna talks of general paths to the divine such as those of knowledge, meditation, good deeds, renunciation of attachment and love and surrender to God. Gita is above religion. Gita is for the whole mankind. In fact Gita is the science of managing one's self.

Its popularity is evident from the number of commentaries, glossaries and expository books written on it in both ancient and modern times. The earliest commentary is that of the great philosopher Shankara. Other important commentaries of ancient times are those of Bhaskar, Ramanuj, Madhva, Nilkanth, Shridhar, Madhusudan etc. In outstanding modern commentaries are those of B.G. Tilak, Aurobindo, Gandhi, Radhakrishnan. It has been translated in almost all the languages of the world.

In fact Gita with its eternal values can serve the whole mankind as a path finder forever.

- **Sanskrit and Other Classical Languages**

Sanskrit is one of the languages of Indo-European family. Indo-European is the name given to the family of languages to which Sanskrit belongs. The name is based on the fact that this family covers most of Europe and extends eastward as far as northern India, with a total body of speakers of nearly one and a half billion. Indo-Germanic is a synonymous term preferred by German linguists based on the fact that it includes the easternmost and western most members of the family.

Sanskrit has its close relationship with other classical Languages of Indo-European group like, Latin Greek, French, German etc. For Example the numerals from one to ten are mostly similar in these languages. In Italian Sie- six, settle- seven, otto- eight, nove- nine, etc. The words of closes family relationship like father, mother, sister, brother, etc. as well as a number of other fundamental words of Sanskrit resemble with other classical languages of this family. For example: Bhratr in the Sanskrit, Brother in the German, *bhratheir* in the Irish *brat* in the Russian, *beradar* in the Persian. Pitr in the Sanskrit, *Frater* in the Latin Pharater in Greek.

Some other similarities can be found between Sanskrit and other classical Languages.

Sanskrit	German	Greek	Latin	English
Matri	Mutter	Mateera	Mater	mother
Sunus	Sohn	Yas	Natus	Son
Svasri	Schwester	altheffee	sorror	sister
Apas, jalam	wasser	neero	acqua	water
Dvi	zwei	theeo	duo	two
Ashta	acht	okta	Octo	eight

The verbal system of Avestan so clearly resembles with that of Sanskrit, that a student of Sanskrit after mastering Avestan phonology can easily understand Sanskrit. The Slavic language which is one of the chief languages of *Satam* group of Indo-Uropean languages outside Asia, has many resemblances. Not only in the languages but similarities can be found between Slavic and Indian Culture.

Curiously enough, the Sanskrit Imperative Ending -u seems to be preserved in some Gothic imperative forms of the third person singular and plural like at-steigadau, lingandau. It is evidently the same- au which is evident in all the quotable forms of passive optative in Gothic.

The peculiar perfect endings in Sanskrit *veda, vettha, veda* have their exact counter parts in Greek, *oida, oistha, oide*. The endings of reduplicating perfects are not so easily reconcilable, but see, Greek.: *gegona*, and in Sanskrit yaj*na*.

In perfect tense, Latin has generalized the medial endings. Thus *tutudi*, though in meaning identical with Sanskrit *tutuda*, agrees in form more with Sanskrit *tutude, tutudai*.

From the above illustrations, it is clear that the Sanskrit language has many resemblances with other classical languages of Indo-European group like, Latin, Greek, German, Iranian, Slavic etc.

- **Sanskrit and Modern Indian Languages**

Languages spoken in India belong to various language families like (i) Indo-European Family, (ii) Dravidian Family (iii) Austric, (iv) Sino-Tibetan etc, which include 179 languages and about 544 dialects. The languages spoken in North India are called Indo-Aryan Languages and come under Indo- European Family. The languages spoken in South India belong to Dravidian family. The Languages of Kashmir and Assam belong to Sino-Tibetan Family. Some dialects of Andaman and Nikobar Islands, West Bengal, Bihar, Madhya Pradesh, Tamilnadu and Orissa belong to Austric Family.

The geographical position of a language has very often had a great deal of positive influence upon its development. So Sanskrit being the oldest language of India has influenced all other languages of India, even those, which have not directly originated from it. There are ample evidences that all the languages of Indo-Aryan Group are the offsprings of Sanskrit Languages. Sanskrit is considered to be the mother of most of Indian Languages except Dravidian Family.

All the Modern Indian Languages, like, Hindi, Marathi, Gujrati, Oriya, Bengali, Sindhi, Maithili, Kashmiri, Assamese, Konkani, Rajsthani, Manipuri, Punjabi etc., have been enriched with the words of Sanskrit. Sanskrit has influenced other languages also which have not originated from it, like Urdu and the Dravidian languages like Telugu, Tamil, Kannada and Malayalam.

Another Evidence of the influence of Sanskrit on the Modern Indian Languages is its literary component. The *Ramayana*, the *Mahabharata,* the two oldest epics of Sanskrit are the sources of many other literatures the *Ramacaritamanasa* in Hindi by Tulasidas, the *Adhyatmaramayana* in Malayalam by Ramanuja Eutachh, the *Kambaramayan*a in Tamil by Kamban, the *Mullaramayana* in Telugu and the *Krttibasaramayana* on Bangla by Krttivasab. The notable evidence of the influences of Sanskrit language on modern Indian languages is the literary heritage of it.

- **Sanskrit and the Sciences**

- **Astronomy**

Astronomy was called 'Nakshatravidya', 'Jyotirvijnyanam' or Jyotish in ancient India. The word 'Nakshatradrashta' is used for an Astronomer in *Shuklayajurveda* (30/10) and 'Nakshatravidya' for Astronomy in *Chhandogya Upanishad* (7/1/2).

The earliest references of Astronomy are found in the Rigveda. The Vedic Seers always appreicated the appearance of the light in the sky. Many stars are mentioned in Atharvaveda. We also find natural scientific observations regarding the course of the planets. The Aitareya Brahmana (3/44) says that the sun actually neither rises nor sets but through it's revolution round the earth, causes day and night.

To perform the Vedic rituals and sacrifices, calculation of appropriate time was necessary and this need introduced The Vedang - 'Jyotish' in the history of Indian Astronomy.

'Vedanga Jyotish' of Lagadha the first treatise on Astronomy, contains two parts: Arch Jyotish in 36 shlokas and Yajush Jyotish in 43 shlokas.

It is exclusively devoted to calculation of time. An attempt to cast a calander is also found in this vedang.

'Panchasiddhantika' of Varahmihira mentions five siddhantas of earliar Astronomy in which a complete system of Astronomy is presented. They are – Pitamaha siddhanta, Vashistha siddhant, Paulisha siddhanta, Surya siddhanta and Romaka siddhanta.

Surya Siddhanta is the most prominent treatise of Siddhant period. According to the introductory verses Surya the Sun God disclosed it to Asura Maya in the city of Romaka. The cosmological timecycles and the Solar Planetary cycles are described here. The average length of the Sideral year (the length of the Earth's revolution round the sun) is 365.2563627 days which is only 1.4 seconds longer than the modern value of 365.2563627 days.

The following works and the authors have an eminent place in the history of Astronomy:

i.   *Aryabhatiyam of Aryabhata* also called the Arya siddhanta, consist of four parts – the Dashagitika sutra, Ganita Pada, Kalkriyapada and Golapada. The first and second part are related to Mathematics. The Third part, in 25 verses contains the basic principals of astronomical time – calculations. The fourth part, in 50 verses deals with the celestial sphere.

ii. *Arya Siddhanta* of Aryabhata IInd, is a voluminous work on astronomy.

iii. *Brahma-sphuta-siddhant* of Brahmagupta, treats the astronomy more elaborately and more methodically.

iv. Siddhantshiromani of Bhaskaracharya is divided into four parts – Lilavati, the Bijganita, the Grahaganitadhyaya and the Goladhyaya. Goladhyaya contains a section, in which difficult austronomico – mathematical problems are posed and solved. It also deals with astronomical instruments and description of the seasons.

v.   *Rajmriganka* of Bhoja

vi. Bhasvati of Shatananda

vii. *Grahalaghava or the siddhantrahasya of Ganesha*

viii. *Siddhantatattva viveka of Kamalakara*

ix. Karanapaddhati of Nilakantha somayaji.

The Indian Astronomy is closely associated with astrology. According to Varahmihira there are three branches of jyotish shastra –

1. Tantra, the astronomic- mathematical branch, that is devoted to the calculative astronomy;
2. Hora, that is devoted to casting of horoscopes and
3. Shakha or Samhita, that teaches the natural Astrology; the discipline about forecasts that are deducible from natural incidents.

- **Mathematics**

'Ganita' the term used in Sanskrit for mathematics; is derived from the root 'gana', which means to count or to enumerate. Mathematics in India has been cultivated in connection with Astronomy. Like the other streams of knowledge, the early references of mathematics, are also found in the vedic literature. The word 'Rashividya' is used for mathematics in Ch*handogya Upanishad* (7.1.2). Some hymns of *Shuklayajureda* reveal the knowledge of odd numbers and tables (18/24,25). The Brahmana texts like ; 'ekaya svaha, dvabhyam svaha, trishyah svaha' reflect the vedic concept of arithmetical progressions. In Pingal sutra there is a discourse on the calculation of squares and square roots.

The Indians; earlier than other nations; became familiar with the system of place value of numerals. Undoubtedly the Europian system of enumeration is of Indian origin. India is the birth place of several mathematical concepts including zero, the decimal system, algebra, algorithm, square root and cube root etc. The origin of calculus was in India, even more than three centuries before Leibnitz and Newton introduced their own theorems.

The concept of zero, i.e. shunya, which means 'void', a figure to indicate the absence of a position of number is virtually void. A round figure, symbol for zero, i.e. '0' had emerged to represent the philosophical concept of void.

Mathematics in India might have started more than five thousand years ago. Since 1000 B.C. almost for a period of two thousand years, many a number of mathematical works were produced in India. Since the 5th centruay A.D., the method of graduated calculation had been introduced in India. By that time, the geometric theories were known to the Indians. We may see some displays of motifs on the walls of ancient temples. Those motifs ideally reflect the patterns available in Indian architecture, as we see the admixture of floral and wall pattern of geometric method. These concepts, were collected and developed further by the mathematicians like Aryabhata who flourished in the 5th Century A.D. His work Aryabhatiyam is equally important for Mathematics and Astronomy. The first part of the book explains the special system of writing numerals that was introduced by Aryabhata alone. The Second part gives a small anthology of mathematical teachings of Aryabhatta. He deals in his work with evolution and revolution, area and volumes, progressions and algebraic identities.

Brahmagupta's work 'Brahma-sphuta-siddhanta' covers very briefly the arithmetical operations, square and cube roots, interest, progressions, geometry and simple algebraic identities.

Bhaskaracharya the great astronomer, enjoys high reputation as a mathematician also. His work Lilavati, in which a lovely maiden is addressed and problems set to her, is a famous book on mathematics. The second book Bijaganita, is the fullest and most systematic account of Indian algebra.

Ganitasarasangraha of Mahaviracharya, Trishati of Shridhara, Bijaganita of Narayan are some prominent Sanskrit treatises on Indian Mathematics.

- **Chemistry**

Chemistry is the branch of science, which deals with the study of elements of organic as well as inorganic nature. In India the knowledge of chemistry was current since the Vedic era, praising Agni (The fire), as we see in the first *sukta* of the *Rigveda*. It is believed that the basic idea of smelting reached India since the *Rigvedic* period. Metallurgy, one of the main branches of chemistry has remained as the central key to all the civilizations from the Bronze Age to the Iron Age.

Ancient India's advanced chemical science was distinct feature in the Vedic contents like the Brahmanas. The chemical action was known as the *pakaprakriya*. The science of chemistry, due to its Vedic antiquity might have been first recognized in India, as a separate discipline. Alchemy and the science of medicine gave rise to the study of chemistry in India. The ancient masters as mentioned in connection with chemistry are: Patanjali,Bhavya,Dattadeva, Vyadi, Svacchanda, Damodara, Vasudeva, Caraka, Sushruta, Harita and Vagbhata. Ancient Sanskrit documents about the advanced chemical science find the expression in activities like distillation of perfumes and fragrant ointments. It is also found in activities like manufacturing of dyes and chemical preparation of pigments and colours and polishing of mirrors. In India itself, certain objects testify to the high level of metallurgy.

There are around fifty Sanskrit works in original found on chemistry. A few of them are as follows:

Work	Author	Date
❖ The Rasaratnakara	Nagarjun	- 8th century A.D.

- ❖ The Rasarajamriganka   Bhoja   – 11th century A.D.

- ❖ The *Rasendracudamani*   Somadeva   —12th century A.D.

- ❖ The *Rasaprakasa-sudhakara*   Yasodhara   —13th century A.D.

- ❖ The *Rasasara*   Govindacarya   —14th century A.D.

- ❖ The *Rasarajalaksmi*   Vishnudeva   —14th century A.D.

- ❖ The *Sharngadharasamhita*   Sharngadhara   —14th century A.D.

- ❖ The *Rasendrasarasangraha*   Gopalakrishna   —14th Century A.D.

- ❖ The *Arkaprakasha* by Ravana; *Arka* is the Sanskritized form of the Persian word *arrak* meaning tincture. Distillation of liquor is mentioned in the Sanskrit work called *Madirarnava*.

The *Carakasamhita* mentions about the Ancient Indians who knew how to prepare sulphuric acid, nitric acid, the oxides of copper tin and zinc, the sulphate of copper, zinc and iron and the carbonates of lead and iron. The weapons mentioned in the *Mahabharata* and the *Ramayana* were actually the products of Chemistry.

Indian chemists knew the production of gunpowder and it was called as *aurbagni,* which was attributed to Aurba, the preceptor of Sagara. The work called *Niticintamani* discusses about the ingredients and power of fire of *Aurba.* It says; " combining burnt wood, saltpeter and sulphur by parts gradually lessened, a terrible fire is produced by which even water and others are burnt."

- **Architecture And Engineering**

Architecture the Vastu vidya or Sthapatya is one of the basic Arts of ancient India. The word 'vastu' is derived from 'vas' to 'reside'. Thus 'vastu' denotes all sorts of buildings – religious, residential and military like – Prasada, mandapa, sabha, shala,

prapa, ranga, skandhawara and fort. It also implies town planning, planning of commercial cities, laying out gardens, making roads, bridges, dams, tanks etc. Thus architecture includes the complete science of Civil Engineering.

There are innumerable references in Rigveda which indicate a very advanced Vastushilpa in Rigvedic age. The Vedic deities Mitra and Varuna are described as residing in a great palace with thousand pillars and thousand gates.

The chief development of the Indian Architecture centres round the Hindu Temple. Specimen of different styles of Temple Architecture particularly, the Northern and Dravidian are found in the two parts of India, north and south. The Temple Architecture reflects the spiritual ideals of India. Temples are the abode of gods and goddesses on earth.

The main Sanskrit treatises on Architecture are the Mayamata, Manasara, Vishvakarma - VastuShastra, Samaranganasutradhara, Aparajita - Priccha, Manasollasa, Prasadamandana, Shilparatnam etc.

Mechanical Engineering is known as 'Yantra Vidya' in Sanskrit Shastras. There are many references in Sanskrit literature which speak of the mechanical skills of Indians. The samarangana-sutradhara describes three classes of yantras (i) yana yantra – conveyances like vimanas and chariots, (ii) udakayantra – water machines – variyantra and dharayantra, (iii) sangramayantra – like Agneyastra, Varunastra, bhushundi, shataghni and sahasraghni etc.

- **Medicine**

Indian the medical science is popularly known as 'Ayurveda' which means 'the Veda for lengthening of the span of life'. The beginning of Medical Science goes back to the age of Vedas. The Vedic Indians, who wanted to live for hundred full years with prosperity and good health, developed a holistic approach in the field of healthcare and medical systems, which emphasizes the physical, mental, intellectual and spiritual aspects of a human being.

'Bhaishajya-suktani' of Atharvaveda reveal the knowledge of medical science in ancient India. Atanomy, embryology and hygiene were also known from the Vedic times.

Ayurveda is considered as an 'Upanga' (subsidiary) to the Atharvaveda. It is inclusive of Achar (the life style), vichar (the thinking process) and ahar (the dietetics).

Ayurveda is divided into eight main branches such as : shalya –tantra (major surgery), shalakyatantra (minor surgery), kaya chikitsa (treatment of diseases of the body), bhutavidya (demonology), kumarbhritya (paediatrics), agad tantra(toxicology), rasayana (elixir) and vajikaran (aphrodisiaca).

