sandhi

A Journal of Science and Heritage Initiatives

भारतीय प्रौद्योगिकी संस्थान खड़गपुर

INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR

www.iitkgpsandhi.org

Theme of logo & cover page

In mythology, the Mayan calendar depicts the four quadrants of truth.

The cardinals represent a year bound time-movement of the sun-god.

In ancient Hermeneutics, the four Vedas are located at four corners or placements (Char-dham) having four cyclic principles namely Agni or the ascending outpouring fire or tapas (Rig Veda); Vayuor the psychic power-movement (Yadju Veda);Surya or the convergence of rays as core knowledge (Sama Veda); and Soma or the descending and inpouring ambrosia which is siddhi (Atharva Veda).It is the basis of cosmic thermodynamics as embedded in the 'Secret of the Vedas'.

The four quadrants are the locations of four Buddha(s) (Kala-chakra-yana). They stand for all-round judgment in the Asokan pillar.

In Chinese iconography or I-Ching, the cruciform stands for 'spring and autumn' i.e.,death and resurrection. The ancient quadrant of Pasargadae in Persia became the Garden of Eden in Semitic faiths – the eternal Paradise. It is called Char-Bagh.

In pattern-recognition and shape grammar, the two regulating lines embedded in the calendar as diagonals are the two Karna-sutras. The crossing of the two oars (ears) stands for conjoint-complementarities of construction and deconstruction in visual semiotics and sensory semantics.

In Cosmogony, it is a yearly cycle of the mortals (Samvatsara) or it can expand to be a Mandala, reflecting a similar but larger aeon or cosmic cycle of dissolution and creation (Sana or the year of Brahma-chakra).

In Tantric Lore, it is the guardian matrix of Lalita-mahatripura-sundari, and her Yantra therefore becomes the sacred cosmic footprint or schema arrayed in her own womb. It is her self-luminous divine beauty (Shri) which she self-exudes and self-extends (based on the root / etymos tan: giving rise to words like 'Tat', 'Tanu', 'Tantuja', 'Tantra' in Sankrit and 'Tension', 'Tender', 'Thunder' and 'Tent'in English meaning looming or weaving or networking through space)like a spider as the web of universal manifestation and assimilation.

The web of universal manifestation and assimilation is the spirit of SandHI.

Developed based on various excerpts from:

Chevalier, Jean and Alain Gheerbrant, the Penguin *Dictionary of Symbols*, Paris, 1982. [Translated from French into English by John Buchanan-Brown]

SandHI, Ankana (Iconography) projects 1 and 2
IIT Kharagpur
February 2015

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Contents

Message

Let me begin by congratulating the entire IIT SandHI team for formulating a rich variety of pilot projects in select cities, which is inclusive of PROJECT VARANASI and other heritage based urban renewal and smart urban engineering projects. As I said in my earlier message, which has cut across the e-web, that I am proud of the achievements of the Team IIT Project SandHI, which is a multi-disciplinary and cross-institutional 'Science and Heritage initiative', focusing on both recognizing the ancient knowledge systems and inculcating the state-of-the art solutions for developing sustainable habitat initiative.

Through the making of the SandHI Journal, a dynamic innovation platform will be created, where the future seeds of understanding and reviving the traditional knowledge systems through science and technology will be best nurtured thereby augmenting the Indian way of scientific thinking and problem-solving, which I believe is the 'need of the hour'.

Special felicitations to IIT Kharagpur to fore-run and steer the making of the Journal on behalf of the entire IIT SandHI team.

Smriti Zubin Irani
Honourable Minister
Ministry of Human Resources Development
Government of India

February 2015

संधि / SandHI

IIT Kharagpur - SandHI Team (October 2014, Review Workshop)

– a spirit of convergence

*S*andHI is an orchestrated force to probe into the depths of the rich heritage of our country in particular and the world in general through the eyes of science and technology and offers modern science and technology the scope and challenge to not only use all the skills available in its repertoire but also discover new ways to uncover Truth. Today, over 25 faculty of our Institute and more than 50 research scholars and assistants are contributing to the making of this force, which one day, I hope will grow to nurture and strengthen the Tree of Wisdom. So to write a few words on 'SandHI, a mega Science and Heritage initiative', sponsored by the Ministry of Human Resources Development, Government of India, it is always one of immense pleasure.

SandHI is blooming like a flower. With all its petals representing a rim of various sectors of traditional knowledge systems converging towards something deeper, the movement has manifold possibilities. SandHI has been largely initiated by the IITs. IIT Kharagpur works in partnership with several leading IITs, like IIT Kanpur, IIT Bombay, IIT BHU at Varanasi and others. As an advisor to the SandHI movement of IIT Kharagpur, I can depict a set of THREE important points, which I think represents its flow, and something that will eventually capture the true spirit of Science and Heritage Initiative.

First, I see SandHI as a cross-dialogue between Science and Heritage. The dialogue is set once a pair of questions is raised and the answers subsequently sought:

▪ On the one hand, how we can we arrive at our systems of traditional knowledge through the lens of deep scientific inquiry and recognizing them as 'systems of science'? Say, in the SANDHI Music project, we are trying to fathom a science, which may constitute the deep structural algorithms of Indian musical renditions like the Ragas conforming to specific times of the day; or seasons of the years; and *Rasas / Bhavas* of the human emotional spread. Is mathematics portrayed as various chords of progression called 'melody' correspondent to the emotive or psychic response of the musician or audience? Here, through Science we can recover Heritage.

▪ On the other hand, we can try to re-position our findings within the scientific constructs. Say, in Indian music we can see how normative-emotive-cultural genres or semantics can be re-used to further augment the constitution of classical analytical processes or inquiry itself. In other words, we see Heritage as a strength that augments science.

Secondly, I see SandHI as a two-way process; a flow that assures give-an-take and establishes 'an interface and reversibility' between the inputs and outputs drawn both from Science and Heritage. I converted the idea into a working plan for all SandHI projects. I called it the SandHI INPUT-OUTPUT Matrix (see Figure 1).

All projects under SandHI are directly or indirectly arriving at the INPUT-OUTPUT Matrix (IOM). The Matrix stands for the very Episteme of SandHI, the very domain. Let me use an instance. One of the largest concerns of SandHI is to bring to light the living foundations of our ancient urban systems which are also living laboratories of traditional systems. Of many, one is PROJECT VARANASI. For example, some of the scientific dimensions in PROJECT VARANASI can be – a) the study of river systems; b) a spatial study of community clusters based on cellular automata; and c) creative economy that have flourished through generations in the ancient city and so on. How these dimensions, studied analytically as inputs may yield the intangible heritage dimensions like a) Ecological footprints of the city; b) aesthetics in traditional systems of knowledge say Varanasi music; and c) cultural traits of the community, if seen as outputs. Once, the IOM is constructed for a single project, SandHI researchers may one day converge to carve out a generic IOM of Indian Science and Heritage Interfaces, which is my dream. I had eventually forwarded this idea to my colleagues, the Principal investigators of various projects under SandHI. And they are very excited about it.