Physiology, Pathology, Materia-Medica, therapeutics, Pediatrics, Hygiene, Dietetics, the science of pulse, veterinary science, the treatments of elephants horses, cattle, ornithology etc. were the different branches of Ayurveda developed in ancient India.

Atreya, Harita, Kashyapa, Agnivesha, Bhela and jivaka are the ancient scholars, who are named by traditions.

The earliest work on the Indian medicine is the Charakasamhita of Charaka in the first century A.D. It consists of eight chapters: 1)Sutrasthan, that in general describes

means of healing, diet, duities of a physician etc. 2)Nidansthan, on the eight principal ailments 3)Vimansthan, on tastes, food, general pathology, and medical stadium 4)Sharirsthana, on anatomy and embryology 5) Indriyasthan, on diagnosis and prognosis 6)Chikitsasthan, on special therapy 7) Kalp and 8)Siddhant sthan, on general therapy.

Charaka, Sushruta and Vagbhata are prominent contributors to the Ayurvedic Literautre. *Sushrutasamhita,* of Sushruta, *Ashtangsangraha* of Vagbhata, Madhavanidan of Madhava, Ayurvedadipika of chakrapanidatta are some other important works in this field.

Ayurveda has a well developed school of surgery. Sushruta was most probably the first surgeon in the world to deal systematically, exhaustively and elaborately with the entire subject of surgery including gynaecology, obstetrics, eye-diseases, plastic surgery, artificial limbs etc. Surgical instruments are also described, 101 kinds of blunt instruments and 21kinds of sharp instruments. Vagbhata had classified diseases into seven distinct groups. He has given a complete list of various diseases. He has enlisted 94 eye diseases, 29 ear disorders, 18 diseases related to nose and 75 diseases related to mouth cavity.

- **Sanskrit and Metaphysical Subjects**

- **Philosophy**

a. What is Metaphysics?

Metaphysics is the science that investigates into the first principles of nature and thought. It is that part of philosophy, which is concerned with the study of things and their ultimate causes and their underlying but unseen nature, often called philosophy. Philosophy is the study of the nature of knowledge. Philosophy is a covered system of thoughts, backed by logic as reason and arguments and manifests itself as a cream or essence of spirituality.

b.   Metaphysical subjects in Sanskrit:

In Sanskrit literature the branch of Metaphysics is called darshana, i.e. sight or vision. The vision of real nature of the substance may be called philosophy.

b.i.   The schools of philosophy in Sanskrit:

The philosophy in Sanskrit is divided into two broad groups: the school of Astika (theist) and the school of Nastika (atheist). The Astika system is one, which accepts the authority of the Vedas. They are six in number: i.e. Nyaya, Vaisheshika, Sankhya, Yoga, Mimamsa, and Vedanta. On the contrary another system called Nastika Darsana does not believe in the authority of the Vedas. It has also three main groups – Buddhism, Jainisam and Charvak philosophy.

The School of Astika Darsana

b ii. 1. Nyaya and Vaisheshika Systems:

In the school of Astika Philosophy, the first twin systems are the Nyaya and the Vaisheshika systems. The two systems are allied together. The Vaisheshika system outlines the scheme of the ontological categories and describes their nature, the origination and the dissolution of the world. The Nyaya System examines the logical explanation, apparatus of human knowledge, the criterion of truth and falsehood, the nature and function of knowledge, its instruments, their limits defects and problems relating to the validity or knowledge. Rishi Gautam wrote the famous Nyayasutra on which an excellent commentary was written by Vatsyayan followed by many othrs. The initiator of Vaisheshika darshan was Kanada whose Vaisheshika sutras were followed by many other explanatory works like Bhasha – Parichcheda by Vishwanatha.

b. ii.2. Sankhya System:

The Sankhya System is considered to be the oldest Indian Philosophical system. There are references to this system in the Upanishads, the Gita, and the Mahabharata. The word Sankhya has two meanings; the knowledge and number. Maharshi Kapila is the originator of the system. The two important source books for the system are Isvara Krishna's Sankhyakarika and the Vachaspati's -Tattva- Kaumudi. This system contains elaborate discussions on Purush and Prakriti.

b. ii.3. The Yoga System:

Amongst all the systems of Astika school, the Yoga System of Maharshi Patanjali is the most widely known and popularly appreciated system of thought. The system of Yoga is a psychosomatic process for training the mind and keeping the body under control. The source and significantly single inspiration for Indian psychology is the Yoga Sutras of Patanjali. The date assigned to Patanjali is the second century B.C. The Yoga system is considered to be complementary to the Sankhya. If Sankhya is the theory; yoga is its practical side. The Yoga System enables one to realize kaivalya (liberation), i.e., his true nature.

b. ii. 4. The Mimamsa System:

Among the philosophical systems, the Mimamsa and the Vedanta are exclusively based on the authority of the Vedas. The word Mimamsa means an enquiry. This system holds that the Vedas issue commands and have ritual actions for the purport. This also prescribes certain actions and prohibits certain others. The prime purport of the Vedas is to command duties and prohibit some acts. It is a list of do's and don'ts. The System is pragmatic in approach.

b. ii. 5. The Vedanta System:

What is living and vital in Indian Philosophy today is the Vedanta system in its various forms. The Vedanta is the crowning edifice of all the systems. The other philosophical systems are mainly studied as accessories to the study of Vedanta and not as ends in themselves. There are different branches of Vedanta which have grown from the interpretation of the triple text: (i) the Upanishads, (ii) the Gita, (iii) the Vedantasutras. All the commentators claim alike that the systems of philosophy, they have built, are in complete accord with the total unitary import of the three texts, that these texts should have lent themselves to a variety of interpretations even contradictory to one another, is

the most amazing nature of these scriptures and their inexhaustible significance. The branches of this system are, the system of Advaita Vedanta (non-dualism) of Shankara, the system of Dvaita Vedanta (dualism) of Madhva, the Dvaitadvaita Vedanta of Nimbarkacharya and Vishistadvaita (qualified non-dualism) of Ramanujacharya.

The Nastika Darhsanas

b.iii.1. The Charvaka System:

The Charvaka School of Philosophy represents the Indian Pattern of atheism and materialism. It is not a dogmatic statement of opinions. It is an argued and reasoned system of materialism. It has a special attraction and glamour for those who believe in uninhibited sensuous living. The superficially reflective and sense -bound vision of man easily accepts the Charvaka philosophy. Scientific empiricism and hedonistic ethics are the foundations of the system.

b.iii.2. The System of Buddhism:

The sayings of Buddha were gathered into three baskets (pitakas), namely (i) Abhidhammapitaka, (ii) Vinayapitaka and (iii) Suttapitaka. The Abhidhammapitaka sets forth the metaphysical views of the Buddha, the Vinayapitaka sets fourth the rules of discipline i.e., the Sadhana aspects of the religion. Suttas contain the stories, parables and the teachings. They are the utterances of Buddha himself.

b.iii. 3. The system of Jainism:

Jainism is an independent non-Vedic school of philosophy originating from the

views of some twenty-three saints before Mahavira. The 23rd is Parsvanatha and the first is Rishsabhadeva. The saints who had the spiritual experience and could attain kaivalyaajnana are called Tirthankaras. They are worshipped by the Jains. Its literature is in ardhamagadhi and Sanskrit. The special features of the Jainism are logic and ethics. The Jaina conception of Reality is not like that of the Buddhists, nor like the unchanging Brahman of the Advaita. It admits both, permanence and change. It is a complex concept. Their classification of philosophical categories goes into two broad divisions: non-spirit (ajiva) and, spirit (jiva). The souls are infinite in number. Their essential properties are omniscience and blissfulness. They are eternal. The second category of reality is non-spirit (ajiva). This category comprises time, akasa (space) and matter. All these items have no consciousness.

- **Sanskrit and Humanities**

- **History**

History is the discipline that studies the chronological record of events. In Sanskrit it is known by the name of Itihasa which means 'Iti +Ha+As i.e. it was definitely like this.

The recording of History in Sanskrit starts from the Vedas which contain a list of teachers. The documents, biographies, artifacts, currencies etc. are the main sources of History.

Though innumerable books are of historical value but four of them deserve special mention. They are Harshacharitam, Navsahasankcharitam, Vikramankadevacharitam and Rajtarangini.

The Harshacharita of Banabhatta is the first historical Kavya written in prose in 7th Century A.D. It has eight chapters called 'Uchchhavas'. In the first three chapters the poet has given autobiographical account of himself. This kavya gives insight into the administration and reign of king Harshavardhan who ruled from 606-647 AD the Historical details given in Harshacharita are similar to those of Hieun Tsang, a Chinese travellor.

Navsahasankcharita is the record historical Kavya written by Padmagupta in 1005 AD. Navsashasankcharita was the nick name of King Sindhuraja the younger brother of King Munja.

Written in 18 cantos, it relates the winning of Shashiprabha, the daughter of Naga King by Sindhuraja or Navasahsank. In the 12th canto all the former kings of

Parmara dynasty have been mentioned in chronological order. These have been confirmed by the records inscribed on inscriptions.

The Vikramankdevacharitam written by a Kashmiri Poet Bilhana in 1085 AD delineates the history of Chalukya Kings. The birth of the founder of Chalukya Dynasty has been traced from the chuluk (kamandala) of Brahma.

The Kavya gives the life of Vikramaditya VI who ruled from 1076 -1127 AD the historical description of the Chalukya Kings given by the poet was proved by many other Chalukya inscriptions also.

The most important work written on History in Sanskrit literature is the Rajatarangini of Kalhana. It was completed by the poet in 1148 AD after a long research. 7826 verses have been divided into eight books called 'Tarangas'. Rajtarangini itself means 'the river of kings'. In this, the poet has tried to trace the history of Kashmir starting from very ancient time upto 12th Cent. AD. It starts with the description of the kings of Govinda Dynasty. The first date mentioned here is 813-814 AD. Starting from here upto 1150 AD all the facts given are historical.

Like a true historian the poet has not hesitated in penning down even the tyrannies and the atrocities of his pattron King Harsha of Kashmir.

The Rajtarangini can be called a historical Kavya in the true sense.

- **Political Economy**

It is a branch of social science which later developed into economics but in India it means the theories and the manuals taken together that deal with practical life, domestic economy , administration and particularly politics.

KAUTILYA'S ARTHASHASTRA

Kautilya's Arthashastra in 15 Adkikaranas and 180 Prakaranas, represents an important tradition in Indian intellectual history. This valuable work was apparently composed and written somewhere around 320 B.C. since Kautilya is regarded as the master teacher Chanakya – the strategist, responsible for the rise of Chandragupta Maurya, the founder of the Mauryan dynasty. Kautilya laid the first cornerstones of the Indian state. The text is mainly in prose form but intermingled with aphorisms and rhythmic verses, Kautilya's saintly king provides a model of Vedic political leadership. His Arthashastra gives us a sense of early thought on realism in domestic policy and in international relations. He emphasizes the importance of Artha – i.e. the material wellbeing as the gateway to Dharma -the basis of Kingdom. Kautilya refers to the Vedas, Manu, various systems of Philosophy and to tribal and republican politics. Kautilya has a conception of distributive justice under the umbrella of a political community. He speaks of state as a creator of order out of anarchy. He lays special emphasis on moral goals. He shows a great commitment to political economy and public administration, encouraging activity and productivity. Without productivity in agriculture, other functions can begin to crumble. The Agricultural division of labour is complemented with manufacturing and the work of skilled artisans. His conception of work ethics includes quality control by the state and punishment of dishonesty and theft. Consumer protection measures are described in great details. The State governed standards should govern fraud in materials, their production and in office transactions. Kautilya goes far beyond in developing an extensive theory of international relations. The three components of power – enthusiasm, military might and the power of counsel are mentioned in ascending order of importance.

His description of elaborate administrative machinery is superb. National administration is divided into thirty four departments, each with a chief and an appropriate number of subordinates. Forestry, mining, mint, state trading, weights and measures,

surveying, shipping, passports, textiles, jails and other major functions are minutely discussed alongwith job descriptions and qualifications. There are long lists of administrative procedures, codes of ethics and sanctions for stealing gems from the treasury, if found guilty the sanction is death. Kautilya also outlines a system of jurisprudence including codification of offences, role of judges, a policy manual for prisons and rules of evidence and other procedures.

The study of Kautilya can add a lot to cross cultural Intellectual history and early political realism in diplomacy.

Even the great Sanskrit poets like Bhasa, Kalidasa, Banabhatta, Vishnusharma etc. have paid their respects to Kautilya and Arthashastra.

The Nitisara of Kamandaka written in about 700 A.D. is based on Arthashastra. It is in the form of poetry and is in 20 cantos. It preaches about morality and describes policy also.

Nitivakyamrita of Somadevasuri throws light on the duties of Kings. Nitirantnakara of Chandreswara, Shukraniti of Shukra also deserve special mention.

- **Law (Dharamashastra)**

The law in Sanskrit is known by the name of Dharmashastra i.e. the science of ordinance but the scope of Dharmashastra is more extensive than what is denoted by 'law'. Dharma can be defined as ordinance, duty, right, justice, morality, virtue, religion, good actions etc. Kalpasutras are the Primary source of 'dharma'. These 'Dharmashastras' contain rules of conduct and rituals, duties of people at various stages of life. They discuss purification rites, forms of hospitality, daily oblations and judicial matters.

After Dharmashastra, smrities define 'dharma'. Although there is mention of eighteen smrities yet Manusmriti compiled by Manu in about 200-300 BC is the most authentic and popular. It has 2694 verses divided into twelve chapters. It deals with various topics such as cosmogony, dharma, initiation and Vedic study, the eight forms of marriage, hospitality, dietary, law, rights and duties of four castes and four stages of life (varnashramas) etc. Its influence has been enormous. Medhatithi Govindraja and Kulluka Bhatta wrote their commentaries on Manusmriti which are very popular.

After Manusmriti comes the Yajnavalkya Smriti. It is related to the Paraskara Grihya Sutra of white (Shukla) Yajurveda. It has 1013 verses which have been distributed under the three headings of good conduct (achara), Law (vyavahara) and Repentence (pryashchitta). As compared to Manusmriti it is more progressive in thoughts and has been written in more systematic manner. Of all the commentaries, the commentary of Vignaneshwara written by the name of Mitakshara became more accepted.

Besides these two smrities, the smritis of Narada, Brihaspati, Ushna, Harita, Katyayana, Parashara, Gautama etc. are also well-known. The Mahabharata is one of

the accepted texts of Dharmashastra. It is to be noted that the Smriti texts have been binding the Indians together till date.

- **Sanskrit and Religion**

- **Hinduism**

Hindu religion owes its origin to the Vedas. They are the *Rgveda*, the *Yajurveda*, the *Samveda* and the *Atharvaveda*. Its full development appears in the Puranas.

The two important constituents of Vedic Religion were prayer and sacrifice. The Rgvedic seers ask Gods to bestow wealth and victory on them and to favour them with heroic sons. They also pray for long life, health and comfort. The Vedas were followed by the Brahmana-literature to interpret Vedic ritual consisting of different *Yajnas* (Sacrifice). In the Upanisad-books the definition of Sacrifices has been changed. Upanisads (the *Chhandogya* and the *Mundaka*) declare that man himself is Yajna (Sacrifice) Special importance is now attached to knowledge (i.e. the *Kena Upanisad*). Later on, the devotional creeds centre largely around the two deities, Vishnu and Siva. Vasudeva or Vishnu became the foundation of the *Bhagavata* religion. In contradiction to Vedic emphasis of Sacrifice and Upanishadic emphasis on knowledge, the Bhagavata religion lays emphasis on devotion and grace as the desirable forms of relationship between man and God.

In short, some of the most prominent features of Hinduism are—

1. The general recognition of the Vedas.

2. The conception of God. It is elaborated into two forms—Absolute (Nirguna Brahman) and God in Human form (Saguna Brahman). God in figure is worshipped under three main forms—Shiva, Shakti and Vishnu.

3. Human life is submitted to the law of retribution and rebirth. Man wanders from life to life carrying with him the consequences of the actions of his previous existence.

4. Liberation (*Moksa*) consists in escaping from the cycle of rebirth. The way of knowledge, or devotion or ritual works (*Jnana, Bhakti, Karma*n) purifies man's activity and gives the true goal of human liberation.

5. In the way of *Bhakti,* the appearance of God (Avatara) is fully established.

    In the practical conduct of human life, the system of castes, of the four stages of life, the four aims (*Dharma, Artha, Kama, Moksa*) have become the established framework in earthly existence.

- **Buddhism**

Buddhism arose in 6th century B.C. in the wake of the Upanishadic speculation. Its originator Gautama Buddha was one of religious ferment. He was largely influenced by the liberal thinking of the Upanishadic sages, the prevailing ideas of knowledge and Yoga practices, leading to mental concentration, the theory of *Karman* and the Value of a mendicant life. *Karman* or one's own deeds influence the destiny of a being, but he denied the authority of the Vedas and Vedic sacrifices. From his spiritual experience, Buddha became convinced of the four noble truths, that there is suffering (*Duhkha*), that it has a cause (*Samudaya*), that it can be suppressed (*Nirodha*) and that there is a way to accomplish this (*Marga*). He accepts that birth is painful, decay is painful, disease is painful, death is painful, union with the unpleasant and separation from the pleasant and dissatisfaction are painful. There is sorrow because all things are transient. They vanish as soon as they occur. Ignorance is the main cause, out of which false desire springs. When knowledge is attained, suffering ends. Life is nothing but a series of manifestations of becoming and destruction. There is nothing that is permanent.

That which breaks the series of sufferings is called eightfold path (*Astangamarga*) or middle path (*Madhyamamarga*). They are *Samyagdrishti, Samyaksankalpa, Samyagvak, Samyakkarma, Samyakajiva, Samyag-vyayama, Samyaksmriti* and *Samyaksamadhi.*

The oldest of all the Buddhist literatures are Tripitakas (the Collection of Three Baskets). The Tripitakas consist of the *Vinayapitaka*, the *Suttapitaka* and the *Abhidhammapitaka*. The *Vinayapitaka* includes the *Suttavibhaga*, the *Khandhakas* and the *Parivara*s. The *Suttapitaka* consists the *Digghanikya*, the *Majjhimanikaya*, the *Samyuttanikaya*, the *Anguttaranikaya* and the *Khuddakanikaya*.

The *Abhidhammapitaka* has seven books, The *Dhammasangani*, the *Vibhanga*, the *Dhatukatha*, the *Puggalapannatti*, the *Katthavatthu*, the *Yamaka* and the *Patthana*. Other books are *Milindapanha*, The *Mahavastu*, the *Lalitvistara* etc.

- **Jainism**

Jainism is closely associated with the name of Mahavira. Jainas regard him as the 24th in the long line of Tirthankaras and the Jina. Jainism is, therefore, the religion of those who aim at conquering the *Karman*—rebirth—cycle under the guiding influence of the lives and teachings of the Tirthankaras as systematized by Mahavira Jina.

In Jainism, there are two main streams, Digambara (Space clothed) and Svetambara (clothed in white). Mahvira's community has remained a well- knit organization comprising four Tirthas (orders) called Muni (monks), Sadhvi (nuns) Sravaka (Laymen) and Sravika (Lay Women).

According to Jainism the universe is made of four living (*jiva*) and five non-living (*ajiva*) kinds of substances. They all are eternal and uncreated. *Karman* is the link between *Jiva*, and *Ajiva*. Accumulated *Karman* follows the soul after death through all its transmigrations. To achieve liberation from them, two tactics should be employed. The first is to check the inflow of new *Karman* (*Samvara*). The second is to cause *Karman* from past to fall off (Nirjara). This is achieved through mortification. Twelve types of such austerities (*tapas*) are usually recommended. When the soul is completely purged of all

burdens, it takes the form of straight line and then develops into its natural form, obtains perfection and puts an end to all the miseries.

The *Jiva* ascends to that *Nirvana* (liberation) by ladder of fourteen steps. The five great rules of conduct are *Ahimsa*, (Non Violence), *Satya (Truth), Asteya (not to steel), Brahmacharya* (celibacy)and *Aparigrarha (non worldly possessions).* The three restraints (three *Guptis*) are *Manogupti* (control of mind), *Vacanagupti* (control of speech), *Kayagupti* (control of bodily Movements) and ten pious duties are also the part of Jainism. *Dravyasangraha, Nayachakra* etc. are the source books of Jainism.

- **Sanskrit and the Arts**

  - **Theatre**

  Prosperity of Sanskrit related theatre is unmatched for its creatively written plays and disciplinary science of Art of Theatrical performance.

  Accomplished dramatist Bhasa wrote 13 plays among them the *Svapnavasavadatta*, the *Pratijnayaugandharayana*, and the *Pratimanataka* are well-known, *Abhijnanasakuntala* of Kalidasa is a much celebrated work and is in UNESCO'S world heritage. Mricchakatika of Sudraka is regarded as the most important play of world literature by international critics. Bhavabhuti's Uttaramacharitam is known for its all inclusiveness of tragic sentiment *Karuna*. The *Mudraraksasa* of Vishakhadatta is a great drama of political intrigue, in which, interest in the action never ceases, *Ratnavali* of Harsha and the *Venisamhara* of Bhattanarayana are inexhaustible mines of illustrations of the theories of dramaturgy.

  The above-mentioned works are a few to be named. There is a long list of Sanskrit plays, which can provide subjects or plots with varied aura and spectra of senses.

  As a disciplinary science of stagecraft, Sanskrit keeps inexhaustible treasury of dramaturgical works, whose exploitation for the present day theatre is yet to be made. The *Natyashastra* of Bharata is encyclopaedic in its content. Other than this, relevant parts of Puranas, the *Natyasarvasvadipika* of Adi Bharata, the *Abhinayadarpana* and the *Bharatarnava* of Nandikesvara, the *Dasharupaka* of Dhananjaya, the *Natyadarpana* of Ramachandra and Gunachandra, etc., are a few dramaturgical works to be named here. These treatises discuss minutest of the details and throw light on remotest of areas.

As far as present day scenario is concerned, Sanskrit theatre is living and vibrant. Sanskrit plays are staged in national and International drama festivals and competitions. Annual drama competitions of Rashtriya Sanskrit Sansthan, New Delhi, Kalidasa Academy, Ujjain, and Delhi Sanskrit Akademi are famous ones. Koodiyattam—the age old ritualistic Sanskrit theatre of Kerala is recognized by UNESCO, as one of the masterpieces of the oral and intangible heritage of humanity.

The above mentioned is a very short account of the potentialities of the Sanskrit drama and dramaturgy, which, if explored thoroughly, can infuse excellence in modern day theatre and cinema of the Globe.

- **Dance**

Dance or Dancing is for the creation of *rasa* (sentiment) through particular suggestions, by suitable movements of different parts of the body, as per the tradition of Sanskrit. There are three main components, *Natya*, *Nritta* and *Nritya*, which together with their subsidiaries make up the classical dance. Natya is the dramatic element of a stage performance. *Nritta* is the rhythmic movement of body in dance. It virtualizes and reproduces beat (t*ala*) and rhythm (*laya*) by means of abstract gestures of the body and hands and extensive and precise use of footwork. On the otherside, *Nritya* is that element of dance which suggests *rasa* (sentiment) and *bhava* (mood), conveyed by facial expressions and appropriate gestures. The object of both, *Nritta* and *Nritya*, is to depict ideas, themes, moods and sentiments by using *abhinaya* (acting). The practice of *abhinaya* involves four techniques; *angika* (of gestures), *vachika* (of speech), *sattvika* (representation of feelings), and *aharya* (of costumes, makeup etc).

In Sanskrit, many treatises on art of dancing are available. The *Natyashastra* of Bharata and the *Abhinayadarpana* of Nandikesvara have been authoritative sources of instruction for Indian classical dances. The *Dasharupaka* of Dhananjaya, the

Sangitaratnakara of Sarngadeva, the *Sangitaraja* of Kumbhakarna, the *Nrityanirnaya* of Pundarika Vitthala, the *Nrityaratnavali* of Jayasenapati, the *Sangitasaramrita* of Tulajaraja, the *Balaramabharata* of Balaramavarman, etc. are few other works from a long list of rich treatises on the art of dance in Sanskrit.

At present, all the chief schools of Classical dance in India are based essentially upon the *Natyashastra*. The Bharatanatyam, which means dance according to the principles of Bharata, follows most closely the *Natyashastra*. Kuchipudi, Kathakali, Mohiniattam, Manipuri, Odissi, etc. accept the *Natyashastra* as their authority. Apart from art and technique of dance, Sanskrit has been the main source of stories and subject matter of dance-dramas. Stories from the *Ramayana*, the *Mahabharata* and the Puranas have been most sought after themes for Indian classical dances. Yakshagana, a dance-drama of Mysore, has about fifty plays based on both the great epics of Sanskrit for its subject matter. Rasalila of Brija and Manipuri dance of Manipur owes much to the *Bhagavata Purana* and the *Gitagovinda*. The *Gitagovinda* of Jayadeva was composed for dancing and its verses and themes are amply used in Indian classical dances. Thus, Sanskrit is the most important source of technique and subject-matter for Indian Classical dances.

- **Music**

In Sanskrit, music is called *gana, giti* or *sangita*. The later Sanskrit treatises on music, explained *sangita* as the combination actually trio of vocal music, instrumental music, and dance (*gita, vadya* and *nritya*). On the ground of reality, all the three arts are independent of each other, but in spite of their independence *gana* subordinates *vadya*, and *vadya* subordinates *nritya*. So, vocal aspect (*Gita*) is predominant. *Gana* or *gita* originates with the succession of tones that produce agreeable and pleasing sensations. Musical sound is impregnated with divine lustre (*lavanya*), aesthetic sentiment (*rasa*)

and mood (*bhava*). Melody or melodic form (*raga*) is soul of music. *Sangita* is accompanied by *pathya* or *sahitya* (text part)

A Brief History

The association of Indian Music with Sanskrit is as old as Sanskrit itself. In the Vedic age, the *Samagana* method of chanting Vedic verses was in practice. The *Samaganas* were possessed of different numbers of notes, registers, metres and literary compositions (*sahitya*). Musicological rules and other relevant details about *Samagana* are spread all over in different Pratishakhyas, Sikshas and other Sanskrit texts of that age. In the Classical period, *Gandharva* type of music, was evolved which was a kind of stage song or *Natyadharmigiti*, possessed of *svara, tala* and *pada*. Afterwards, Bharata systematized the form and system of Music in the *Natyashastra*. The genuine type of *raga* came into being, with ten determining characteristics (*dashalakshanas*) and psychological values, with the new names of *gitiraga* and *gramaraga*. *Jatis* are the forerunners of *ragas* or the parent *ragas,* which gave birth to all Classical *ragas* and formalized *deshiragas*. After Bharata, Kohala, Matanga and other Sanskrit Musicologists made their contributions and hundreds and thousands of *ragas* developed with their new and novel themes and forms. The ancient *gramas* were gradually replaced by *murcchanas* (groupings of upward and downward notes). In the 15th and 16th century A.D., musicologists like—Lochana, Ramamatya etc. represented new trends in music.

Murcchanas, as generators or determining factors of *ragas* appeared with a new nomenclature of *mela* or *thata*. Method of classification of ragas changed from *raga-ragini-putra- vargikarana* into *janya-janaka* or genus- species(cause-effect) method, and most of the ragas appeared with their, new tonal forms. Approximately at the same time, Pandita Damodara, etc., presented *Ragamurtis* (visual pictures) and *Dhyanamantras* (poetical descriptions and contemplative compositions) of *ragas* and *raginis* for their

better appreciation and intuitive perception. In 17th-18th centuries, Abohala, Shrinivasa, etc. altered the total bases (*Svarasthana*) in relation to the microtones (*shrutis*). Thus, by this way, Sanskrit musicologists produced volumes of authoritative works on Indian music and shaped both Hindustani and Karnataka (Carnatic) Music to their present-day-status. Contribution of Sanskrit towards Indian Music is great. This contributory association can generally be understood from two points of view —

i.   *Sahitya* or *Pathya* (Literary compositions or texts) for music and

ii.   Sanskrit treatises on Musicology.

i.   **Sahitya or Pathya**: Sanskrit was a medium of Music from the very ancient time. It formed the text part (*sahitya*) of Vedic music *samagana*. The *Ramayana* was itself a *Geyakavya*. In the *Mahabharata* and the Puranas, we find many references of music with *marga* or *deshi* type of songs with Sanskrit text parts. Many *gatha-ganas* of the Buddhist text *Lalitavistara* are in Sanskrit *pathya*. Musicological works in Sanskrit are full of different types of songs with Sanskrit *pathya*. Classical Sanskrit Literature comprises many references of music with Sanskrit *pathya*. Sanskrit hymnal literature (*stotrasahitya*) and many other *gathas* are Sanskrit p*athyas*. Padagitis of Jayadeva's *Gitagovinda* and Lilashuka-Bilvamangala's *Srikirshnakarnamrita* and many other songs are in Sanskrit. Legendary vocalists of present age, like M.S. Subbulakshmi, Pandit Jasrraja and many others have used Sanskrit *pathya* for their musical renderings.

ii.   **Sanskrit Treatises on Musicology:** Most of the authoritative works on Indian Music are in Sanskrit. Different *Siksha, Pratishakhya* and other Vedic Texts related to *Samagana*, the *Natyashastra* of Bharata, the *Bharatarnava* of Nandikeshvara, the *Brihaddesi* of Matanga, the *Naradiya Siksa* and the *Sangitamakaranda* of Narada, the *Sangitaratnakara* of Sarngadeva, the *Ragatarangini* of Lochana, the *Svaramelakalanidhi* of Ramamatya, the *Sadragachandrodaya*, the *Ragamala*, and the

Ragamanjari of Pundarika Vitthala, the *Ragavibodha* of Somanatha, the *Sangitadarpana* of Damodara, the *Caturdandiprakshika* of Venkata makhi, the *Sangitaparijata* of Ahobala, the *Ragatattvavibodha* of Shrinivasa, the *Sangitasaramirta* of Tulajaraja, are few a from a very long list of Sanskrit treatises on Musicology.

- **Sculpture**

The sculpture or the Taksanashilpa is the allied Science of Architecture and other cognate Arts. It is derived from the word "Sculp" or "Taksa" which means to "carve" or to "engrave". The heavenly architect "Tvashta" was the mythical originator of this Art.

Sculpture in Sanskrit literature may be seen in making images of deities, in decoration of the temples, in making thrones (sinhasanas), royal umbrellas, chariots, couches (paryanka) kalpavriksas (the ornamental trees) beautifully decorated with creepers) colourful jewels, ornaments and garlands.

Iconography or pratima yantyana is an important branch of sculpture. Pauranic religion, Agams and Tantras, Buddhism and Jainism gave encouragement to this art. The images may be classified into nine broad divisions:
(i) Trimurti (Tri-image), (ii) Vaishnava, (iii) Shaiva, (iv) Shakt, (v) Saurya, (vi) Bauddha, (vii) Jain, (viii) Yaksha and (ix) Shalbhanjaka (images).

Eight types of materials were used in making images – the clay, wood, stone, metals, precious stones, ivory and mixed substances.

The images were made according to pratima laksan shastras, Mayamata, Mansara, Samaranganasutradhar, Hayashirsha – Pancharatna, kashyapasamhita,

vishnudharmottarpurana (chitra sutra) Brihat Samhita etc. are some prominent treatises on sculpture.

- **Sanskrit hymns and Subhashitas**

The land of Bharata is called Deva-bhu and Sanskrit language – a devine language. There is an undercurrent of spirituality in the entire Sanskrit literature, which is primarily based on the achievement of the four-fold objectives called Purushartha – chatushtayam i.e. Dharma, Artha, Kama and Moksha. Hence there is hardly any work which may be found lacking in the usage of excellent effective sayings, but from ancient times, specific works have been written by poets and scholars to compose beautiful collections of good saying only in order to inculcate moral values in the coming generations. Some of the ancient works in this direction are Raja-niti Samuchchaya, Chanakya-Niti-Darpanam, Nitisara, Niti-Pradeep etc.

Later on, in modern times, efforts have been made to collect such sayings from the entire ocean of Sanskrit literature. Subhashita-ratna-bhandagara is one such popular collection. There is one more Subhashita Sangraha in a number of volumes by Ludwig. Sanskrit Academy has published seventen volumes of Sukti samgraha which contain subhashitas from vedic hymns, puranas, epics, Jain and Bauddha granthas, Mahakavyas, works on various sciences and poetics etc. Prof. Satya Vrata Shastri's Subhashita Sahasri contains 1000 verses collected subjectwise from various sources. Kapil Deva Dvivedi's Sukti Sangraha is also very popular. Some private publishers have also come forward to bring out very useful works. Manjula Manjusha and Shiksha Sukti sangraha published by Nita Prakashan, Sanskrit Sukti Sindhu by Madan Lal Verma are excellent efforts in this direction.