Thirdly, it is the dimension of outreach and dissemination. As the current Director of the Institute, I would personally like to play a role in this as a member. I believe, very sooner or later, every SandHI project, be it Language of Iconography; Geo-exploration or Creative economy revival, will construct a comfortable niche to showcase a nationally accessible digitized archive of our traditional knowledge systems. It is my first objective

FLOW MATRIX OF VARANASI

Conceptual Epistemology : SANDHI: inter- and intra-projects

Scientific dimensions

S_1 | S_2 | S_3 | S_4 | S_5............S_n

Heritage dimensions

H_1 — INDUCTION
H_2
H_3
. — DEDUCTION
H_n
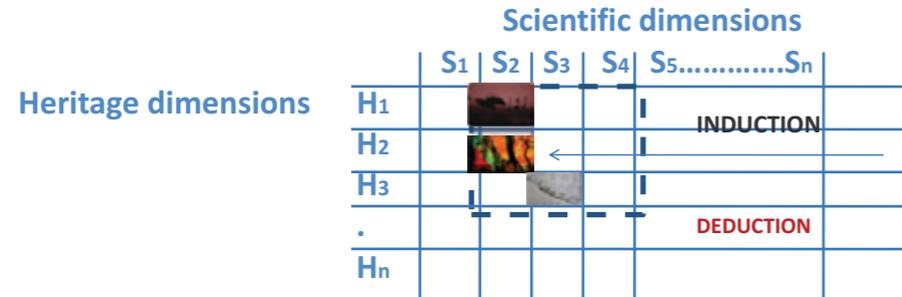
S2 – River systems; S3 – Spatial-community-automata; S4 – Creative Economic Generations
H1 – Cosmic and ecological footprints; H2 – Aesthetics and ethics recovery in TKS: Buddhism
H3 – Normative and cultural dimensions of community planning

Documentation of:
a) Available Knowledge (D) ---- b) Analyzed Knowledge (A) ---- c) Steps to recovery (R)
-----Outreach through Visualization - Portals, workshops, exhibits, courses

VARANASI: an exploratory study of a flow of Built Ethos
ANALYSES, SYNTHESIS & DELIVERABLES

Figure 1: SandHI Input-Output Matrix

as far as dissemination is concerned. The other objective is of outreach and under its ambit; I would like to bring out a Vigyan Katha Sagar. It will be a series of tales portrayed in the simple words of science, describing say, the lore of ancient city planning techniques that we had in this country; or the water harvesting system that kept Indian economy alive and golden in the ancient times. And all that story telling will be done in such a way that it will be simply accessible to the millions of child-minds of our nations. I think that is how SandHI will able to bridge past and future and pave a roadmap for India's future holistic development.

The present journal is just a beginning, where some of the great minds have penned their first thoughts. More will come in the forthcoming issues of the SandHI Journal, which I hope will one day reach all corners of the world.

I am thankful to the Ministry of Human Resources and Development and the Honourable Minister for the encouragement and support to this activity. I am extremely grateful to Ms. Amita Sharma, past Additional Secretary (Technical Education), MHRD, Government of India, and currently Advisor, for her sustained and overarching guidance and support in the making and blooming of SandHI. I am also elated to see a galaxy of best minds penning this inauguration volume, ranging from the best experts from around the world to ones who belong to a relatively younger generation, which is great hope! I thank our colleagues in the partner IITs for their constant hand holding and cooperation. I am also grateful to the eminent scholars who have constantly encouraged and supported us in this initiative and some of them have also contributed to this inaugural volume. Professor Joy Sen has been the 'life-force' of the SandHI movement at IIT Kharagpur and a binding thread to the efforts all across the IIT system and beyond. He and his enthusiastic team have made a wonderful beginning. I am very happy to see their untiring efforts bear fruit. I wish the very best for the initiation of the Journal and I hope with continuous inpouring of scholarly contributions from around the world, the journal will go a long way to contribute to the ambit of Indic studies driven conjoint Science and Heritage initiative.

Partha P. Chakrabarti
Director, IIT Kharagpur

Editorial

An editorial note can begin with an exploration in the ancient Indus Valley. It will be more interesting if we join a group of people, whose contribution matters in what we are doing now. They are a party of European disciples, who were interested in India and her rich ancient history. They had accepted Indian names like Sister Dhira Mata, Sister Jaya, Sister Nivedita. They and a few others were following the footsteps of Swami Vivekananda along the banks of an ancient river. The date and the year is July 20, 1898. It is an excerpt from Sister Nivedita's book giving an account of Swamiji's trip to the western Kashmir Valley. The description is named 'Walks and talks beside the Jhelum', which goes like this:

"That morning the river was broad and shallow and clear, and two of us walked with the Swami across the fields and along the banks about three miles. He (Swamiji) began by talking of the sense of sin, how it was Egyptian, Semitic and Aryan. It appears in the Vedas, but quickly passes out. The devil is recognized there as the Lord of Anger. Then, with the Buddhists he became Mara, the Lord of Lust, and one of the most loved of the Lord Buddha's titles was "Conqueror of Mara" (vide the Sanskrit lexicon Amarkosha that Swami learnt to patter as a child of four!) But while Satan is the Hamlet of the Bible, in the Hindu scriptures the Lord of Anger never divides creation. He always represents defilement, never duality.

Zoroaster (or Zarathustra) was a reformer of some old religion. Even Ormuzd (Ahura Mazda or more appropriately known, Ashura Mahadeo) and Ahriman (Angira Manyu) with him were not supreme; they were only manifestations of the Supreme. That older religion must have been Vedantic. So the Egyptians and Semites cling to the theory of sin while the Aryans, as Indians and Greeks, quickly lose it. In India righteousness and sin become Vidyâ and Avidyâ — both to be transcended. Amongst the Aryans, Persians and Europeans become Semitized by religious ideas; hence the sense of sin.

And then the talk drifted."

It is not duality; not an 'either or' – it is 'conjoint-complementary'

The power of discrimination helps us to sieve out 'what is good' from 'what is not good'. But it is not a divider, but a stepping stone to reach something higher than the virtue of discrimination. Once discrimination is activated, human mind reaches something higher. From there mind begins to eliminate the 'thorn' of 'what is not good' with the 'sharpness' of 'what is good'. Once the long job is done, there is no trace of 'what is not good'. As a result, 'what is good' is also eliminated. Why? Its role of an eliminator is over. Then mind reaches something higher and it starts enjoying the all-pervading life force of creation. It is the 'mother force' as she is equal to all. She takes no sides and encompasses all, and embraces it all. Within her womb, the 'matrix', all co-exist. All are conjoint and complementary. There is no duality.

In the words of great impressionist Vincent Van Gogh:

"In my life and painting, I can do without the Good God (against an Evil Satan). But I can never, as I suffer here, do without something which is greater than 'I', than my life itself: the power of creation."

An episteme of assimilation

Indian epistemology transcends duality and reaches 'holism'. In the words of World-Poet Gurudev Rabindranath Tagore:

'Where knowledge is free and where the world has not been broken up into fragments'.

An idea of the Impersonal and the Universal truth is that interconnects the 'web of creation and flow of manifestation'.'As unity' it epitomizes Vedanta or the summit of Vedas. Ancient Rishis reached that truth again and again, in different aeons and ages, and they always gave it a higher omnipresent place than others, which are individualized and personified. Personification leads to fragmented truth-systems or disjoint knowledge systems. Music, poetry, and science are apparently different. But the science of ratios, proportions and chords are eternal and universal, and they embed the 'deep structure' of all three. Technology changes and science is therefore universal and eternal. Religion changes, but spirituality is eternal and universal. Here lies the clue to arrive at the episteme of assimilation. From Sage Kapila to the Milesian Philosophers and particularly, Pythagoras of Samos, Greece, the integral episteme sustained.

In the words of Sri Aurobindo:

> *"In ancient times Veda was revealed as a sacred book of wisdom, a great mass of 'inspired poetry', the work of Rishis – seers and Sages (mantra-drastas), who received in their illumined minds rather than mentally (or intellectually) constructed 'a great universal, eternal and impersonal truth', which they embodied in Mantras, revealed verses of power, not of an ordinary but of a divine inspiration and source".*

(Hymns to the Mystic Fire, page 1)

In India, you can take out and throw away a whole list of Gods and Avatars, who came in countless ages and saved us. Still nothing affects the Universal plane – the knowledge of the 'self' as the self which is beyond (*param-atman*) and as the 'self of the universe' (*viswa-atman*). The summit of Vedas or revealed truths of the Upanishads (*Srutis*) is therefore sustainable through ages. It is '*Sanatana'* or that is universal-impersonal-eternal. '*Sanatana'* is not an 'either-or'. It is a conjoint of structures, and its movements embrace both something that is fixed or 'ordered' and something that is 'free and changing'. '*Sanatana*' forwards multiple universes to the self to discover new ways to realize that same universal truth before it transcends the universe. The conjoint of scientific order and poetic inspiration is the interface we are seeking. The multiple ways to same truth is the combination of 'order' and 'freedom' that we are seeking. The spirit of the double in tender is the spirit of assimilation. The name of the spirit is SandHI.