Sanskrit works like Panchatantra, Hitopadesha, Epics Ramayana and Mahabharata, Bhartihari's Nitishatakam are excellent encyclopaedias of subhashitas.

- <u>The Great Personalities Of Sanskrit</u>

<u>From The West</u>

<u>Contribution To Vedic Literature</u>

Sanskrit is considered to be the richest language in the world, due to its literary contents. Some Western scholars may be put on the first rank, to bring it into the light of the world, who translated Sanskrit texts in various foreign languages.

Contributions to Vedic Literature:

i. Fredric Rozane, was a German Scholar, who edited and translated some parts of the *Rigveda* into German in 1830.

ii. S.A. Longlois, of France, translated the whole text of the *Rigveda* into French, which was published in Paris, during 1848-51.

iii. Friedrich Max Muller (1823-1900) lived in England, sacrificed his own life in the study of the Vedas, and edited the whole *Rigveda* with its *Sayanabhashya* that was published by East-India Company. He published his "Vedic Hymns" on famous Suktas of the *Rigveda*, under the *Sacred Books of the East*.

iv. Theodar Benfey (1909-81), translated 130 Suktas of Ist Mandala of the *Rigveda* into German. He also translated the whole text of the *Kauthuma Shakha* in German that was published with illustrations and lexicons in the year 1848.

v. Hermann Grassman (1809-77), was a German Scholar, who made a poetic translation of the *Rigveda* and a Lexicon of the *Rigveda* in German titled, *Worterbruchzum Rgveda*.

vi. Alfred Ludwig (1832-1911), belonged to Germany, was a Professor of Sanskrit in the University of Prague. He prepared the German translation of the *Rigveda,* titled *Der Rigveda* with 230 important Suktas of the *Atharvaveda* translated into Germany.

vii. Harace Hymen Wilson of 19th Century A.D. belonged to England and lived in India for a long time. He edited and translated the text of the *Rigveda* with the *Sayana Bhashya* into English.

viii. R.T.H. Griffith 1828-1906, was the first and the last after H. H. Wilson, who translated the whole text of the *Rigveda* into English. He has also published his poetic translation of the *Yajurveda*, the *Samaveda* and the *Atharvaveda*.

ix. A.Weber 1805-1901, was very famous among those who contributed to Vedic literature. He was a French Missionary. He translated the *Shukla Yajurveda Samhita's* Ninth and Tenth Chapters into Latin and its 16th chapter into German. He also translated the *Atharvaveda* into German, published under the title *Indische Studien*.

x. A.B. Keith, was the student of McDonnell, who translated the *Taittiriya Samhita* into English, that was published under the *Harward Oriental Series* in 1914 in America.

Contribution Of Other Western Scholars

Sir William Jones (1746-94 A.D.), British scholar and founder of Royal Asiatic Society, famous institution involved in Indological studies, admired the theme, form, power and beauty of Sanskrit Language and stressed its affinity to Greek and Latin. He translated the *Shakuntala* in English, the *Manusmriti* in English and German, and edited the *Ritusamhara*, which was his first printed work in Sanskrit.

Charles Wilkins (1750-1836), a British scholar translated *Hitopadesha* and the *Bhagavadgita* in English. His translation of the *Bhagavadgita* (London 1785), was first Sanskrit book to be directly translated into an European language. For his book '*Sanskrit Grammar*' (1808), Sanskrit type was used for the first time in Europe, a type that the

author himself had made. The *Shakuntala* episode of the *Mahabharata* (1793) was also his work.

H.T. Colebrooke, a French Scholar (1765-1837) who edited and/or translated. The *Shakuntala* (1830) the *Amarushataka* (1831). The *Hitopadesa* (1804), the *Amarakosa* (1808), the *Shatakatraya* of Bhartrihari (1804), *Samkhyakarika* of Ishvarakrishna (1837) and two treatises on Hindu law of inheritance (1810). His work on algebra with arithmetic and mensuration based on Sanskrit works of Brahmagupta and Bhaskara preceded by a dissertation on the state of science as known to Hindus was published in 1917 in London. His *Digest of the Hindu Law on Contracts and Recessions* (1997-98) was a translation of composition, prepared by native scholars on the law of succession and contract, from the Indian law books. He also wrote the '*Grammar of the Sanskrit Language*' (1805).

A.W.V. Schlegel (1767-1845), a German scholar, founded a periodical '*Indische Bibliothek*' (First Vol. appeared in 1823) He contributed the *Ramayana*, the *Hitopadesha* and also first critical edition of the *Bhagavadgita* with Latin translations (1823).

Max Muller (1823-1900) a German scholar, was associated with *The Sacred Books of the East Series*. He translated Upanisads and Apastamba-Sutras in English, and edited the *Rigveda* with Commentary of Sayana (6 Vols.) He also edited the *Hitopadesa,* the *Meghaduta* (1847), the *Rigveda Pratishakhya* (1859-69) with German translations. He wrote many books on Philosophy, Grammar and History related to Sanskrit.

Monier Williams (1819-89) a British scholar wrote *An Elementary Grammar of the Sanskrit language* (1846), *A Practical Grammar of the Sanskrit Language, A Sanskrit Manual for Composition* (1862) and composed English- Sanskrit (1851) and Sanskrit-English (1872) Dictionaries. He edited and translated the *Shakuntala* (1856), the

Vikramorvashiyam, the *Nalopakhyanam* (1879) and wrote many other books like the *Hinduism* (1877) and the *Indian Wisdom* (1878).

William Dawight Whitney (1827-94), an American scholar , edited the *Atharvaveda* (1856) and wrote the *Sanskrit Grammar* (1879) and *The Roots, Verb-forms and Primary Derivations of Sanskrit language* (1885). He edited the *Atharvaveda Pratishakhya* (1862) and the *Taittiriya Pratishakhya*, with commentary and translation. He also edited and translated the *Surya Siddhanta*, a treatise on Astronomy and Astrology and produced the *Oriental and Linguistic Studies* in two volumes (1873-74).

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Thus Spake the Great Men

"Samskrit language, as has been universally recognized by those competent to form a judgment, is one of the most magnificent, the most perfect, the most prominent and wonderfully sufficient literary instrument developed by the human mind."

Sri Aurobindo

"Without the study of Samskrit one cannot become a true Indian and a true learned man."

Mahatma Gandhi

"If I was asked what is the greatest treasure which India possesses and what is her finest heritage, I would answer unhesitatingly that it is the Samskrit language and literature and all that it contains. This is a magnificent inheritance and so long as this endures and influences the life of our people, so long will the basic genius of India continue. If our race forgot the Buddha, the Upanishads and the great epics (Ramayana and Mahabharata), India would cease to be India ."

Jawaharlal Nehru

"Samskrit has moulded the minds of our people to the extent to which they themselves are not conscious. Samskrit literature is national in one sense, but its purpose has been universal. That was why it commanded the attention of people who were not followers of a particular culture."

Dr. S. Radhakrishnan

"The language of Samskrit is of a wonderful structure, more perfect than Greek, more copious than Latin and more exquisitely refined than either. Human life would not be

sufficient to make oneself acquainted with any considerable part of Hindu literature."

Sir William Jones

Samskrit was at one time the only language of the world. It is more perfect and copious than Greek and Latin."

Prof. Bopp

"Samskrit is the origin of modern languages of Europe ."

Mr Bubois

Samskrit is the unsurpassed zenith in the whole development of languages yet known to us."

Wilhelm von Humboldt

"The intellectual debt of Europe to Samskrit literature has been undeniably great. It may perhaps become greater still in the years that are to come. We (Europeans) are still behind the making even our alphabet a perfect one."

Prof. Macdonell

"Samskrit is the greatest language of the world."

Max Muller

" India was the motherland of our race and Samskrit the mother of Europe 's languages...Mother India is in many ways the mother of us all."

Will Durant

"If Samskrit would be divorced from the everyday life of the masses of this country, a light would be gone from the life of the people and the distinctive features of Hindu culture which have won for it an honoured place in world-thought would soon be affected to be great disadvantage and loss both of India and of the world."

Sir Mirza Ismail

~ SANSKRIT Language: Scientific Base, Computer Programming Usage & Free Online Resources
January 7, 2013

Sanskrit (means 'Refined Speech") is one of the oldest languages on the earth. It is an Indo-Aryan language and mother of many Indian languages . Indo-European studies also focuses on Sanskrit. Sanskrit learning and speaking also helps to improve pronunciation and broaden one's linguistic skills. Sanskrit is also studied in UK , Irland, Harvard-USA and New Zealand and some other countries in the world apart from Indians. A New Zealand school teacher says Sanskrit helped their kids to learn English! See an discussion on benefits of learning sankrit, a western perspectives.

Hollywood Movie Matrix and Sanskrit Connection!

- **Hollywood movie Matrix and Sanskrit usage:**
- **Upanishads Verses which reflects the Matrix philosophy:**
- **Intellectual and Interesting discussion "Matirx- Vedanta Reloaded :**

Sanskrit (Indian Language) and European languages have common root. Even many English words actually have Sanskrit origin. Watch this **ThinkingallowedTV** discussion about Sanskrit – The most Scientific, ancient , Spiritual Language

Sanskrit as Computer Programming Language and for Artificial Intelligenece:

Recent reserch shows that Sanskrit is useful for computer software programming. NASA research paper demonstrates how Sanskrit can be used for computer in publication – Knowledge representation in Sanskrit and Artificial Intelligence. Also, see interesting fact that NASA to use Sanskrit as computer language Article discussed that using Sanskrit message can be sent by the computer in least number of words! More similar views on this by a scribed user here. Sanskrit usage is also published in a scientific paper where they used it in Computer simulation concept . Find various articles on Sanskrit usage as programming language for computer :

- **Sanskrit as programming language**
- **Discussion forum-** **Is Sanskrit the most suitable language for computer software?**
- **Other interesting facts about** **Sanskrit as software language and origin**

Very soon the traditional Indian language Sanskrit will be a part of the space, with the United States of America (USA) mulling to use it as computer language at NASA. After the refusal of the Indian Sanskrit scholars to help them acquire command over the language, US has urged its young generation to learn Sanskrit.

On visit to Agra, Aurobindo Foundation (Indian Culture) Pudcherry Director Sampadananda Mishra told Dainik Jagran about the prospects of Sanskrit. Mishra said, "In 1985, NASA scientist Rick Briggs had invited 1,000 Sanskrit scholars from India for working at NASA. But scholars refused to allow the language to be put to foreign use."

According to Rick Briggs, Sanskrit is such a language in which a message can be sent by the computer in the least number of words.

After the refusal of Indian experts to offer any help in understanding the scientific concept of the language, American kids were imparted Sanskrit lessons since their childhood.

The NASA website also confirms its Mission Sanskrit and describes it as the best language for computers. The website clearly mentions that NASA has spent a large sum of time and money on the project during the last two decades.

The scientists believe that Sanskrit is also helpful in speech therapy besides helping in mathematics and science. It also improves concentration. The alphabets used in the language are scientific and their correct pronunciation improves the tone of speech. It encourages imagination and improves memory retention also.

Mishra told the daily that even the call centre employees are improving their voice by reading Sanskrit, besides the language being used by news readers, film and theatre artist for alternative voice remedy.
- See more at: http://post.jagran.com/NASA-to-use-Sanskrit-as-computer-language-1332758613#sthash.lG6tpspC.dpuf

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संस्कृत बनेगी नासा की भाषा, पढ़ने से गणित और विज्ञान की शिक्षा में आसानी

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Researchers at NASA
give, object, ball
give, recipient, Mary
give, time, past
Based on what the grammarians themselves have stated, we may conclude that the Sanskrit grammar was an attempt to discipline and explain a spoken language.
Another hope for the return of Sanskrit lies in computers. Sanskrit and computers are a perfect fit. The precision play of Sanskrit with computer tools will awaken the capacity in human beings to utilize their innate higher mental faculty with a momentum that would inevitably transform the world. In fact the mere learning of Sanskrit by large numbers of people in itself represents a quantum leap in consciousness, not to mention the rich endowment it will provide in the arena of future communication.

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Researchers at NASA have been looking at Sanskrit as a possible computer language because of its perfect morphology that leaves very little room for error.

Pāṇini's Ashtadhyayi shows significant similarities to the Backus-Naur Form grammar that is used to describe modern programming languages today. Many

Sanskrit enthusiasts and linguists hope that, one day, Sanskrit will become the language of the world. Its clear and precise language structure enhances

communication and opens alternative means for expression.

Modern scientists hail the ancient language of the gods as the only unambiguous natural language on the planet

This interesting article refers to a NASA article on Sanskrit in **AI(Artificial Intelligence) Magazine** in Spring of 1985 written by NASA researcher, Rick Briggs.

In ancient India the intention to discover truth was so consuming, that in the process, they discovered perhaps the most perfect tool for fulfilling such a search that the world has ever known — the Sanskrit language.

Of all the discoveries that have occurred and developed in the course of human history, language is the most significant and probably the most taken for granted. Without language, civilization could obviously not exist. On the other hand, to the degree that language becomes sophisticated and accurate in describing the subtlety and complexity of human life, we gain power and effectiveness in meeting its challenges. The access to modern technology which has been designed to give ease, efficiency and enjoyment in meeting our daily needs did not exist at the beginning of the century. It was made possible by accelerated advancement in the field of mathematics, a "language" which has helped us to discover the interrelationship of energy and matter with a high degree of precision. The resulting technology is evidence of the tremendous power that is unleashed simply by being able to make the finer and finer distinction that a language like mathematics affords.

At the same time humankind has fallen far behind the advancements in technology. The precarious state of political and ecological imbalance that we are now experiencing is an obvious sign of the power of technology far exceeding the power of human beings to be in control of it. It could easily be argued that we have fallen far behind the advancements in technology, simply because the languages we use for daily communication do not help us to make the distinctions required to be in balance with the technology that has taken over our lives.

Relevant to this there has recently been an astounding discovery made at the NASA research center. The following quote is from an article which appeared in AI Magazine (Artificial Intelligence) in Spring of 1985 written NASA researcher, Rick Briggs.

In the past twenty years, much time, effort, and money has been expended on designing an unambiguous representation of natural languages to make them accessible to computer processing. These efforts have centered around creating schemata designed to parallel logical relations with relations expressed by the syntax and semantics of natural languages, which are clearly cumbersome and ambiguous in their function as vehicles for the transmission of logical data. Understandably, there is a widespread belief that natural languages are unsuitable for the transmission of many ideas that artificial languages can render with great precision and mathematical rigor.

But this dichotomy, which has served as a premise underlying much work in the areas of linguistics and artificial intelligence, is a false one. There is at least one language, Sanskrit, which for the duration of almost 1000 years was a living spoken language with a considerable literature of its own. Besides works of literary value, there was a long philosophical and grammatical tradition that has continued to exist with undiminished vigor until the present century. Among the accomplishments of the grammarians can be reckoned a method for paraphrasing Sanskrit in a manner that is identical not only in essence but in form with current work in Artificial Intelligence. This article demonstrates that a natural language can serve as an artificial language also, and that much work in AI has been reinventing a wheel millennia old.

The discovery is of monumental significance. It is mind-boggling to consider that we have available to us a language which has been spoken for 4-7000 years that appears to be in every respect a perfect language **designed for enlightened communication**. But the most stunning aspect of the discovery is this: **NASA the most advanced research center in the world for cutting edge technology has discovered that Sanskrit, the world's oldest spiritual language is the only unambiguous spoken language on the planet.**

In early AI research it was discovered that in order to clear up the inherent ambiguity of natural languages for computer comprehension, it was necessary to utilize semantic net systems to encode the actual meaning of the sentence. Briggs gives the example of how a simple sentence would be represented in a semantic net.

Example: "John gave the ball to Mary."

give, agent, John

He further comments, "The degree to which a semantic net (or any unambiguous nonsyntactic representation) is cumbersome and odd-sounding in a natural language is the degree to which that language is "natural" and deviates from the precise or "artificial". As we shall see, there was a language (Sanskrit) spoken among an ancient scientific community that has a deviation of zero."

Considering Sanskrit's status as a spiritual language, a further implication of this discovery is that the age old dichotomy between religion and science is an entirely unjustified one.

It is also relevant to note that in the last decade physicists have begun to comment on the striking similarities between their own discoveries and the discoveries made thousands of years ago in India which went on to form the basis of most Eastern religions.

Because of the high level of collaboration required in uncovering the nature of energy and matter, it is inconceivable that it ever could have taken place without a common language, namely mathematics. This is a perfect example of using a language for discovering and designing life. The language of mathematics, being inherently unambiguous, minimizes personal interpretation and therefore maximizes opportunity for exploration and discovery. The result of this is a worldwide community of scientists working together with extraordinary vitality and excitement about uncovering the unknown.

It can also be inferred that the discoveries that occurred in India in the first millennia B.C. were also the result of collaboration and inquiry by a community of spiritual scientists utilizing a common scientific language, Sanskrit. The truth of this is further accented by the fact that throughout the history and development of Indian thought the science of grammar and linguistics was attributed a status equal to that of mathematics in the context of modern scientific investigation. In deference to the thoroughness and depth with which the ancient grammatical scientists established the science of language, modern linguistic researchers in Russia have concluded about Sanskrit, "The time has come to continue the tradition of the ancient grammarians on the basis of the modern ideas in general linguistics."

Sanskrit is the most ancient member of the European family of languages. It is an elder sister of Latin and Greek from which most of the modern European languages have been derived. The oldest preserved form of Sanskrit is referred to as Vedic . The oldest extant example of the literature of the Vedic period is the Rig-Veda . Being strictly in verse, the Rig-Veda does not give us a record of the contemporary spoken language.

The very name "Sanskrit" meant "language brought to formal perfection" in contrast to the common languages, Prakrits or "natural" languages. The form of Sanskrit which has been used for the last 2500 years is known today as Classical Sanskrit. The norms of classical Sanskrit were established by the ancient grammarians. Although no records are available of their work, their efforts reached a climax in the 5th century B.C. in the great grammatical treatise of Panini, which became the standard for correct speech with such comprehensive authority that it has remained so, with little alteration until present times.

The NASA article corroborates this in saying that Indian grammatical analysis "probably has to do with an age old Indo-Aryan preoccupation to discover the nature of reality behind the impressions we human beings receive through the operation of our senses."

Until 1100 A.D., Sanskrit was without interruption the official language of the whole of India. The dominance of Sanskrit is indicated by a wealth of literature of widely diverse genres including religious and philosophical; fiction (short story, fable, novels, and plays); scientific literature including linguistics, mathematics, astronomy, and medicine; as well as law and politics.

With the Muslim invasions from 1100 A.D. onwards, Sanskrit gradually became displaced by common languages patronized by the Muslim kings as a tactic to suppress Indian cultural and religious tradition and supplant it with their own beliefs. But they could not eliminate the literary and spiritual- ritual use of Sanskrit.

Even today in India, there is a strong movement to return Sanskrit to the status of "national language of India." Sanskrit being a language derived from simple monosyllabic verbal roots through the addition of appropriate prefixes and suffixes according to precise grammatical laws has an infinite capacity to grow, adapt and expand according to the requirements of change in a rapidly evolving world.

Even in the last two centuries, due to the rapid advances in technology and science, a literature abundant with new and improvised vocabulary has come into existence. Although such additions are based on the grammatical principles of Sanskrit, and mostly composed of Sanskrit roots, still contributions from Hindi and other national and international languages have been assimilated. For example: The word for television, duuradarshanam, meaning "that which provides a vision of what is far away " is derived purely from Sanskrit.

Furthermore, there are at least a dozen periodicals published in Sanskrit, all-India radio news broadcast in Sanskrit, television shows and feature movies produced in Sanskrit, one village of 3000 inhabitants who communicate through Sanskrit alone, not to mention countless smaller intellectual communities throughout India, schools, as well as families where Sanskrit is fostered. Contemporary Sanskrit is alive and well.

The discussion until now has been about Sanskrit, the language of mathematical precision, the world's only unambiguous spoken language. But the linguistic perfection of Sanskrit offers only a partial explanation for its sustained presence in the world for at least 3000 years. High precision in and of itself is of limited scope. Generally it excites the brain but not the heart. Sanskrit is indeed a perfect language in the same sense as mathematics, but Sanskrit is also a perfect language in the sense that, like music, it has the power to uplift the heart.

It's conceivable that for a few rare and inspired geniuses, mathematics can reach the point of becoming music or music becoming mathematics. The extraordinary thing about Sanskrit is that it offers direct accessibility by anyone to that elevated plane where the two, mathematics and music, brain and heart, analytical and intuitive, scientific and spiritual become one. This is fertile ground for revelation. Great discoveries occur, whether through mathematics or music or Sanskrit, not by the calculations or manipulations of the human mind, but where the living language is expressed and heard in a state of joy and communion with the natural laws of existence.

Why has Sanskrit endured? Fundamentally it generates clarity and inspiration. And that clarity and inspiration is directly responsible for a brilliance of creative expression such as the world has rarely seen.

The Ancient and classical creations of the Sanskrit tongue both in quality and in body and abundance of excellence, in their potent originality and force and beauty, in their substance and art and structure, in grandeur and justice and charm of speech and in the height and width of the reach of their spirit stand very evidently in the front rank among the world's great literatures. **The language itself, as has been universally recognized by those competent to form a judgment, is one of the most magnificent, the most perfect and wonderfully sufficient literary instruments developed by the human mind**, at once majestic and sweet and flexible, strong and clearly-formed and full and vibrant and subtle, and its quality and character would be of itself a sufficient evidence of the character and quality of the race whose mind it expressed and the culture of which it was the reflecting medium.

Sanskrit after all is the language of mantra — words of power that are subtly attuned to the unseen harmonies of the matrix of creation, the world as yet unformed. The possibility of such a finely attuned language is only conceivable by drawing upon sounds so inherently pure in combinations so harmoniously blended that the result is as refreshing and pure as the energy of creation forming into mountain streams and lakes and the flawless crystal structures of natural gems, while at the same time wielding the power of nebulae and galaxies expanding into the infinitude of space.

But from the perception of Rishis, the source of language transcends such conceptions. In Sanskrit, Vaak,speech, the "word" of Genesis, incorporates both the sense of "voice" and "word". It has four forms of _expression. The first, Paraa , represents cosmic ideation arising from the original and absolute divine presence. The second, Pashyantii (literally "seeing") is Vaak as subject "seeing," which creates the object of madhyamaavaak , the third and subtle form of speech before it manifests as vaikhariivaak, the gross production of letters in spoken speech.

Sanskrit is a language whose harmonic subtlety, mysteriously sources the successive phases of creation all the way to origination. This implies the p ossibility of having speech oriented to a direct living truth which transcends individual preoccupation with the limited information available through the senses. Spoken words as such are creative living things of power. They penetrate to the essence of what they describe. They give birth to meaning which reflects the profound interrelatedness of life.

It is a tantalizing proposition to consider speaking a language whose sounds are so pure and euphonically combined. The mere listening or speaking inspires and produces joy and clarity. And yet it has been precisely the tendency of humanity as a whole to merely be tantalized by happiness, but not actually to choose it. It's as though we had been offered the most precious gem and we answered, "No, I'd rather be poor." The only possible background for such a choice is the unconscious belief that, "I can't have it. I can't be that."

Interestingly enough, this is exactly what is triggered in people who are faced with the opportunity to learn Sanskrit. The basic attitude towards learning Sanskrit in India today is, "It's too difficult." *Actually Sanskrit is not difficult. On the contrary, there are few greater enjoyments.* The first stage, experiencing the individual power of each of the 49 basic sounds of the Sanskrit alphabet is pure discovery, especially for Westerners who have never paid attention to the unique distinctions of individual letters such as location of resonance and tongue position. The complete alphabet must have been worked out by learned grammarians on phonetic principles by long before it was codified by Panini around 500 B.C. It is arranged on a thoroughly scientific method, the simple vowels (short and long) coming first, then the complex vowels (dipthongs), followed by the consonants in uniform groups according to the organs of speech with which they are pronounced.

The unique organization of the Sanskrit alphabet serves to focus one's attention on qualities and patterns of articulated sound in a way that occurs in no other language. By paying continuous attention to the point of location, degree of resonance and effort of breath, one's awareness becomes more and more consumed by the direct experience of articulated sound. This in itself produces and unprecedented clarity of mind and revelry in the joy of language. Every combination of sound in Sanskrit follows strict laws which essentially make possible an uninterrupted flow of the most perfect euphonic blending of letters into words and verse.

The script used to depict written Sanskrit is known as Devanaagari or that "spoken by the Gods." Suitably for Sanskrit, it is a perfect system of phonetic representation. According to linguists, the phonetic accuracy of the Devanaagari compares well with that of the modern phonetic transcriptions.

Because of its inherent logic, systematic presentation and adherence to only the most clear and most pure sounds, the Sanskrit alphabet in its spoken form, is perhaps the easiest in the world to learn and recall. Once the alphabet is learned, there is just one major step to take in gaining access to the Sanskrit language: learning the case and tense endings. The endings are what make Sanskrit a language of math-like precision. By the endings added onto nouns or verbs, there is an obvious determination of the precise interrelationship of words describing activity of persons and things in time and space, regardless of word order. Essentially, the endings constitute the software or basic program of the Sanskrit language.

The rigor of learning the case endings is precisely the reason why many stop in their pursuit of Sanskrit. Yet by an effective immersion method, fluent reading of the Devanagari script, accurate pronunciation, and the inputting of the case and tense endings can easily be accomplished. Such a method must take advantage of the fact that Sanskrit grammar is structured by precise patterns, and once a pattern has been noted it is a simple exercise to recognize all the individual instances that fit the pattern; rather than see the pattern after all the individual instances have been learned. Color coding provides a tremendous support in this regard.

Learning the case endings through the chanting of basic pure sound combinations in musical and rhythmic sequences is a way to overcome learning inhibitions, attune to the root power of the Sanskrit language and access the natural computer efficiency, speed and clarity of the mind.

Although learning Sanskrit in some ways presents challenges similar to those of learning calculus or music, it also induces a lubrication and acceleration of mental function that actually makes such a process exciting and enjoyable. Perhaps the greatest immediate benefit of learning Sanskrit by this method is that it requires participants to relinquish control, abandon prior learning structures and come into a direct experience of the language.

The actual simplicity and enjoyment of the sounds of Sanskrit provides everyone with an opportunity to learn a subject which is technically precise with fluidity and ease. This tends to produce a complete reversal of the inhibiting competitive environment in which most life education traditionally took place, by creating an atmosphere in which mutual support generates personal breakthrough and vice-versa.

One thing is certain, Sanskrit will only become the planetary language when it is taught in a way which is exciting and enjoyable. Furthermore it must address individual learning inhibitions with clarity and compassion in a setting which encourages everyone to step forth, take risks, make mistakes and learn. Already we have outstanding examples of this approach in the work of teachers such as Jaime Escalante, whose remarkable achievements in teaching advanced calculus to underprivileged high school students in East Los Angeles were featured in the Academy Award nominated movie, "Stand and Deliver."

Sanskrit has always inspired the hearts, mind and souls of wise people. The great German scholar Max Muller, who did more than anyone to introduce Sanskrit to the West in the latter part of the 19th century, contended that without a knowledge of the language (Sanskrit), literature, art, religion and philosophy of India, a liberal education could hardly be complete — India being the intellectual and spiritual ancestor of the race, historically and through Sanskrit.

Max Muller also pointed out that Sanskrit provides perfect examples of the unity and foundation it offers to the Celtic, Teutonic, Slavonic, Germanic and Anglo-Saxon languages, not to mention its influence on Asian languages.The transmission of Buddhism to Asia can be attributed largely to the appeal to Sanskrit. Even in translation the works of Sanskrit evoked the supreme admiration of Western poets and philosophers like Emerson, Whitman, Thoreau, Melville, Goethe, Schlegel and Schopenhauer.

The fact is that Sanskrit is more deeply interwoven into the fabric of the collective world consciousness than anyone perhaps knows. After many thousands of years, Sanskrit still lives with a vitality that can breathe life, restore unity and inspire peace on our tired and troubled planet. It is a sacred gift, an opportunity. The future could be very bright

ONE COSMIC DAY OF CREATOR BRAHMA
(as per Hindu scriptures, particularly the Srimad-Bhagavatam)

- The one day is divided into 14 periods. Six such periods are over. We are now in the 7th.
- Each period is named after the One Ruler who is appointed to rule the entire earthly world during that period. The generic name for such a ruler is *Manu*. The period is called a *Manvantara*.
- The name of the present *Manu* is *Vaivasvata*, the son of the Sun-God.
- How long is the day of Brahma ? (4.32 billion years)
- What is the present age of this universe ?
- What is the Hindu concept of Time ?

Names of the *manvantaras* of this day of Brahma upto the present seventh.
(each *manvantara* is of duration 306,720,000 human years)

1.Svaayambhuva   Beginning of Creation
Dhruva Episode
Descent of the Lord as Half-man-half-lion to blessPrahlada

2.Svaarochisha   The Episode of King Suratha

3. Uttama

4.Taamasa   The Episode of Gajendra, the elephant-devotee

5. Raivata

6. Chaakshusha   The churning of the Ocean of milk
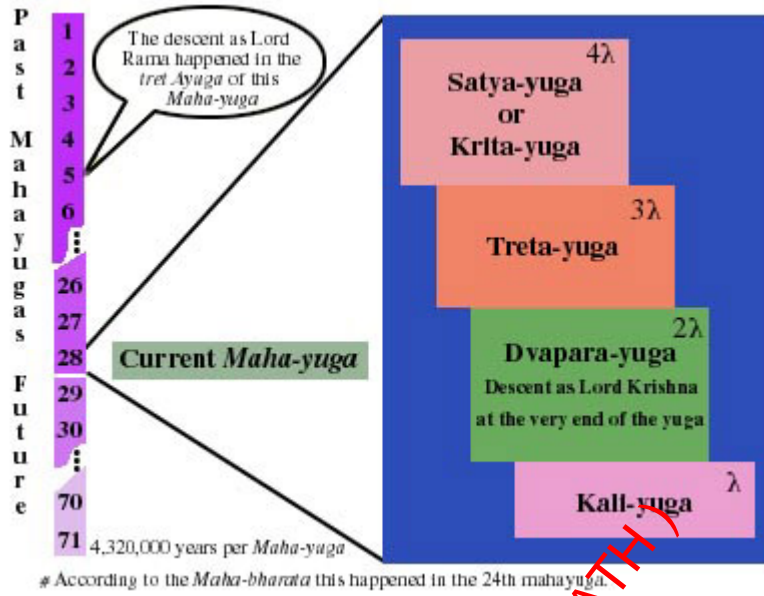
7. Vaivasvata PRESENT *MANVANTARA*
There are seven more *manvantaras* to go in the future

We are in the 7th *manvantara* .
Each *manvantara* **is divided into 71** *maha-yugas*.
We are in the 28th *maha-yuga* **of this** *manvantara*.
Each *maha-yuga* **is divided into 4** *yugas* **shown below for the current** *maha-yuga*.

The descent as Lord Rama happened in the *tret Ayuga* of this *Maha-yuga*

P a s t M a h a y u g a s F u t u r e

1 2 3 4 5 6 ⋮ 26 27 28 29 30 ⋮ 70 71

Current *Maha-yuga*

4,320,000 years per *Maha-yuga*

According to the *Maha-bharata* this happened in the 24th mahayuga.

4λ — **Satya-yuga or Krita-yuga**

3λ — **Treta-yuga**

2λ — **Dvapara-yuga** Descent as Lord Krishna at the very end of the yuga

λ — **Kali-yuga**

We are presently in the *kaliyuga*
of the 28th *maha-yuga*
of the 7th *manvantara* of Brahma's day
(**Duration of every *kali-yuga* = 432,000 years**)
Notation λ: = 432,000

Begining twilight period of 36,000 years

Central period of Kaliyuga 360,000 years

Ending twilight period 36,000 years

First 6000 years of Twilight Period

3102 B.C. : Starting of Kali-yuga

Indus-valley civilization

2000 B.C.

1000 B.C.

Mahavir, The Buddha

1 A.D.

Sankara

1001 A.D.

Ramanuja; Madhwa

2001 A.D.

Age of the Universe

Portion of Brahma's day elapsed so far (till say, 2000 A.D.) consists of	*Duration Table*

- 6 *manvantara*-twilights (6 x 4λ)
- 6 *manvantaras* completed (6 x71 x10λ)
- 1 *manvantara*-twilight before the 7th (4 λ)
- 27 *maha-yugas* past in this *manvantara* (27 x 10λ)
- elapsed yugas in this *maha-yuga* ((4 + 3 + 2) λ)
- 5102 years in *kali-yuga*

This adds up to 4567 λ + 5102 =
1,972,949,102 human years
This is the present (*as of 2000A.D.*) age of the universe in this day of Brahma

Duration of Kali-yuga (λ) =
432,000 (human years)

Duration of Dvapara-yuga (2λ)

Duration of Treta-yuga (3λ)

Duration of Satya-yuga (4λ)

Duration of maha-yuga:

(λ + 2 λ + 3 λ + 4λ) = 10λ

Duration of manvantara: 71 x 10λ

Duration of one manvantra- twilight : 4λ
(*one before every manvantara*)

Duration of Brahma's day

One day of Brahma is of duration equivalent to 1000 *mahayugas.* His night is equally long. At the beginning of every day creation starts. At the end of the day all that was created merge in the Absolute and Brahma 'sleeps' as it were. 360 such days and nights make one year of Brahma. According to the *Puranas*, He has spent 50 years like this and this day is the first day in his fifty-first year!