Re-formulation of Indian history – a humble beginning

Agni, who has encompassed everything - all gods, is like the felly encompassing the spokes of a wheel.

<div align="right">Rig Veda: 5th Mandala: 13.6</div>

Returning is the motion of the Tao; going far is returning.

<div align="right">Lao Tzu in 'Tao Te Ching'</div>

Prophet Zarathusthra in Persia had been a reformer of that same thought where righteousness and sin became *Vidyâ* and *Avidyâ* — both are to be transcended – as the srutis says:

'Great and unified is the basis and the foundation of the Devas (suras) and the Ashuras'

<div align="right">(Rig Veda: 3.55)</div>

Solomon Nigosian (1993), in his book 'The Zoroastrian faith: tradition and modern research' establishes that Classical writers such as Plato, Plutarch and Diogenes proposed dates for the Persian Prophet prior to 6000 BCE. Some traditions also establish the ancient Persian priests as 'Athaurvans' and links the Old Avestan language of the *Gathas* being very close to the Sanskrit of the Rigveda. Diogenes confirms the Prophet as an outcome of a preceding westward migration from Aryabarta (Indica) to the land further west (Airyan or Iran). The Colonial scholarship could not accept this. The only exception was Will Durrant, who earmarks the 'wisdom of the East' as the very first chapter named 'Our Oriental Heritage' in his 'The Story of Civilization'. So we can revert back to 'the talk and the walk by the river Jhelum':

> *"Zoroaster (or Zarathustra) was a reformer of some old religion. Even Ormuzd (Ahura Mazda or Ashura Mahadeva) and Ahriman (Angira Manyu) with him were not supreme; they were only manifestations of the Supreme. That older religion must have been Vedantic."*

What could have been the older religion? Can SandHI offer an answer? To do that, let us move to the contributions in this inauguration volume.

Thought-words

To arrive at the foundation of a vaster and deeper form of truth is the goal of SandHI. The spirit of SandHI is best initiated by the following words of Prof. Partha P. Chakrabarti, whose leadership and guidance fore-runs the SandHI movement at IIT Kharagpur:

> *"SandHI is an orchestrated force to probe into the depths of the rich heritage of our country in particular and the world in general through the eyes of science and technology and offers modern science and technology the scope and challenge to not only use all the skills available in its repertoire but also discover new ways to uncover Truth."*

The thought-vibrations are sustained as they emerge beautifully in the words of Ms.Amita Sharma:

> *"SandHI hopes to be able to inspire educational processes that evoke 'deep-unravelling surprising and beautiful connections among different realms of thought.' SandHI is an acronym for Science and Heritage Initiative that emerged spontaneously and appropriately in a workshop on January 3rd, 2013 for discussing the interrelatedness of science and culture as cross- disciplinary studies."*

Ms. Sharma explains how SandHI had a modest beginning, as it is about to have multiple interpretations, narratives and innovations among a few IITs that adopted that name to band together their cross-disciplinary studies on science and culture. She presents a summary of SandHI in IIT Kharagpur, which includes studies on

1. ***Bhasha*** (language) – which is spearheaded by a band of professors namely Prof. Pawan Goel, Prof. Sudeshna Sarkar, Prof. Pallab Dasgupta, Prof. Joy Sen, Prof. V. N. Giri, Prof. Anirban Dasgupta

2. ***Dhyan*** (meditation) by Prof. Aurobindo Routray, Prof. Priyadarshi Patnaik, Prof. Rajlakshmi Guha

3. ***Sangeet*** (music) by Prof. Pallab Dasgupta, Prof. Priyadarshi Patnaik, Prof. K. S. Rao, Prof. D. Suar, Prof. Sourangshu Bhattacharya

4. ***Itihas*** (history) – having a three projects (one in Chandraketugarh in West Bengal; and two in Coastal Odisha) by Prof. Arindam Basu, Prof. W. K. Mohanty, Prof. Probal Sengupta, Prof. Abhijit Mukherjee, Prof. Priyadarshi Patnaik, Prof. N. C. Nayak, Prof. Joy Sen and others

5. ***Ankan*** (iconography) by Prof. Haimanti Banerji, Prof. Joy Sen, Prof. Priyadarshi Patnaik

6. ***Dana*** (Generosity) by Prof. N. C. Nayak, Prof. J. Mahakud, Prof. C. S. Mishra, Prof. A. K. Pradhan

7. ***Moksha*** (End-of-life care) by Prof. Suhita C. Chatterjee, Prof. Priyadarshi Patnaik, Prof. A. K. Pradhan, Prof. J. Mahakud

8. ***Shilpa*** (creative economy) byProf. Saikatpaul, Prof. S. Sen, Prof. Joy Sen, Prof. Pulak Mishra, Prof. BhargabMaitra, Prof. N. C. Nayak, Prof. PriyadarshiPatnaik

9. **Project Varanasi** by Prof. V. N. Giri, Prof. Abhijit Mukherjee, Prof. Priyadarshi Patnaik, Prof. Joy Sen, Prof. Probal Sengupta, Prof. Arindam Basu, Prof. Bhargab Maitra, Prof. Pallab Dasgupta and associates

One may meticulously read Ms. Sharma's words explaining how efforts under SandHI signify an epistemology, an educational perspective, and diverse interpretations of civilisation and society and in the ultimate analysis of self-hood and a realization of the 'self as the self of the universe'.

The descriptions of SandHI in IIT Kanpur have been forwarded by Dr. Koumudi Patil in an equally wonderfully written and exquisitely named paper entitled – *"Paani ko suraj ki roshani se bachana hai!* (Save water from the sun!). Koumudi's ideas resonate with that of Tagore and particularly, 'Santiniketan', where Koumudi's educational career has been shaped:

Where the clear stream of reason has not lost its way

Into the dreary desert sand of dead habit -

Today there is a need to position the richness and diversity of the 'Creative Economy' of our country and augment technology as shaped by culture. Koumudi further says:

"Technology is socially created and its application is shaped by culture. Different forms of technology are suitable to different forms of cultural and social systems. This suitable fit has evolved over a period of time determined by cultural as well as geographical advantages and constraints. Therefore, heights of musical excellence achieved in India, were closely paralleled with the design and engineering of the instruments themselves."

SandHI an India's Ethos

As IIT Kharagpur treads the first year of SandHI, there are many lessons and revelations. Two of the best minds in the SandHI movement of IIT Kharagpur have penned them – Prof. Pallab Dasgupta and Prof. Priyadarshi Patnaik. They represent to my mind the two-folds of SandHI.

Pallab has lucidly pronounced the subtle ways and emphatic means through which SandHI can ideally take place. I have called it –'Ancient India through the technological prowess of new India – a need for patient and inclusive research'.

Priyadarshi humbly sets aside his calm words looking up to 'SandHI as a fusion of mind-systems transcending boundaries'.

Re-exploration

One of the key challenges in SandHI is to re-explore India's ancient Mythology and match the findings with the logical explanations from Geo-archaeology and the normative arguments that Language and Culture systems study may offer. And this is a very tough job!

To cite a powerful instance, controversies and counter-responses to the controversies have revolved and fought with each other around two key stones of Indic studies – one, an idea of an 'Aryan Invasion', once coined by the Colonial interests; and the other, 'a system of Indo-European Language tree' where a myriad network of languages from all corners of Europe and Asia could be linked and explained on the basis of that invasion.