One day of Brahma = 14 *manvantaras* + 15 *manvantara* twilights
(because there is an extra *manvantara* - twilight at the end of all the 14 *manvantaras*)

= 14 x 71 *mahayugas* + 15 x 4 λ

= 994 *mahayugas* + 60 λ

= 994 *mahayugas* + 6 *mahayugas*

= 1000 *mahayugas*

= 1000 x10 λ = 4,320,000,000 human years.

One 'second' of Brahma
= 4,320,000,000 / 12x60x60
= 100,000 human years

'Back to
the future'
Story

Names of the remaining seven (future) *manvantaras* of this day of Brahma

- 8 Saavarni --------------------->
- 9 Daksha-saavarni
- 10 Brahma-saavarni
- 11 Dharma-saavarni
- 12 Rudra-saavarni

The next Manu (i.e., the eighth) will be *Saavarni*. This promise was made by Mother Goddess to one King Suratha during the second *Manvantara*. To him (and another) the triple story of Mother Goddess is narrated in the *Devi-bhagavatam* (also *Chandi* or *Durg A-saptasati*). The story begins from a

- 13 Deva-saavarni
- 14 Indra-saavarni

after which cosmic night will follow

mythological event that happened after the end of the last *kalpa* (= day of Brahma) and ends up by forecasting the feats of Mother Goddess that are yet to happen in this *kalpa*. One such is the prediction that Suratha will be born as Manu *Saavarni*.

BACK TO THE FUTURE

(Source: Srimad-Bhagavatam, IX - 3)

In the mid-*satya-yuga* of the first *maha-yuga* of the present *manvantara* i.e., around 115 million years ago there lived a King of the Solar dynasty, by name Kakudmi, and his beautiful daughter Revati. Not trusting the astrologers of his time, yet believing in the maxim 'marriages are made in heaven' Kakudmi took his daughter to the celestial world of Brahma the Creator (*Note*: in every *satya-yuga* such journeys are supposed to be possible) in order to ask the Creator Himself as to who would be the right marital match for his daughter. Kakudmi had somebody in his own mind. But Lord Brahma was available to him only after a twenty minutes or so of waiting time (by the standards of that world). When Kakudmi finally had the opportunity to ask Brahma his question, Brahma laughed and said:

My dear Kakudmi, from the time you came here your earthly world has passed through 27 *maha-yugas* and so none of whom you have in mind or their descendents are alive now. Right now people are enjoying the *avatara* (=descent) of Lord Krishna on the Earth. Go back and marry off your daughter to Balarama, the elder brother of Krishna'.

Thus it was that Kakudmi and Revati travelled '*back to their future'* -- from the 1st mahayuga to the 27th -- and Revati was married to Balarama.

Note: 1 *mahayuga* = 43.2 'seconds' for Brahma.

THE HINDU CONCEPT OF TIME

According to Hindu religion and cosmology the flow of Time is eternal. Creation and Dissolution are only two events in a long cyclic succession of Cosmic events. There is no beginning in the past and there is no end to the future. Creation is a manifestation in concrete terms of the Absolute. Dissolution is when all the created universe merges in the Absolute. And that is when the period of non-manifestation begins. The periods of manifestation and of non-manifestation alternate. These are the days and nights of Brahma.

Brahma Himself is a manifestation of the Absolute. He has a life of 100 years in His time.

Between one *kalpa* (technical name for Brahma's day) and the next, the only thing that survive are, Brahma himself (who has to be 'brought back to memory', by the Absolute,

after his 'sleep' !), the vedas in their latent form and the collected aggregate of *vaasanaas* (imprints of actions and thoughts) of all individual souls. Just as each *kalpa* is followed by another *kalpa* with an intervening Cosmic Night, so also one Brahma is followed by another Brahma.

Environmental Awareness in Ancient India

India was a cradle of civilization in the ancient world.

An interesting feature of all ancient civilization was that its inhabitants realised the tremendous value of water in human life. Each of these civilizations was located on the banks of a river (s) or within a convenient distance from the sea. This was to ensure a perennial supply of water for day to day activities.
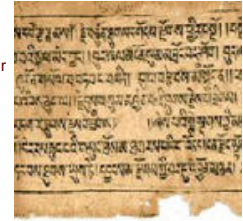
The Rig Veda

It is indeed astonishing to realize that at the dawn of civilisation, the humans understood the significance and importance of water. Apart from cooking, personal cleanliness and hygiene, water was vital for cultivation and irrigation of crops. In that early age, water was a major mode of transport; with further progress and development water again became an invaluable source of food as well as trade and commerce.

According to ancient Hindu beliefs, the universe, the cosmic world comprises five basic elements — *kshiti* (earth), *apah* (water), *teja* (light/heat), *marut* (air) and *vyoma* (ether/space).

According to the **RigVeda,** all life on this planet is evolved from *apah (*water). Water is usually acknowledged as the basic need of all living creatures upon the face of this earth. There are copious references in Vedic literature about medicinal properties of water, uses of water, last but not the least the importance of conservation and preservation of water. Pure water is termed as '*divyajal*' due to its following properties: *Sheetam* (cold to touch), *Suchihi* (clean), *Shivam* (replete with useful minerals and trace of useful elements), *Istham* (transparent), *Vimalam Lahu Shadgunam* (its acid-base balance should not exceed normal limits).

Panchabhuta -the five elements

Water Conservation

The Indus Valley Civilization, that flourished along the banks of the river Indus and other parts of western and northern India about 5,000 years ago, had one of the most sophisticated urban water supply and sewage systems in the world. The fact that this civilization was well acquainted with hygiene and sanitation is evident from the covered drains running beneath the streets of the ruins at both **Mohenjodaro** and **Harappa.** Yet another excellent example is the well-planned city of **Dholavira,** in Gujarat.

Though nature has blessed the Indian landmass with a large number of perennial rivers, unlimited rainfall in most areas, yet the pragmatism and prudence of the ancient seers, scholars and learned individuals led them to ponder over the issue of water conservation

One of the oldest water harvesting systems is found about 130 km from Pune, along a place known as **Naneghat**, situated in the Western Ghats. A large number of tanks were cut in the rocks to provide drinking water to tradesmen who used to travel along this ancient trade route. Each fort in the area had its own water harvesting and storage system in the form of rock-cut cisterns, ponds, tanks and wells that can be seen in use even today.

In ancient times, houses in the western part of Rajasthan were constructed in such a way that each had a rooftop water harvesting system. Though scanty, rainwater from these rooftops was directed into underground tanks. This system can be seen in use even today in all the forts, palaces and dwelling houses of the region.

Earthen pipes and tunnels, (placed underground) to maintain the flow of water besides transporting it to distant places, are still functional at places like **Burhanpur (**Madhya Pradesh), **Golconda** (Andhra Pradesh), **Bijapur** in Karnataka, and **Aurangabad** in Maharashtra

Ruins of Mohen jo Daro

Naneghat

Water Purification

Purification of ground water in the dug wells is dealt with at length in *Brihat-Samhita* written and compiled by **Varahamihira.** He suggested an infusion be made from a mixture of powdered herbs namely *Anjan, Bhadramustha, Khas* (vetiver), *Amla* (emblica *officinalis*, gooseberry*)* and *Nirmali* (*bhui amla / kataka*) in water, which in measured quantities was to be added to water in the wells for purification. Detailed practical guidance for water purification is given in the famous treatise of Indian physician, **Sushruta.** Sushruta disclosed that muddy water could be purified with herbs and naturally occurring substances; *Nirmali* seeds, roots of *Kamal* (lotus/water lily), rhizomes of algae and three stones, *Gomed* (garnet) *Moti* (pearl) *Sphatik* (quartz crystal) were used. He recommended the disinfection of contaminated water by exposing it to the sun or immersing red hot iron or hot sand in it.

The ancient Indian custom of storing drinking water in brass vessels for good health has now been proved scientifically by researchers. Microbiologists affirm that water stored in brass containers can help combat many water-borne diseases and should be used in developing countries rather than their cheaper counterparts i. e plastic containers.

The scientific principle involved in this is the fact that any metal or alloy tends to disrupt biological systems. The element acts by interfering with the membranes and enzymes of cells; for bacteria, this can mean death. Pots made of brass, (an alloy of copper and zinc), shed copper particles into the water that they contain. But the miniscule amount that circulates into the water, while destroying the bacteria cannot harm human beings.

Environmental Awareness in Ancient India

Contribution of Architecture and sculpture towards a better environment

The ancient science of Sthapatya Veda provides extensive knowledge about life supporting building and design principles. It was believed that a properly designed home will promote harmony between parents and children, better physical health, besides financial success.

The word Sthapatya, derived from Sanskrit, means establishment. Veda means knowledge. Thus Sthapatya Veda means the knowledge of establishing a relationship between the owner, house and/or building and the cosmic order.

In the arena of ancient temple construction, there is ample evidence of extensive application of Sthapatya Veda's design principles. In addition to the spiritual activities at these temples, there are precise mathematical and astrological calculations, proportions of building plan, specific orientation and the applied knowledge of subtle physical properties which produces this feeling of well being.

The ancient Indians firmly believed that the universe is in perfect order since its birth. If an architect can establish a good

Indian Astrology

relationship between building design and order of universe, the life of an individual can be healthier, devoid of stress, creative and blissful. Sthapatya Veda was born out of the fusion of two branches of Veda; Ayur Veda and Jyotish Shastra. AyurVeda is the science of health and the longevity of the human body, while Jyotish Shastra encompasses knowledge of man's relationship to the universe, and the fluctuating effects which tthehe universe exerts on man. Thus Sthapatya Veda encompasses the needs of the human body and the environment in one holistic science.

Indian Vastu Shastra
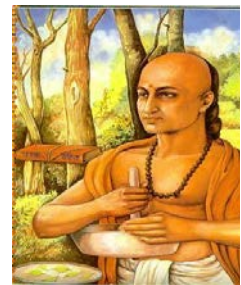
Ayurveda and Environment

Ayurveda is an upaveda (subsection) of Atharva, the fourth Veda composed during the period 3,000 to 2,000 BC. Ayurveda has several disciplines v.i.z Kayachikitsa (Internal Medicine), Shalakya Tantra (thoracic surgery, opthalmology and otolaryngology), Shalya Tantra (Surgery), Agada Tantra (Toxicology), Bhuta Vidya (Psychiatry), Kaumarabhritya (Pediatrics), Rasayana (rejuvenation or anti-aging), Vajikarana (the science of fertility).
The most fascinating aspect of Ayurvedic system of medicine was the diversified method of treatment and cure — yoga (meditation),aromatherapy, use of gems, precious stones and amulets, herbs, diet, jyotish (astrology), color and surgery. It is amply evident that each of these methods of treatment had a direct connection with nature i.e the eco-system around us. The use of synthetics and chemicals (a part of Allopathy) was conspicuous by its absence.
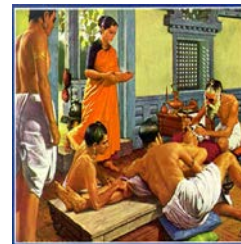
Though Ayurveda came into being as a part of Atharva Veda, it has close links with other Vedas also. For instance the Yajur Veda, which lays down elaborate rituals to pacify the panchabhutas (the five basic elements of nature) for the purpose of healing both the Cosmic Being as well as the individual soul, is related to ayurveda in its principles and regulations of lifestyle. Additionally, another upaveda, the Dhanur Veda (related to warfare and the martial arts) and Ayurveda both lay emphasis on the marmas (sensitive points in the body) — a precursor of accupressure and acupuncture perhaps!!!

The famous physician, Charaka

Dhanvantari, believed to be a reincarnation of Lord Vishnu, was the guiding spirit of Ayurveda. He made this science of health and longevity popular and widely prevalent. Two major Samhitas (treatises) were written in the early part of 1000 BC. The great physician Charaka authored Charaka Samhita which has remained a landmark of internal medicine till date. The famous surgeon Susruta, wrote Susruta Samhita, a vast treasure house of knowledge about surgery to replace limbs, cosmetic surgery, caesarian operations and even brain surgery. He is famed for his innovation of cosmetic surgery on the nose (rhinoplasty).

Ayurveda's relevance in the present age lies in its, subtle, scientific, and holistic approach to the cure and treatment of a disease. It aims at healing not only the body, but also the mind and spirit. Its understanding of the similarities of the laws of nature and the functioning of the human body helps to strike a balance between Man and Nature.


The famous surgeon,Sushruta

Environment and Aesthetics

In ancient India, a man's life was assumed to be of a 100 years; it was sub-divided into four stages, each comprising 25 years — Brahmacharya (celibacy) Garhastya (householder) Vanprastha (gradual detachment) and Sanyasa (renunciation of the world)

During the first phase, the main task of an individual was acquiring of education and other useful skills. Those days there were no schools, colleges or universities; composite education on diverse subjects was imparted by learned men and scholars who were hailed as Acharyas and Gurus. The Guru was a father figure, a guardian, an advisor, a counsellor and a confidante. In this connection it was mandatory for a young male to spend a number of years in what was known as a gurukula. This was some kind of a residential college.

The students lived with the guru's family members, each performing a specific set of chores, apart from imbibing education and ideology. These gurukulas or ashrams were located far away from cities towns and villages.

Since they lived in a natural environment, the students as well as their gurus were concerned about its preservation. They protected trees and worshipped them as Vriksha Devta (tree god), the forest covers as Van Devta (forest god) and the rivers as sources of delicious life-giving water. The ancient people cared for wildlife too. Terms and titles such as Nag Devta (snake god), Kamdhenu (the cow that fulfills your desires) and Kalpavriksha (the wish –fulfilling tree) symbolized the benefits that accrued to human beings from nature and their respect for wildlife. Thus pantheism or animism, by whatever name we may call it, eventually pointed to ecological balance and conservation of nature.
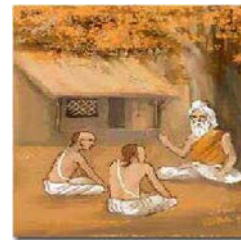
An Ashram of ancient India

It would be interesting to note that compassion and reverence for life are among the basic tents of Jainism. The term Ahimsa (a = non, himsa = violence), is rooted in positive aims and actions which are directly related to environmental issues. Ahimsa ought to be practised not only towards human beings, but towards all living creatures including plants. By not killing or destroying plants or animals one can help to maintain the ecological balance.

Democracy In Vedic Society

.

In a nomadic society, the State is not a territorial entity, but a flexible one - lacking a physical status but ultimately very cohesive. Shifting settlements meant a shifting State. Kings, for instance, ruled over tribes, and Vedic literature of the period refers to rulers of individual tribes such as the *Kurus*, the *Pañcälas*, the *Yadus*, and the *Turvasas*. Nowhere are these rulers described as regional monarchs nor their kingdoms defined in terms other than tribal.

With the previously nomadic State metamorphosing into a clearly bounded, physical entity, the agricultural communities too became a reality.

The political structure was, naturally enough, a Monarchy - republics or oligarchies were rare. The Vedas offer an appropriate origin for this form of government: the continuously vanquished *Devas* concluded that only the presence of a suitable leader could assure them of victory against the *Asuras*. Lord Indra was thus annointed King of the *Devas* and he led the exultant gods to victory. The choice was based on Lord Indra's military might and on a subsequent occasion, this stood challenged and defeated by Lord *Varuna* who proved himself mightier than the mighty!