Recent paradigm shifts in Indic studies have drifted far from this problem. There is an entirely different viewpoint now backed up by fresh validations from the matching of myths, geo-archaeology, and cultural research. Three brilliant papers present the first rays of the reversals:

1. From **Sarasvati to Ganga'** by Michel Danino, Guest professor, IIT Gandhinagar;

2. **Aryan Invasion: a Myth or Reality** by Prof. Amitabha Ghosh, Ex-Director, IIT Kharagpur; and

3. **Significance of Palaeography and Linguistic Palaeontology as Important Tools to Decipher Ancient Past'** by Sudipto Das, Author of *the Ekkos Clan;* Alumnus, IIT Kharagpur and VP Engineering, Mirafra Technologies.

Re-cognition

With the advent of Information Age and the World Wide Web (WWW), new avenues of exchange and global interactions have emerged. In a recent book called 'American Veda' by Philip Goldberg (2010), an emphatic and responsible understanding of the Indian mind in the western context has been made evident.

To put it simply, the ancient East is materializing under the advent of rapid globalization-industrialization, which is a gift from the West. The West is de-materializing under the deep-ecological impact of Eastern spirituality in their era of post-industrialization. Much of what 'was Indian' is now re-portrayed as 'Western'. And much of 'what is westernised' is an acceptable domain of the contemporary Indian living standards. They represent interesting cross-roads. We are in the middle. It is perhaps not an 'either-or'. It is conjoint and complementary. SandHI is an effort to make that evident.

The four papers, which are marked under 'recognition', are strong endorsements of the cross-exchange and reciprocity in a conjoint-east-west paradigm. The papers show how an idea of 'co-operative duality vogue in the West' had once run our ancient scriptures; they also show how modern algorithms of time and space are embedded in the architectural foundations of ancient Indian structures and they can be made explicit through an ecological footprint based on spatio-temporal mapping; and finally, how Indian mathematics had been the mother of present day binary system (sunya, adwaita i.e., 0, 1) and the language of Modern science is much indebted to the logic of six ancient Vedangas and the subsequent Sulbasutras. The four papers are:

1. **From Radical to Co-operative Duality: Moving Towards a Non-Dualistic Interpretation of Classical Yoga** by Dr.Ian Whicher, who is now the Head of the Department of Religion and Cultural Studies, University of Manitoba, Canada

2. **Time, Space and Structure in Ancient India**, by Prof. SubhashKak, Regents Professor and Ex-Head of Computer Science Department at Oklahoma State University

3. **Presenting Mathematics in Metrical form**, by Prof. K. Ramasubramanian, Professor, Department of Humanities and Social Sciences, IIT Powai and

4. **Technology and Tradition: spatio-temporal mapping of Temple Architecture in South and Southeast Asia** by Prof. Sambit Datta of Architecture, School of Built Environment, Curtin University, Australia

Traditional Built Environment and Systems

Continuity and Change is the spirit of Indian architecture. There is something which assures 'nothing has changed in depth, though everything has changed on surface' It is evident in these words of Art-historian Percy Brown:

'In each of the major historical developments of architecture there is one basic principle underlying its conception, and one which is supremely distinctive. With the Greeks this was refined perfection; Roman buildings are remarkable for their scientific construction; French Gothic reveals a condition of passionate energy, while Italian renaissance reflects the scholarship of its time.

In the same way the outstanding quality of the architecture of India is its spiritual content. It is evident that the fundamental purpose of the building art was to represent in concrete form the prevailing religious consciousness of the people. It is 'mind materialized in terms of rock, brick or stone.'

Continuity and change are conjoint where history and sustainability co-exist. The spiritual content of Indian civilization is the heart of the matter, and that is best evident through three papers:

1. PROJECT VARANASI, forwarded by Prof. Rajeev Sangal, Director, IIT (BHU), Varanasi ; Vice Chancellor, BHU, Varanasi and Professor, Computer Science and Engineering;

2. **Banaras, the Cultural Capital of India: Visioning Cultural Heritage and Planning'** by Prof. Rana P. B. Singh, Professor, Cultural Geography and Heritage Studies, and Head, Dept. of Geography, Banaras Hindu University, Varanasi;

3. A rendition by Prof. V. N. Giri, Head, Department of Humanities and Social Sciences, IIT Kharagpur called **'Varanasi: An Exploration of Mythology about Its Origin'.** Research scholar Saurabh Sharma and others have joined Prof. Giri in this research.

Creative Economy: Revivals and Resurgence

The inauguration volume of this Journal cannot be complete without a paper on Tagore. Artist-Engineer Arunendu Banerjee, Director, STS Systems, Kolkata and Advisor, Viswabharati and Rabindra Bharati University forward the fulfilment by writing a sensitive and built-ecologic rendition called **'Santiniketan Built Environment and Rabindranath Tagore'.** The paper shows that the modern ideas of green politics and sustainable built-environment are as old as the Ashrams-Viharas of ancient Rishis to which Poet Rabindranath is a living continuity.

But the richness of the past also needs a contemporary footing. It seeks a great equivalence in terms of economy, business, travel and leisure-experience. To do this, Mr. Kunal Sen, Executive Director, Peerless Hotels, Ltd., Kolkata forwards the 'down-to-earth' finale through his realistic piece on **'Prospects of Creative Business Tourism'.**

Punascha: Oncore!

To conclude, let us resonate what our Director Prof. Partha P. Chakrabarti has already said.

Let us be always thankful to the Ministry of Human Resources and Development and the Honourable Minister for the encouragement and support to this activity and particularly, Ms. Amita Sharma, the key force behind it all.

Let us hope that the best experts from around the world continue to pour into the making of subsequent issues of this Journal and make it sustainable and worthy. Let the Journal be a binding thread to the efforts all across the IIT system and beyond.

Let us pray to the Mother Life force so that she graces this small and humble effort of ours for treading a long way to contribute to the gamut of conjoint Science and Heritage initiative.

Wish you a pleasant reading.

Joy Sen
Principal Investigator, SandHI initiative, IIT Kharagpur
Professor, Architecture and Regional Planning, IIT Kharagpur
Head, Ranbir and Chitra Gupta School of Infrastructure Design and Management
IIT Kharapur

February 2015

sandhi
– an Episteme

SandHI -" surprising and beautiful connections among different realms of thought."[1]

Amita Sharma

Former Additional Secretary (Technical Education), Ministry of Human Resources Development, Government of India

Essence

Such efforts under SandHI signify an epistemology, an educational perspective, and diverse interpretations of civilisation and society and in the ultimate analysis of self-hood and identity. This article is an attempt to explore briefly some of these implications and their interrelationships.

SandHI connotes an episteme of unity. This is not a meta -narrative or a pre -cognitive unity or a monistic metaphysic. It is an exploration of the cognitive resonance between different interpretive responses to the world and different constructs of experience, and at one level, it has as it's underpinning, in an epistemological search that pushes the borders of different categories of thought, creates shifting perspectives and a palimpsest of meanings.

The meaning of SandHI is best expressed by quoting Professor Manjul Bhargava, who won the Fields Medal in 2014 and who is as disarming in his simplicity as he is amazing in his mathematical genius and who truly embodies its ideals:

"I always found the three subjects-music, poetry, and mathematics-very similar. In fact, I find that I think about them all in very similar ways. In school, mathematics is generally grouped in the "science" category. But for mathematicians, mathematics-like music, poetry, or painting-is a creative art. All these arts involve-and indeed require-a certain creative fire. They all strive to express truths that cannot be expressed in ordinary everyday language. And they all strive towards beauty.

The connection between music/poetry and mathematics is not only an abstract one. While growing up, I learned from my grandfather how much incredible mathematics was discovered in ancient times by scholars who considered themselves not mathematicians, but poets (or linguists). Linguists such as Panini, Pingala, Hemachandra, and Narayana discovered some wonderful and deep mathematical concepts while studying poetry. The stories that my grandfather told me about them were very inspirational to me not just poetically, but mathematically.