Clearly, the need for a stable, established kingship was neccessitated by the fact of war against the non-Aryans, and became an

important concept in Aryan/Vedic society. War notwithstanding, the roots of kingship are clearly traceable to the patriarchal social system already in existence among the Vedic peoples. Within the family structure (*kul*), these individuals were accustomed to the presence of, and deference to, a family head, the *kulapati* (or *patriarch*). Several *kulas* comprised a vis, dominated by a *vispati*; several visas combined into a *jana*, ruled by a *janapati*. These gradations were not unlike the gens, curiae and tribes of the ancient Romans.

WAS KINGSHIP ELECTIVE?

It remains easy to understand the concept and selection of a *Kulapati* - he was the family *patriarch*; the selection of a *vispati* and *janapati* remains speculative. Assumably, the seniormost *kulpati* was accorded the honour of being the vispati. Similarly, the choice of *janapati* was possibly based on like consideration. Kings (*janapatis*) were elected on occasion by the *visas* (people), as we know from the
Rig-Veda. The Atharva-Veda recommends this form of selection, although it was in all probability the *vispatis* rather than the general populace who formed the electorate. This text contains, too, the assuring 'Let your enemies challenge you, we have elected you' message from the people to their King. He was generally more feared than loved, elections a rare occurrence, and kingship more often than not hereditary . The Vedic period witnessed, for instance, hereditary kingship over four generations of the *Purus* and ten generations of the *Srnjayas*.

The Vedic kingdom could not have been larger than the city-state of ancient Greece. This was to change during the later Vedic period and the *Brahmanas* testify to the concept of an empire 'from the Himalayas to the seas'. References have also been made to the exalted political status of samrat (or emperor) and the *rajasuya* and *asvamedha* sacrifices. Titles such as *raja*, *maharaja*, *svarat*, *bhoja*, and *samrat* are indicative of the different levels of power and status attributed to and wielded by Kings. These differences, although not clearly stipulated, are referred to in later
Vedic literature.

KING'S POWER

Initially, the elected monarch was a 'first among equals' (as was the Homeric king) - he accepted his elected post but could not ipso facto demand taxes. Voluntary payments and gifts were the norm. His power remained restricted, and tellingly enough, a poet is depicted as offering prayers on the King's

behalf - for the receipt of regular taxes from the people! This changed with the gradual increase in monarchial power, signalled by court grandeur, land ownership and the possession of cattle herds. This, together with his existent command of the military force, led to a position of absolute strength. Religion was never far behind - religious duties were the domain of the royal *purohit* (priest) who was vital to the continuing prosperity of realm and ruler. The King, like the *pharoahs* of Egypt, performed no religious ceremonies himself.

Powers of Samiti or Parliament

.

The King remained absolute ruler but with the increase in power came the necessary restrictions. The *Samiti* (Parliament) was the most powerful of the assemblies and the coronation ceremony came to include the prayer that the wishes of the *Samiti* be in sync with those of the newly annointed ruler. Likewise, a horrific curse from a Brahman to an unjust King would be that of a disagreeable *Samiti*! Vedic texts do not provide any clear information on the election, constitution and full powers of the Samiti or the other two assemblies. These were the *Vidatha* i.e. probably, assembly of scholars and the *Sabha* i.e. probably, assembly of villagers.

War & peace, and justice were the chief duties of the King, although the first two were undoubtedly his exclusive prerogative. His military might was the means to maintaining peace and warding off aggression, and the *epithet dhrtavrata* demonstrates the additional requirement of establishing moral order. Whilst cases were tried by the village courts, the monarch remained the supreme judge of the land.

Kings Divinity

.   ### Ratnins or King's Councillors

The exaltation of the monarch from mortal to divine was arguably the result of needing to explain the power accorded to one individual. Only in the later *Samhitas* is the office of King imbued with divinity : the ruler as the earthly representative of Lord *Prajapati*, the god *Savitr* the chief witness at the coronation (the coronation believed to be at his request), and Lord *Indra's* power manifesting in the King! Early Vedic writings do not exalt

the King thus. On one occasion, King *Purukutsa* is referred to as ardha-deva (demi-god) because according to popular legend, he was gifted to his widowed mother by the Lords *Indra* and *Varuna*. In another instance, the *Atharva-Veda* speaks of King *Parikshit* as a divinity on earth, but this can be seen in the light of subjectivity. These are rare instances - Kings are described and praised, but not deified.

RATNINS OR KING'S COUNCILLORS

A council of able councillors assisted in the administrative and military duties of the King. Later Vedic texts refer to these individuals as ratnins and their council is the predecessor to the council of ministers of a later date. Comprising this selective circle were the *senani* (commander-in-chief), *purohit* (priest), *sangrahitr* (treasurer), *suta* (charioteer), *bhagadhuk* (tax-collector), *gramani* (village head), *ksattr* (chamberlain), *aksavapa* (game companion), and amazingly, the *mahisi* (the crowned queen).

A small kingdom required no provincial or district government; the village head (*gramani*) and his *Sabha* (village assembly) were well-equipped to administer to all defence and legal needs at the village level. There was no concerted effort at writing, thereby precluding the existence of a Secretariat.

Republics

.

The rare instance of a State without a King meant that the state was a republic - where the population was both ruler and ruled. The *Aitreya Brahmana* refers to *vi-rat* (Kingless States) across the Himalayas, and there are also references to the republican States of *Uttarakurus* and *Uttaramadras*.

Oligarchies were more common - other rulers selecting the King (as in *vispatis* and *kulapatis* electing the *janapati*) or other Kings selecting the one to be King. One Vedic passage is adamant in its espousal of this last. The repeated selection of individuals from a specific family,

continuing through generations, heralded hereditary kingship.

The Vedic age can be assessed through the limited material available. One fact clearly emerges from the remnants of history - political sophistication meant, too, the advance of social and artistic factors.

Vedic Science

द्वीपेषु तेषु वर्षाणि चत्वारिंशत्तथैव च । तावन्तः पर्वताश्चैव पर्यान्ते
द्वीपाः समुद्राश्च अन्योन्यस्य तु मण्डलम् । सन्निकृष्टाः स्वभागेन समावृत्य
निर्म्मेमे ब्रह्मा स्थानानीमानि सर्वशः ॥ १६ ॥ कलपस्य चैय ब्रह्मा वै
॥ १७ ॥ स्वर्गं दिशः समुद्राश्च नदीः सर्वाश्च पर्वताः । ओषधीनां

Sanskrit & Artificial Intelligence – NASA
Knowledge Representation in Sanskrit and Artificial Intelligence

by
Rick Briggs
Roacs, NASA Ames Research Center, Moffet Field, California

Abstract

In the past twenty years, much time, effort, and money has been expended on designing an unambiguous representation
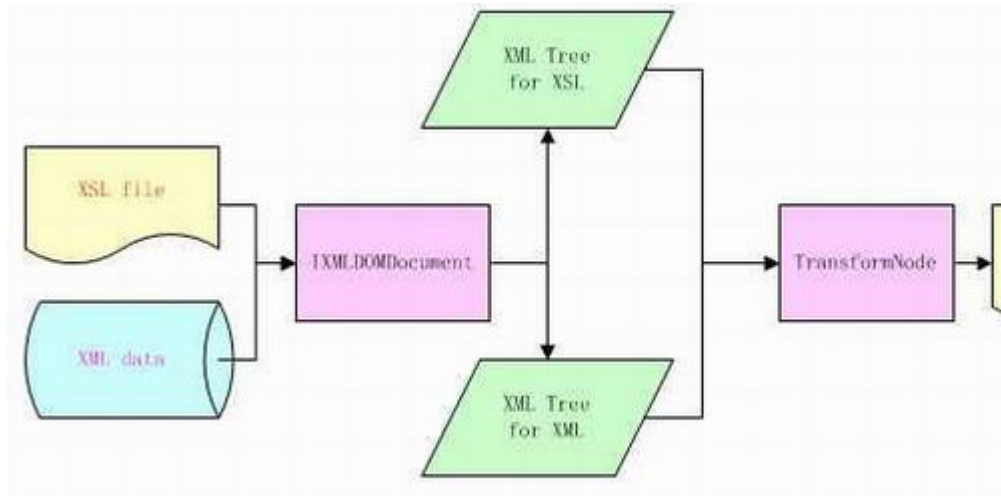
of natural languages to make them accessible to computer processing. These efforts have centered around creating schemata designed to parallel logical relations with relations expressed by the syntax and semantics of natural languages, which are clearly cumbersome and ambiguous in their function as vehicles for the transmission of logical data. Understandably, there is a widespread belief that natural languages are unsuitable for the transmission of many ideas that artificial languages can render with great precision and mathematical rigor.

But this dichotomy, which has served as a premise underlying much work in the areas of linguistics and artificial intelligence, is a false one. There is at least one language, Sanskrit, which for the duration of almost 1,000 years was a living spoken language with a considerable literature of its own. Besides works of literary value, there was a long philosophical and grammatical tradition that has continued to exist with undiminished vigor until the present century. Among the accomplishments of the grammarians can be reckoned a method for paraphrasing Sanskrit in a manner that is identical not only in essence but in form with current work in Artificial Intelligence. This article demonstrates that a natural language can serve as an artificial language also, and that much work in AI has been reinventing a wheel millenia old.

First, a typical Knowledge Representation Scheme (using Semantic Nets) will be laid out, followed by an outline of the method used by the ancient Indian Grammarians to analyze sentences unambiguously. Finally, the clear parallelism between the two will be demonstrated, and the theoretical implications of this equivalence will be given.

Semantic Nets

For the sake of comparison, a brief overview of semantic nets will be given, and examples will be included that will be compared to the Indian approach. After early attempts at machine translation (which were based to a large extent on simple dictionary look up) failed in their effort to teach a computer to understand natural language, work in AI turned to Knowledge Representation.

Since translation is not simply a map from lexical item to lexical item, and since ambiguity is inherent in a large number of utterances, some means is required to encode what the actual meaning of a sentence is. Clearly, there must be a representation of meaning independent of words used. Another problem is the interference of syntax. In some

sentences (for example active/passive) syntax is, for all intents and purposes, independent of meaning. Here one would like to eliminate considerations of syntax. In other sentences the syntax contributes to the meaning and here one wishes to extract it.

बाल पठति . बाला लिखति .
Boy   reads   Girl   writes

स चलति . सा खेलति .
He   walks   She   plays

राम शाम च वदतः . तौ वदतः .
Ram   and   Sham   speak   They   speak

I will consider a "prototypical" semantic net system similar to that of Lindsay, Norman, and Rumelhart in the hopes that it is fairly representative of basic semantic net theory. Taking a simple example first, one would represent "John gave the ball to Mary" as in Figure 1. Here five nodes connected by four labeled arcs capture the entire meaning of the sentence. This information can be stored as a series of "triples":

give, agent, John

give, object, ball

give, recipient, Mary

give, time, past.

Note that grammatical information has been transformed into an arc and a node (past tense). A more complicated example will illustrate embedded sentences and changes of state:

John Mary

book past

Figure 1.

"John told Mary that the train moved out of the station at 3 o'clock."

As shown in Figure 2, there was a change in state in which the train moved to some unspecified location from the station. It went to the former at 3:00 and from the latter at 3:00. Now one can routinely convert the net to triples as before.

The verb is given central significance in this scheme and is considered the focus and distinguishing aspect of the sentence. However, there are other sentence types which differ fundamentally from the above examples. Figure 3 illustrates a sentence that is one of "state" rather than of "event ." Other nets could represent statements of time, location or more complicated structures.

A verb, say, "give," has been taken as primitive, but what is the meaning of "give" itself? Is it only definable in terms of the structure it generates? Clearly two verbs can generate the same structure. One can take a set-theoretic approach and a particular give as an element of "giving events" itself a subset of ALL-EVENTS. An example of this approach is given in Figure 4 ("John, a programmer living at Maple St., gives a book to Mary, who is a lawyer"). If one were to "read" this semantic net, one would have a very long text of awkward English: "There is a John" who is an element of the "Persons" set and who is the person who lives at ADRI, where ADRI is a subset

of ADDRESS-EVENTS, itself a subset of 'ALL EVENTS', and has location '37 Maple St.', an element of Addresses; and who is a "worker" of 'occupation 1'. . .etc."

The degree to which a semantic net (or any unambiguous, nonsyntactic representation) is cumbersome and odd-sounding in a natural language is the degree to which that language is "natural" and deviates from the precise or "artificial." As we shall see, there was a language spoken among an ancient scientific community that has a deviation of zero.

The hierarchical structure of the above net and the explicit descriptions of set-relations are essential to really capture the meaning of the sentence and to facilitate inference. It is believed by most in the AI and general linguistic community that natural languages do not make such seemingly trivial hierarchies explicit. Below is a description of a natural language, Shastric Sanskrit, where for the past millenia successful attempts have been made to encode such information.

Shastric Sanskrit

The sentence:

(1) "Caitra goes to the village." (graamam gacchati caitra)

receives in the analysis given by an eighteenth-century Sanskrit Grammarian from Maharashtra, India, the following paraphrase:

(2) "There is an activity which leads to a connection-activity which has as Agent no one other than Caitra, specified by singularity, [which] is taking place in the present and which has as Object something not different from 'village'."

The author, Nagesha, is one of a group of three or four prominent theoreticians who stand at the end of a long tradition of investigation. Its beginnings date to the middle of the first millennium B.C. when the morphology and phonological structure of the language, as well as the framework for its syntactic description were codified by Panini. His successors elucidated the brief, algebraic formulations that he had used as grammatical rules and where possible tried to improve upon them. A great deal of fervent grammatical research took place between the fourth century B.C and the fourth century A.D. and culminated in the seminal work, the Vaiakyapadiya by Bhartrhari. Little was done subsequently to advance the study of syntax, until the so-called "New Grammarian" school appeared in the early part of the sixteenth century with the publication of Bhattoji Dikshita's Vaiyakarana-bhusanasara and its commentary by his relative Kaundabhatta, who worked from Benares. Nagesha (1730-1810) was responsible for a major work, the Vaiyakaranasiddhantamanjusa, or Treasury of dejinitive statements of grammarians, which was condensed later into the earlier described work. These books have not yet been translated.

The reasoning of these authors is couched in a style of language that had been developed especially to formulate logical relations with scientific precision. It is a terse, very condensed form of Sanskrit, which paradoxically at times

becomes so abstruse that a commentary is necessary to clarify it.

One of the main differences between the Indian approach to language analysis and that of most of the current linguistic theories is that the analysis of the sentence was not based on a noun-phrase model with its attending binary parsing technique but instead on a conception that viewed the sentence as springing from the semantic message that the speaker wished to convey. In its origins, sentence description was phrased in terms of a generative model: From a number of primitive syntactic categories (verbal action, agents, object, etc.) the structure of the sentence was derived so that every word of a sentence could be referred back to the syntactic input categories. Secondarily and at a later period in history, the model was reversed to establish a method for analytical descriptions. In the analysis of the Indian grammarians, every sentence expresses an action that is conveyed both by the verb and by a set of "auxiliaries." The verbal action (Icriyu- "action" or sadhyu-"that which is to be accomplished,") is represented by the verbal root of the verb form; the "auxiliary activities" by the nominals (nouns, adjectives, indeclinables) and their case endings (one of six).

The meaning of the verb is said to be both vyapara (action, activity, cause), and phulu (fruit, result, effect). Syntactically, its meaning is invariably linked with the meaning of the verb "to do". Therefore, in order to discover the meaning of any verb it is sufficient to answer the question: "What does he do?" The answer would yield a phrase in which the meaning of the direct object corresponds to the verbal meaning. For example, "he goes" would yield the paraphrase: "He performs

an act of going"; "he drinks": "he performs an act of drinking," etc. This procedure allows us to rephrase the sentence in terms of the verb "to do" or one of its synonyms, and an object formed from the verbal root which expresses the verbal action as an action noun. It still leaves us with a verb form ("he does," "he performs"), which contains unanalyzed semantic information This information in Sanskrit is indicated by the fact that there is an agent who is engaged in an act of going, or drinking, and that the action is taking place in the present time.

Rather that allow the agent to relate to the syntax in this complex, unsystematic fashion, the agent is viewed as a one-time representative, or instantiation of a larger category of "Agency," which is operative in Sanskrit sentences. In turn, "Agency" is a member of a larger class of "auxiliary activities," which will be discussed presently. Thus Caitra is some Caitral or instance of Caitras, and agency is hierarchically related to the auxiliary activities. The fact that in this specific instance the agent is a third person-singular is solved as follows: The number category (singular, dual, or plural) is regarded as a quality of the Agent and the person category (first, second, or third) as a grammatical category to be retrieved from a search list, where its place is determined by the singularity of the agent.