Maybe I can give you an example, originating in 500 B.C., that has been particularly fascinating to me as a drummer. In the rhythms of Sanskrit poetry, there are two kinds of syllables-long and short. A long syllable lasts two beats, and a short syllable lasts one beat. A question that naturally arose for ancient poets was: how many rhythms can one construct with exactly (say) 8 beats, consisting of long and short syllables? For instance, one can take long-long-long-long, or short-short-short-long-long-short.The answer was discovered by the ancients, and is contained in Pingala's classical work Chandashastra, which dates back to between 500 and 200 B.C. Here is the elegant solution. We write down a sequence of numbers as follows. We first write down the numbers 1 and 2. And then each subsequent number is obtained by adding up the two previous numbers. So, for example, we start with 1 and 2, and then 1+2 is 3, so we have so far 1 2 3. The next number is obtained by adding up the last two numbers 2 and 3, which is 5. So we have so far 1 2 3 5. The next number written is then 3+5 which is 8. In this way, we get a sequence of numbers 1 2 3 5 8 13 21 34 55 89.... The n-th number written tells you the the total number of rhythms, consisting of long and short syllables, having n beats. So for 8 beats, the answer is that there are 34 such rhythms in total. This sequence of numbers is now ubiquitous in mathematics, as well as in a number of other arts and sciences! The numbers are known as the Hemachandra numbers, after the 11th century linguist who first documented and proved their method of generation — called a "recurrence relation" in modern mathematics. The numbers are also known as the Fibonacci numbers in the West, after the famous Italian mathematician who wrote about them in the 12th century. These numbers play an important role now in so many areas of mathematics (there is even an entire mathematical journal, the Fibonacci Quarterly, devoted to them!). They also arise in botany and biology. For example, the number of petals on a daisy tends to be one of these Hemachandra numbers, and similarly for the number of spirals on a pine cone (for mathematical reasons that are now essentially understood). One of my favorite photographs, which I keep in my office, is of a vast field of daisies, in which every daisy has 34 petals! (Recall that 34 is the same number that appeared as the answer to our question about 8 beat rhythms, revealing a hidden connection that mathematicians now understand.) This story inspired me when I was growing up because it is a wonderful example of a simple idea that grew into something so omnipresent, important, and deep-unravelling surprising and beautiful connections among different realms of thought." (As told to Chidanand Rajghatta, Aug 17, 2014, TOI)

SandHI hopes to be able to inspire educational processes that evoke 'deep-unravelling surprising and beautiful connections among different realms of thought.'

SandHI is an acronym for Science and Heritage Initiative that emerged spontaneously and appropriately in a workshop on January 3rd, 2013 for discussing the interrelatedness of science and culture as cross- disciplinary studies. SandHI now has multiple interpretations, narratives and innovations among a few IITS that adopted that name to band together their cross- disciplinary studies on science and culture. In IIT Kharagpur[2], SandHI includes studies on Bhasha, (language), Dhyan, (meditation), Sangeet (music), Itihas (history), Ankan, (iconography), Shilpa (creative economy), and Varanasi. SandHI in IIT Kanpur[3] includes the study of traditional water conservation and harvesting systems such as the ancient water systems at Shringverpur at Allahabad or the medieval fort of Kalinjar in Central India, iron and steel making processes in ancient India, studies on Indian Ragas and Indian Music instruments that examines musical excellence along with design and engineering. It explores mathematical and philosophical concepts in ancient Indian classical texts and encourages the study of classical languages, beginning with Sanskrit, key to many knowledge texts.

Such efforts under SandHI signify an epistemology, an educational perspective, and diverse interpretations of civilisation and society and in the ultimate analysis of self-hood and identity. This article is an attempt to explore briefly some of these implications and their interrelationships.

SandHI connotes an episteme of unity. This is not a meta -narrative or a pre -cognitive unity or a monistic metaphysic. It is an exploration of the cognitive resonance between different interpretive responses to the world and different constructs of experience, and at one level, it has as it's underpinning, in an epistemological search that pushes the borders of different categories of thought, creates shifting perspectives and a palimpsest of meanings. The ways in which these are articulated generate multiple discourses and the ways in which they are related form an episteme. Several epistemes may co- exist, but as a result of various factors that constitute power systems, a dominant episteme emerges that defines the conditions of creating all knowledge. Such epistemic hegemony determines not just what is legitimate knowledge, but more significantly, equates it with ' truth'. A way of seeing becomes the only way of being. This has serious implications for the creative growth of individual and society, attenuating the rich diversity of thought, stifling cultural, and intellectual freedoms, perpetuating a selective set of constructions as knowledge.

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[1] Phrase taken from Prof Manjul Bhargava' s interview to the Times of India, August 2014, after the Fields Award was conferred on him in 2014

[2] http://www.iitkgpsandhi.org/

[3] http://www.iitk.ac.in/web_sandhi/

A consumerist market superimposes values on knowledge forms, leading to a curious commodification of knowledge. Knowledge gets labelled as useless and useful subjects of study, shearing off what is not directly related to certain kinds of productivity.

Such a superscript of values has, needless to say deleterious consequences. It leads to the fragmentation of knowledge, the restriction of cognitive fields, and despite an explosion of 'facts', it actually spawns an unquestioning mind, a fundamentalism of the intellect, and cultural intolerance all counter to original thinking and ironically, impeding the production of new knowledge.

There is a need to disrupt the monochrome of the mind. There is an urgency to create a pedagogy of critical consciousness. How can education liberate the mind to ask beyond the given, to appreciate the pluralism of thought and to search beyond taxonomical binaries for a more holistic understanding? SandHI is an illustration of this way of thinking. Since it is a way of thinking, it expresses itself in different forms and different field of knowledge, research and action. However, they emerge from a common belief that given the complex nature of reality, and the ceaseless myriad ways in which human imagination seeks to grasp it, there are multiple ways of intuiting and expressing it and it is both desirable and possible to engage with them. SandHI is an argument for openness of the mind and the process of knowledge construction as a non-linear and non - hierarchical dialectical process.

The implication of such an epistemology for education are manifold and interesting specially for the ways in which it is formally organised in India. Formal education in India tends to be wedged into compartments and these are many. This is surprising considering that Indian culture traditionally has known embedded knowledge systems in the sense that knowledge of different fields were entwined with each other[ii]. Several classical knowledge texts in other ancient civilisations such as Greece also had nested discourses flowing from a holistic world view. The dialogues of Socrates, and Aristotle's ethics are conspicuous examples.

This was not just inter- disciplinarity, very much a modern word. This was the result of a holistic view of reality. There was also a way in which knowledge concepts in India were expressed as cultural practices, beliefs, symbols. Increasing knowledge and specialisation and the expansion of the education system led to the separation of knowledge systems. The continuous ramifications, divergences and splitting off of knowledge fields is inevitable and the formal education system consolidates this in ways that tend towards rigid compartmentalisation of different disciplines. In terms of individual capabilities, this creates what TS Eliot calls' the dissociation of sensibility[iii] the disconnect between reason and imagination, the loss of intuitive cognition - the source of creativity and innovation.

It becomes important to consciously encourage cross-disciplinary studies, specially between science and liberal arts, technology and culture. More importantly, the pedagogy of such cross-disciplinary study needs careful designing. The challenge is to be able to develop processes that transact learning objects in ways that stimulate exposure to multiple knowledge fields encouraging the abilities for multiple interpretations, for analysis and synthesis of different ways in which reality is constructed, broadening and deepening comprehension , making for more inclusive perspectives. For example, a musical instrument can teach music, material sciences, physics, mechanical engineering, math, history, culture. Examples can multiply. This will lessen the burden of too many subjects, while actually enriching understanding.

In fact, with this pedagogy of multiple constructions , almost ' any thing ' can be a learning object. It opens the immense possibilities of using local context as a text. Learning is a process where the mind acquires the ability to make connections between the particular and the general, the individual and the general, the local and the universal, the subjective and the objective, to analyse and synthesise what is given, to be able to infer and conceptualise what is not. Good education is one that develops these abilities. Teaching - learning resources shape this process.

Conventionally, formal education systems rely heavily on a set of prescribed text books. They are standardised and the content is frozen. There is no room for engaging with and learning from the local context, the surrounding environment. The starting point of learning should be what is known and slowly push towards the unknown. Paradoxically, formal education in India begins with the unfamiliar. Unfamiliar language, unfamiliar content. Even if the content is familiar, it gets masked under an unfamiliar language. School intended to be the first institutionalised socialisation, becomes the beginning of an alienating experience. Assimilating what is unknown becomes difficult because the basic ground is strange. And what is known is marginalised, erased, worse, de-legitimised. A whole world of relevant knowledge and the language through which it is expressed is submerged. Even when it is recognised, it is usually in a reductionist way as 'indigenous' or ethnic or as extra -curricular.

It is important to connect with the context and existing local resources to nurture sound roots of learning. There are at least two initiatives that I have been involved with, that demonstrated to me the effectiveness of this approach. One, *Aas Paaski Khoj*[iv] was inspired by a great perplexity as to why children who grew up in rural areas, either failed or barely passed in the environment sciences that dealt with crops, geography, natural resources. After all, this was their life context. A small initiative Aas Paaski Khoj was initiated that encouraged students of classes sixth to eighth in the rural area of the district Bhopal, MP, to interact with their local neighbour-hood, and environment, and discover their local geography, history, and politics, markets, under the themes of janjangaljal, jameen and develop their own texts. It was soon obvious that they well comprehended the subjects in which they were under -performing. This was because they were learning through a familiar medium. The other project of Apna School in a remote village of a tribal district, Shahdol, worked with poor farming communities, where the children learnt by making their texts based on the work they did. These experiments, like many others like these, did not survive, because it is very difficult to shake strongly entrenched mainstream practice and such innovations shrink into footnotes of a peripheral tinkering. All the more reason to evolve a greater number of innovations that explore the impact of learning through local resources.

The context is not just the present that surrounds us but also our past. The past is never past, and the presence of the past shapes our contemporary experience. *Time present and time past Are both perhaps present in time future, And time future contained in time past[4]*. Eliot also describes tradition as a "simultaneous order," by which Eliot means a historical timelessness – a fusion of past and present – and, at the same time, a sense of present temporality[5]. Understanding tradition is an important way of understanding the community, and the culture in which we are located, of constructing new knowledge. Indian knowledge systems, with a rich tradition of math, science, life-systems, technology, natural resource management, philosophy, unfortunately, remain an unknown realm to the Indian students. Such distancing of our own intellectual tradition marginalises a considerable body of knowledge, and in fact, by-passes some effective ways of learning. This requires a good body of well- researched material that can be presented for further use and enquiry. This is where higher education and school education need to come together to re-evaluate the curriculum and pedagogy at the school level, to effect a paradigm shift towards an education that fosters critical consciousness, the ability to learn from just about anything, because the mind has been trained to observe, enquire, connect and infer, the freedom to learn beyond the segregation of subjects, the dichotomy of art-science, tradition and modernity, culture and science.

It is worth closing by quoting Prof. Manjul Bhargava again. He once simplified a 200-year-old number theory law with help of an Indian mathematician's work from 6th century CE and the popular Rubik's Cube. He believes that "students in India should be taught about the great Indian legacy of mathematicians, since ancient times, like Panini, Pingala, Hemachandra, Aryabhata, Bhaskara, Brahmagupta, Madhava, for example, and more recently Ramanujan, etc. Their stories and works inspired me, and I think they would inspire students across India. Many of these works were written in Indian languages in beautiful poetry with the flavor of Indian stories, and contain some of the most important breakthroughs in the history of mathematics. I think it would be beneficial if young Indian children were also exposed to their stories, just as I was as a child!"

i   *The Archaeology of Knowledge*, 1972, Michel Foucault

ii   *Cultural Specificities in the History of Indian Science*, IIC Quarterly, September, 2011, Michel Danino

iii   *The Metaphysical poets*, 1921,TS Eliot.

iv   *Aas Paaski Khoj*, National Conference on Enhancing Learning in Elementary Schools, Bangalore, 23-25july, 2004 AK Mittal and Shiksa Sangam, Innovations under the Sarva Shiksha Abhiyan, Aas Pas ki Khoj, Ravi J. Matthai Centre of Educational Innovation, IIM Ahmedabad, August 2006,

4   Four Quartets, Burnt Norton, T. S. Eliot

5   Tradition and the Individual Talent, TS Eliot, 1919

IIT Kharagpur - SandHI Team (October 2014, Review Workshop)

sandhi
– in IIT Kanpur

Paani ko suraj ki roshani se bachana hai! (Save water from the sun!)

Koumudi Patil

Assistant Professor, Department of Humanities and Social Sciences, IIT Kanpur

Aim

The IIT Kanpur SandHI- Scientific study of Indian knowledge systems, aspires to actively engage in the preservation, examination, and dissemination of Indian knowledge systems in the context of contemporary scientific body of knowledge and contexts of application. It is envisaged as a dynamic network of collaborations rather than an institutional facility, which encourages like-minded faculty members to practice an interdisciplinary approach towards the discourse of culture, with appropriate, acceptable, and sustainable technologies.

Technology is socially created and its application is shaped by culture. Different forms of technology are suitable to different forms of cultural and social systems. This suitable fit has evolved over a period of time determined by cultural as well as geographical advantages and constraints. Therefore, heights of musical excellence achieved in India, were closely paralleled with the design and engineering of the instruments themselves.

Every grain of sand is thirsty for a drop of water in Rajasthan. The local residents work on a simple principle- *Paani ko suraj ki roshani se bacchana hai!* This age old wisdom translated into contemporary scientific terms, tells us, prevention of evaporation conserves water. With this mantra in hand, the non-enginnering communities of Rajasthan have built ingenious water harvesting structures, that are a perennial source of water supply, in a region that receives less than 10 cms of annual rainfall. (Pareek & Trivedi, 2011; Pandey, 2000; Kala & Sharma, 2010) This ancient knowledge passed down the ages, rivals our contemporary discourse on water. Such knowledge embedded in the communities, our languages and in our history requires preservation, interpretation as well as dissemination through a scientific enquiry.

Therefore, the IIT Kanpur SandHI - Scientific study of Indian knowledge systems, aspires to actively engage in the preservation, examination, and dissemination of Indian knowledge systems in the context of contemporary scientific body of knowledge and contexts of application. It is envisaged as a dynamic network of collaborations rather than an institutional facility, which encourages like-minded faculty members to practice an interdisciplinary approach towards the discourse of culture, with appropriate, acceptable, and sustainable technologies.

Technology is socially created and its application is shaped by culture. Different forms of technology are suitable to different forms of cultural and social systems. This suitable fit has evolved over a period of time determined by cultural as well as geographical advantages and constraints. Therefore, heights of musical excellence achieved in India, were closely paralleled with the design and engineering of the instruments themselves. Warmer climates were more attuned to rain harvesting, refrigeration and wind catchers than cooler climates, therefore India has witnessed systems of water conservation and harvesting, that are still viable. Mountainous regions spent more resources in earthquake safe habitats while the tribals in Andaman and Nicobar have indigenous methods of sensing a forthcoming Tsunami.

This Sandhi aspires to understand and explain the histories of Indian technologies as they were shaped by culture and geography through field studies, modeling, simulations as well as translation and interpretation of indigenous texts. This will also help the engineering curriculum at IIT Kanpur

to construct a context for the development of technology and also localize knowledge scenarios for social relevance to the students.

Here is an overview of the SandHI at IIT Kanpur, beginning with its three points of focus.