The next step in the process of isolating the verbal meaning is to rephrase the description in such a way that the agent and number categories appear as qualities of the verbal action. This procedure leaves us with an accurate, but quite abstract formulation of the scntcnce: (3) "Caitra is going" (gacchati caitra) - "An act of going is taking place in the present of

which the agent is no one other than Caitra qualified by singularity." (atraikatvaavacchinnacaitraabinnakartrko vartamaanakaa- liko gamanaanukuulo vyaapaarah:) (Double vowels indicate length.)

If the sentence contains, besides an agent, a direct object, an indirect object and/or other nominals that are dependent on the principal action of the verb, then in the Indian system these nominals are in turn viewed as representations of actions that contribute to the complete meaning of the sentence. However, it is not sufficient to state, for instance, that a word with a dative case represents the "recipient" of the verbal action, for the relation between the recipient and the verbal action itself requires more exact specification if we are to center the sentence description around the notion of the verbal action. To that end, the action described by the sentence is not regarded as an indivisible unit, but one that allows further subdivisions. Hence a sentence such as: (4) "John gave the ball to Mary" involves the verb Yo give," which is viewed as a verbal action composed of a number of auxiliary activities. Among these would be John's holding the ball in his hand, the movement of the hand holding the ball from John as a starting point toward Mary's hand as the goal, the seizing of the ball by Mary's hand, etc. It is a fundamental notion that actions themselves cannot be perceived, but the result of the action is observable, viz. the movement of the hand. In this instance we can infer that at least two actions have taken place:

(a) An act of movement starting from the direction of John and taking place in the direction of Mary's hand. Its Agent is "the ball" and its result is a union with Mary's hand.

(b) An act of receiving, which consists of an act of grasping whose agent is Mary's hand.

It is obvious that the act of receiving can be interpreted as an action involving a union with Mary's hand, an enveloping of the ball by Mary's hand, etc., so that in theory it might be difficult to decide where to stop this process of splitting meanings, or what the semantic primitives are. That the Indians were aware of the problem is evident from the following passage: "The name 'action' cannot be applied to the solitary point reached by extreme subdivision."

The set of actions described in (a) and (b) can be viewed as actions that contribute to the meaning of the total sentence, vix. the fact that the ball is transferred from John to Mary. In this sense they are "auxiliary actions" (Sanskrit kuruku- literally "that which brings about") that may be isolated as complete actions in their own right for possible further subdivision, but in this particular context are subordinate to the total action of "giving." These "auxiliary activities" when they become thus subordinated to the main sentence meaning, are represented by case endings affixed to nominals corresponding to the agents of the original auxiliary activity. The Sanskrit language has seven case endings (excluding the vocative), and six of these are definable representations of specific "auxiliary activities." The seventh, the genitive, represents a set of auxiliary activities that are not defined by the other six. The auxiliary actions are listed as a group of six: Agent, Object, Instrument, Recipient, Point of Departure, Locality. They are the semantic correspondents of the syntactic case endings: nominative, accusative, instrumental, dative, ablative and locative, but these are not in exact

equivalence since the same syntactic structure can represent different semantic messages, as will be discussed below. There is a good deal of overlap between the karakas and the case endings, and a few of them, such as Point of Departure, also are used for syntactic information, in this case "because of". In many instances the relation is best characterized as that of the allo-eme variety.

To illustrate the operation of this model of description, a sentence involving an act of cooking rice is often quoted: (5) "Out of friendship, Maitra cooks rice for Devadatta in a pot, over a fire."

Here the total process of cooking is rendered by the verb form "cooks" as well as a number of auxiliary actions:

1. An Agent represented by the person Maitra

2. An Object by the "rice"

3. An Instrument by the "fire"

4. A Recipient by the person Devadatta

5. A Point of Departure (which includes the causal relationship) by the "friendship" (which is between Maitra and Devadatta)

6. The Locality by the "pot"

So the total meaning of the sentence is not complete without the intercession of six auxiliary actions. The action itself can be inferred from a change of the condition of the grains of rice, which started out being hard and ended up being soft.

Again, it would be possible to atomize the meaning expressed by the phrase: "to cook rice": It is an operation that is not a unitary "process", but a combination of processes, such as "to place a pot on the fire, to add fuel to the fire, to fan", etc. These processes, moreover, are not taking place in the abstract, but they are tied to, or "resting on" agencies that are associated with the processes. The word used for "tied to" is a form of the verbal root a-sri, which means to lie on, have recourse to, be situated on." Hence it is possible and usually necessary to paraphrase a sentence such as "he gives" as: "an act of giving residing in him." Hence the paraphrase of sentence (5) will be: (6) "There is an activity conducive to a softening which is a change residing in something not different from rice, and which takes place in the present, and resides in an agent not different from Maitra, who is specified by singularity and has a Recipient not different from Devadatta, an Instrument not different from.. .," etc.

It should be pointed out that these Sanskrit Grammatical Scientists actually wrote and talked this way. The domain for this type of language was the equivalent of today's technical journals. In their ancient journals and in verbal communication with each other they used this specific, unambiguous form of Sanskrit in a remarkably concise way.

Besides the verbal root, all verbs have certain suffixes that express the tense and/or mode, the person (s) engaged in the "action" and the number of persons or items so engaged. For example, the use of passive voice would necessitate using an Agent with an instrumental suffix, whereas the nonpassive voice implies that the agent of the sentence, if represented by a noun or pronoun, will be marked by a nominative singular

suffix.

Word order in Sanskrit has usually no more than stylistic significance, and the Sanskrit theoreticians paid no more than scant attention to it. The language is then very suited to an approach that eliminates syntax and produces basically a list of semantic messages associated with the karakas.

An example of the operation of this model on an intransitive sentence is the following:

(7) Because of the wind, a leaf falls from a tree to the ground."

Here the wind is instrumental in bringing about an operation that results in a leaf being disunited from a tree and being united with the ground. By virtue of functioning as instrument of the operation, the term "wind" qualifies as a representative of the auxiliary activity "Instrument"; by virtue of functioning as the place from which the operation commences, the "tree" qualifies to be called "The Point of Departure"; by virtue of the fact that it is the place where the leaf ends up, the "ground" receives the designation "Locality". In the example, the word "leaf" serves only to further specify the agent that is already specified by the nonpassive verb in the form of a personal suffix. In the language it is rendered as a nominative case suffix. In passive sentences other statements have to be made. One may argue that the above phrase does not differ in meaning from "The wind blows a leaf from the tree," in which the "wind" appears in the Agent slot, the "leaf" in the Object slot. The truth is that this phrase is transitive, whereas the earlier one is intransitive. "Transitivity" can be viewed as an additional feature added to the verb. In Sanskrit this

process is often accomplished by a suffix, the causative suffix, which when added to the verbal root would change the meaning as follows: "The wind causes the leaf to fall from the tree," and since English has the word "blows" as the equivalent of "causes to fall" in the case of an Instrument "wind," the relation is not quite transparent. Therefore, the analysis of the sentence presented earlier, in spite of its manifest awkwardness, enabled the Indian theoreticians to introduce a clarity into their speculations on language that was theretofore un- available. Structures that appeared radically different at first sight become transparent transforms of a basic set of elementary semantic categories.

It is by no means the case that these analyses have been exhausted, or that their potential has been exploited to the full. On the contrary, it would seem that detailed analyses of sentences and discourse units had just received a great impetus from Nagesha, when history intervened: The British conquered India and brought with them new and apparently effective means for studying and analyzing languages. The subsequent introduction of Western methods of language analysis, including such areas of research as historical and structural linguistics, and lately generative linguistics, has for a long time acted as an impediment to further research along the traditional ways. Lately, however, serious and responsible research into Indian semantics has been resumed, especially at the University of Poona, India. The surprising equivalence of the Indian analysis to the techniques used in applications of Artificial Intelligence will be discussed in the next section.

Equivalence

A comparison of the theories discussed in the first section with

the Indian theories of sentence analysis in the second section shows at once a few striking similarities. Both theories take extreme care to define minute details with which a language describes the relations between events in the natural world. In both instances, the analysis itself is a map of the relations between events in the universe described. In the case of the computer-oriented analysis, this mapping is a necessary prerequisite for making the speaker's natural language digestible for the artificial processor; in the case of Sanskrit, the motivation is more elusive and probably has to do with an age-old Indo-Aryan preoccupation to discover the nature of the reality behind the the impressions we human beings receive through the operation of our sense organs. Be it as it may, it is a matter of surprise to discover that the outcome of both trends of thinking-so removed in time, space, and culture-have arrived at a representation of linguistic events that is not only theoretically equivalent but close in form as well. The one superficial difference is that the Indian tradition was on the whole, unfamiliar with the facility of diagrammatic representation, and attempted instead to formulate all abstract notions in grammatical sentences. In the following paragraphs a number of the parallellisms of the two analyses will be pointed out to illustrate the equivalence of the two systems.

Consider the sentence: "John is going." The Sanskrit paraphrase would be

"An Act of going is taking place in which the Agent is 'John' specified by singularity and masculinity."

If we now turn to the analysis in semantic nets, the event

portrayed by a set of triples is the following:

1. "going events, instance, go (this specific going event)"

2. "go, agent, John"

3. "go, time, present."

The first equivalence to be observed is that the basic framework for inference is the same. John must be a semantic primitive, or it must have a dictionary entry, or it must be further represented (i.e. "John, number, 1" etc.) if further processing requires more detail (e.g. "HOW many people are going?"). Similarly, in the Indian analysis, the detail required in one case is not necessarily required in another case, although it can be produced on demand (if needed). The point to be made is that in both systems, an extensive degree of specification is crucial in understanding the real meaning of the sentence to the extent that it will allow inferences to be made about the facts not explicitly stated in the sentence

बाल पठति . बाला लिखति
Boy   reads   Girl   writes

स चलति . सा खेलति
He   walks   She   plays

राम शाम च वदतः . तौ वदतः .
Ram and Sham   speak   They   speak

The basic crux of the equivalence can be illustrated by a careful look at sentence (5) noted in Part II.

"Out of friendship, Maitra cooks rice for Devadatta in a pot over a fire "

The semantic net is supplied in Figure 5. The triples

corresponding to the net are:

cause, event, friendship

friendship, objectl, Devadatta

friendship, object2, Maitra

cause, result cook

cook, agent, Maitra

cook, recipient, Devadatta

cook, instrument, fire

cook, object, rice

cook, on-lot, pot.

The sentence in the Indian analysis is rendered as follows:

The Agent is represented by Maitra, the Object by "rice," the Instrument by "fire," the Recipient by "Devadatta," the Point of Departure (or cause) by "friendship" (between Maitra and Devadatta), the Locality by "pot."

Since all of these syntactic structures represent actions auxiliary to the action "cook," let us write %ook" uext to each karakn and its sentence representat(ion:

cook, agent, Maitra

cook, object, rice

cook, instrument, fire

cook, recipient, Devadatta

cook, because-of, friendship

friendship, Maitra, Devadatta

cook, locality, pot.

The comparison of the analyses shows that the Sanskrit sentence when rendered into triples matches the analysis arrived at through the application of computer processing. That is surprising, because the form of the Sanskrit sentence is radically different from that of the English. For comparison, the Sanskrit sentence is given here: Maitrah: sauhardyat Devadattaya odanam ghate agnina pacati.

Here the stem forms of the nouns are: Maitra-sauhardya- "friendship," Devadatta -, odana- "gruel," ghatu- "pot," agni- "fire' and the verb stem is paca- "cook". The deviations of the stem forms occuring at the end of each word represent the change dictated by the word's semantic and syntactic position. It should also be noted that the Indian analysis calls for the specification of even a greater amount of grammatical and semantic detail: Maitra, Devadatta, the pot, and fire would all be said to be qualified by "singularity" and "masculinity" and the act of cooking can optionally be expanded into a number of successive perceivable activities. Also note that the phrase "over a fire" on the face of it sounds like a locative of the same form as "in a pot." However, the context indicates that the prepositional phrase describes the instrument through which the heating of the rice takes place and, therefore, is best regarded as an instrument semantically. cause

Of course, many versions of semantic nets have been proposed, some of which match the Indian system better than others do in terms of specific concepts and structure. The important point is that the same ideas are present in both traditions and that in the case of many proposed semantic net systems it is the Indian analysis which is more specific.

A third important similarity between the two treatments of the sentence is its focal point which in both cases is the verb. The Sanskrit here is more specific by rendering the activity as a "going-event", rather than "ongoing." This procedure introduces a new necessary level of abstraction, for in order to keep the analysis properly structured, the focal point ought to be phrased: "there is an event taking place which is one of cooking," rather than "there is cooking taking place", in order for the computer to distinguish between the levels of unspecified "doing" (vyapara) and the result of the doing (phala).

A further similarity between the two systems is the striving for unambiguity. Both Indian and AI schools en-code in a very clear, often apparently redundant way, in order to make the analysis accessible to inference. Thus, by using the distinction of phala and vyapara, individual processes are separated into components which in term are decomposable. For example, "to cook rice" was broken down as "placing a pot on the fire, adding fuel, fanning, etc." Cooking rice also implies a change of state, realized by the phala, which is the heated softened rice. Such specifications are necessary to make logical pathways, which otherwise would remain unclear. For example, take the following sentence:

"Maitra cooked rice for Devadatta who burned his mouth while eating it."

The semantic nets used earlier do not give any information about the logical connection between the two clauses. In order to fully understand the sentence, one has to be able to make the inference that the cooking process involves the process of "heating" and the process of "making palatable." The Sanskrit grammarians bridged the logical gap by the employment of the phalu/ vyapara distinction. Semantic nets could accomplish the same in a variety of ways:

1. by mapping "cooking" as a change of state, which would involve an excessive amount of detail with too much compulsory inference;

2. by representing the whole statement as a cause (event-result), or

3. by including dictionary information about cooking. A further comparison between the Indian system and the theory of semantic nets points to another similarity: The passive and the active transforms of the same sentence are given the same analysis in both systems. In the Indian system the notion of the "intention of the speaker" (tatparya, vivaksa) is adduced as a cause for distinguishing the two transforms semantically. The passive construction is said to emphasize the object, the nonpassive emphasizes the agent. But the explicit triples are not different. This observation indicates that both systems extract the meaning from the syntax.

Finally, a point worth noting is the Indian analysis of the intransitive phrase (7) describing the leaf falling from the tree. The semantic net analysis resembles the Sanskrit analysis remarkably, but the latter has an interesting flavor. Instead of a change from one location to another, as the semantic net analysis prescribes, the Indian system views the process as a uniting and disuniting of an agent. This process is equivalent to the concept of addition to and deletion from sets. A leaf falling to the ground can be viewed as a leaf disuniting from the set of leaves still attached to the tree followed by a uniting with (addition to) the set of leaves already on the ground. This theory is very useful and necessary to formulate changes or statements of state, such as "The hill is in the valley."

In the Indian system, inference is very complete indeed. There is the notion that in an event of "moving", there is, at each instant, a disunion with a preceding point (the source, the initial state), and a union with the following point, toward the destination, the final state. This calculus-like concept

fascillitates inference. If it is stated that a process occurred, then a language processor could answer queries about the state of the world at any point during the execution of the process.

As has been shown, the main point in which the two lines of thought have converged is that the decomposition of each prose sentence into karalca-representations of action and focal verbal-action, yields the same set of triples as those which result from the decomposition of a semantic net into nodes, arcs, and labels. It is interesting to speculate as to why the Indians found it worthwhile to pursue studies into unambiguous coding of natural language into semantic elements. It is tempting to think of them as computer scientists without the hardware, but a possible explanation is that a search for clear, unambigous understanding is inherent in the human being.

Let us not forget that among the great accomplishments of the Indian thinkers were the invention of zero, and of the binary number system a thousand years before the West re-invented them.

$$
\begin{array}{r}
10 \\
+9 \\
\hline
19
\end{array}
\qquad
\begin{array}{r}
400 \\
\times 10 \\
\hline
4{,}000 = 4 \times 10^3
\end{array}
$$

(tat) savitur varenyam

sa light	vi light	tur heavy	va light	ren heavy	yam light	
1	1	0	1	0	1	num val
1	2	4	8	16	32	binary
1	2	0	8	0	32	product
					43	decimal value
					44	rank value

Their analysis of language casts doubt on the humanistic distinction between natural and artificial intelligence, and may throw light on how research in AI may finally solve the natural language understanding and machine translation problems.

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