(a) Preservation: To design an interactive museum of Indian knowledge systems as understood and interpreted by the participants of this project for exposing IIT Kanpur students, in particular, and wider community of Kanpur city, in general, to the achievements of the Indian mind. It would be a place where the ancient knowledge systems, would not just be displayed in the form of artifacts and static models, but, would instead be brought to life by appending these items with working knowledge and technological relevance. It is this feature, that will distinguish the proposed museum from others, where works are usually treated as static objects of the forgotten and mystical past. Very little, if any, information based on their essential value is presented along with.

The museum will also house a state of the art library of Indian knowledge systems in Sanskrit, as well as other vernacular languages, their translations, interpretations, and related texts. It will also have associated literature, which is committed for preservation as well as dissemination of Indian ways of thinking and problem solving. The library will have all the necessary infrastructure for digitization and preservation of books.

(b) Interpretation: To examine, understand, and interpret Indian culture, as it shaped and was shaped by science and technology over the ages. Towards this end, the following projects are being carried out:

1. **A scientific study of Indian musical instruments: history, mathematical modeling, and experiments.** This includes a detailed investigation of several existing musical instruments, as well as an attempt to reconstruct/verify ancient instruments based on a close reading of texts like *Natyas`āstra* and *Sangī ta-ratnākara*. We also aim to develop mechanisms to document and preserve the current practices of manufacturing musical instruments.

2. **Science and technology of water harvesting and management in the medieval fort of Kalinjar in central India** The project aims to

investigate and understand science and technology of water harvesting and management in medieval forts of Central India. The goal of this study is to carry out a detailed hydrological investigation of Kalinjar fort, which is a representative medieval fort of Central India.

3. **Understanding the past history of ancient settlements in the great Rann of Kachchh, Gujarat: Influence of seismic activities or climatic fluctuations?** This project is an interdisciplinary attempt to understand the cultural and historical evolution of ancient sites in the Kachchh region as shaped by the tectonic movements as well as climatic fluctuations during past 10,000 years. The study aims at understanding paleo-drainage and landscape that provided suitable site for these settlements, in addition to reconstructing ancient landscape and water system and collecting historical written records.

4. **Experimental study of iron and steel making processes in ancient India.** This project proposes experimental investigation of the processes used by ancient Indians for iron making in a pit/shaft furnace and steel making.

5. **3D documentation of Heritage Structures and development of documentation standards-with Taj Mahal as the test bed.** The project involves the development of standards for documentation of heritage structures based on the experience gained with Taj Mahal. It uses data for initial structural analysis of the structure and to understand the modular planning in its construction.

6. *Vaiśesika* **and Science.** We have incubated an active study group with a focus on *Vais´esika*. Our emphasis is on the history of science and possible connections with certain aspects of modern science. This includes a monthly seminar, short-term visitors, a short course, and a resource center.

7. **Resources for studying indigenous texts.** The project takes up translation and interpretation of indigenous texts, provide linguistic support to other projects, and develop pedagogical tools for language teaching suitable for researchers.

(c) Dissemination: The SandHI, IIT Kanpur is actively engaged in the dissemination of knowledge generated through various projects, seminars/workshops, and publications. The dissemination of such knowledge would help in the integration of culture-technology studies in the IIT curriculum, and subsequently within the overall Indian education system. The various activities planned are as follows:

1. All the activities in various projects are envisaged to culminate into development of models, multimedia presentations, booklets, reports, and other mediums to be finally added to the proposed museum and resource center. This way the museum will act as a dynamic entity showcasing the progress made by various SandHI initiatives at IIT Kanpur in addition to displaying other works of art and technology.

2. We plan to publish books(both in electronic and paper form) at multiple levels of engagement, at an introductory level, aiming towards the young reader as well as at an advanced level for researchers. All the SandHI projects will remain incomplete unless sufficient effort is made towards documentation of gained insights. We plan to publish seminars and workshop proceedings held under the banner of SandHI. We would also like to project our SandHI as a platform for experts outside our system to get their translations/interpretations published as long as they are in line with the present initiative. In fact we plan to constitute an editorial board which can both oversee and appoint external experts for producing texts under the auspices of SandHI.

3. It is mandatory for all IIT Kanpur SandHI participants, to integrate their research into the regular course curriculum. They will do this either by preparing short modular courses or in terms of a full-fledged semester long course. We believe that it is only by integrating the knowledge of ancient Indian science and technology into our regular teaching that we can hope to realize the true purpose of SandHI.

At IIT Kanpur, SandHI has become a confluence of various approaches towards the Indian knowledge systems, that were growing alone, in individual quarters. It has provided a platform for supporting and encouraging a passionate scientific enquiry of our heritage, not as a jingoist bid, but as an effort to enlarge and open our sphere of knowledge.

Note:

Here, is a list of faculty members of IIT Kanpur engaged in SandHI

1. Anurag Gupta (coordinator), Department of Mechanical Engineering
2. Mahendra Verma, Department of Physics
3. Sandeep Sangal, Department of Materials Science and Engineering
4. Shivam Tripathi, Department of Civil Engineering
5. Javed Malik, Department of Civil Engineering
6. Koumudi Patil, Department of Humanities and Social Sciences
7. Pankaj Wahi, Department of Mechanical Engineering
8. Saikat Ghosh, Department of Physics
9. Naren Naik, Department of Electrical Engineering
10. Raj Chabra, Department of Chemical Engineering
11. Ashish Garg, Department of Materials Science and Engineering
12. Bharat Lohani, Department of Civil Engineering
13. Samit Ray Chaudhury, Department of Civil Engineering

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सन्धि
— an India's Ethos

Ancient India through the technological prowess of new India – need for patient and inclusive research

Pallab Dasgupta

Associate Dean, Sponsored Research and Industrial Consultancy (SRIC);
Professor, Department of Computer Science and Engineering; and Principal Investigator,
SandHI (Music) project1, IIT Kharagpur

The Ideal

SandHI is our modest attempt to discover the roots of India through scientific studies. We are belittled by the enormity of this venture and conscious of the responsibility it bequeaths on our research teams. Technology is based on scientific rationale, whereas fine arts, religion, language and music are based on perception and natural understanding. The task of finding the scientific basis for factors that are subjective and intuitive in nature is a daunting challenge and fraught with sensitive and questionable outcomes. We must be patient and inclusive of all who wish to join this discovery of ancient India through the technological prowess of new India.

The great civilizations of the world have always carried with them their distinctive cultural and socio-economic traits. Past scholars of history, politics, and culture, travelled to other parts of the world, often suffering great hardships on their way, to learn about other civilizations and their values. This resulted in cross pollination of ideas, both in the scientific and sociological domains. Today, with the digital age providing us with a myriad of information about other societies, an average individual has the potential of becoming a true citizen of the world.

The civilization in the Indian sub-continenthas been shaped by the convergence of multiple races. The Indian continent has been invaded by numerous civilizations over the years, the *Sakas*, the *Huns*, the *Greeks*, the *Persians*, the *Pathans*, and the *Moghuls*, to name a few. A remarkable aspect of these invasions, or for that matter the after effect of these, is that a significant fraction of the invaders continued to stay back in the sub-continent and eventually became part of the Indian civilization. This inclusive nature of the Indian civilization has enriched many facets of the society, ranging from fine arts, science, music, religions and religious tolerance, all of which are hallmarks of the Indian civilization.

Civilizations must look back from time to time to retrospect on the gains and losses from its evolution. This gives it the ability to learn from its past mistakes, to archive and rectify obliteration of its cultural and social traits, and to protect the signatures which formed its identity. Today such tasks can be greatly facilitated with modern technology, and therefore the confluence of technology and heritage is very important in the present context -- particularly because the digital era has led to the delightful cross pollination of civilizations, sometimes at the cost of obliterating their individual identities.

SandHI is our modest attempt to discover the roots of India through scientific studies. We are belittled by the enormity of this venture and conscious of the responsibility it bequeaths on our research teams. Technology is based on scientific rationale, whereas fine arts, religion, language and music are based on perception and natural understanding. The task of finding the scientific basis for factors that are subjective and intuitive in nature is a daunting challenge and fraught with sensitive and questionable outcomes. We must be patient and inclusive of all who wish to join this discovery of ancient India through the technological prowess of new India. Only then shall SandHI live up to its name.

SandHI, a fusion of mind-systems transcending boundaries

Priyadarshi Patnaik

Professor-in-charge, SandHI (Documentation, Dissemination and Communication-Outreach);
Professor, Department of Humanities and Social Sciences, IIT Kharagpur; and Principal Investigator,
SandHI (Music) project2, IIT Kharagpur

The Process

Working with SandHI MHRD project makes one aware of both these things. Each project looks at problems, 'things,' that belong to no distinctive discipline and hence to everybody. A fond parable used in Jain Anekaantavaada is that of the elephant and the six blind men. Each one touches the elephant and perceives it differently. Someone touches the teeth and defines the elephant as hard and long and sharp. Another touches the tail and thinks the elephant is elongated and flexible like a snake. A third touches the leg and defines the elephant after a pillar. None can grasp the totality. But if the six blind men come together, they would probably be able to solve the problem of defining the elephant much more comprehensively. SandHI is this convergence, this re-articulation of the problem and the solution with shared knowledge and shared humility.

SandHI, which often refers to the fusion of sounds across boundaries, metaphorically transcends that meaning and covers a lot more. It is the point of confluence, convergence, intersection, interaction, transition, union, etc. – and underlying all these meanings a 'metamorphosis,' a 'transformation' is hinted at.

Something changes. Identities are 'lost,' they merge. Ego gives way to sublimation. Things which are very different, but which have an underlying sub-strata of commonality, come together. It is that critical point where identity and difference are mapped. At *s*andHI there is identity (merged). Move away from the intersection and the differences are apparent. Somehow, two different messages are communicated. One, for all their apparent differences, things co-exist, and then merge, becomes one. Two, all things have composite identities, they acknowledge difference, it is only through differences that identities are formed.

Working with SandHI MHRD project makes one aware of both these things. Each project looks at problems, 'things,' that belong to no distinctive discipline and hence to everybody. A fond parable used in Jain *Anekaantavaada* is that of the elephant and the six blind men. Each one touches the elephant and perceives it differently. Someone touches the teeth and defines the elephant as hard and long and sharp. Another touches the tail and thinks the elephant is elongated and flexible like a snake. A third touches the leg and defines the elephant after a pillar. None can grasp the totality. But if the six blind men come together, they would probably be able to solve the problem of defining the elephant much more comprehensively. SandHI is this convergence, this re-articulation of the problem and the solution with shared knowledge and shared humility.

Working with SandHI has made me realize that knowledge is not (and should not be) a privilege. It is a gift to be shared. It belongs to everybody. The compartmentalization collapses, different knowledge give up their ego, come together to share and to solve. In this sharing and solving we move to the root,

realize that different branches of knowledge are not really separate – in all real life problems they actually exist as one. We separate them for our convenience, in order to understand better, and at some point in our evolution; have become a blind man each, carrying the burden of our own specialized knowledge. SandHI allows us to look beyond our boundaries, at knowledge, as a whole; and the whole is a real life problem; a problem that belongs to humanity; that which can be solved through unity.

Re-exploration: Mythology, Geo-archaeology and Language

From Sarasvati to Ganga

Michel Danino
Guest Professor, IIT Gandhinagar

The problem and its solutions

Despite the broad consensus, some scholars started in the 1980s questioning this term and the identification between Ghaggar and Sarasvati. What prompted this rather late reaction? The pattern of settlements in the Sarasvati basin now revealed that in its central part - roughly southwest Haryana, southern Punjab and northern Rajasthan - most Harappan sites were abandoned sometime around 1900 BCE, a period coinciding with the end of the urban phase of the Indus civilization. Clearly, the river system collapsed— which archaeologists now see as a contributing factor in the decline of the brilliant Indus civilization.

Praised in the Rig-Veda as a 'mighty' river flowing 'from the mountain to the sea' somewhere between the Yamuna and the Sutlej, the Sarasvati is reported a few centuries later to be disappearing in the desert at a point called *Vinashana*, then a revered pilgrimage site. The river went on dwindling down, eventually becoming 'mythical', finally relocated at the confluence between Ganga and Yamuna as an 'invisible' river so she would be remembered (Danino, 2010).

As early as in 1760, a map from *The Library Atlas* (Bryce, Collier & Schmitz) showed the Sarasvati (spelt 'Soorsuty') joining the Ghaggar ('Guggur') in Punjab; indeed, even today a small stream called 'Sarsuti' seasonally flows there. In 1778, James Rennell, a noted English geographer and cartographer, published a *Map of Hindoostan or the Mogul Empire* with similar details. In the early 19th century, British topographers surveyed the bed of the Ghaggar, a
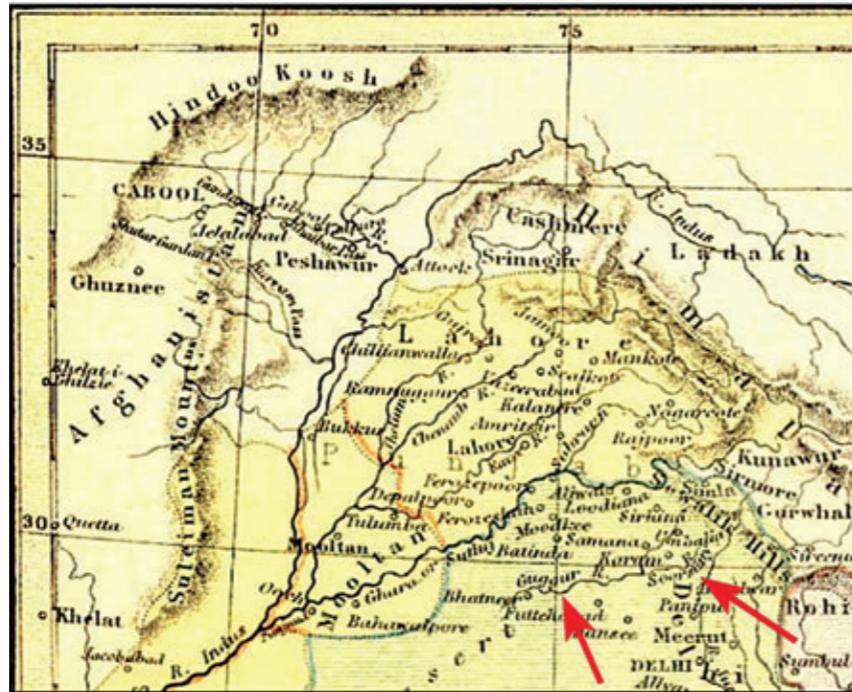
The Sarasvati and the Ghaggar marked by the two arrows in this detail of a 1760 British map. (Courtesy Prof. Frances Pritchett of Columbia University, www.columbia.edu/itc/mealac/pritchett/00maplinks/colonial/india1760/india1760.html)

seasonal river flowing down from the Shivalik hills, and found it much too wide for the paltry waters it carried during monsoons. The first scholar to propose, in 1855, that the Ghaggar-Sarasvatiwas the relic of the Vedic Sarasvati was the noted French geographer Louis Vivien de Saint-Martin (Vivien de Saint-Martin, 1858). Subsequently, nearly all Indologists, from Max Müller to Monier-Williams, Macdonellor Renou accepted this thesis. Geologists such as R. D. Oldham (1886) joined in, followed by geographers such as the Indian Shamsul Islam Siddiqi (1944) or the German Herbert Wilhelmy (1969).

The Sarasvati and the Indus Civilization

Archaeology sprung a major surprise by redefining the Sarasvati's role. In the 1920s, the Bronze Age cities of Harappa and Mohenjo-daro came to light; initial findings were limited to the Indus Valley and Baluchistan, but in 1941, the intrepid explorer and Sanskritist Marc Aurel
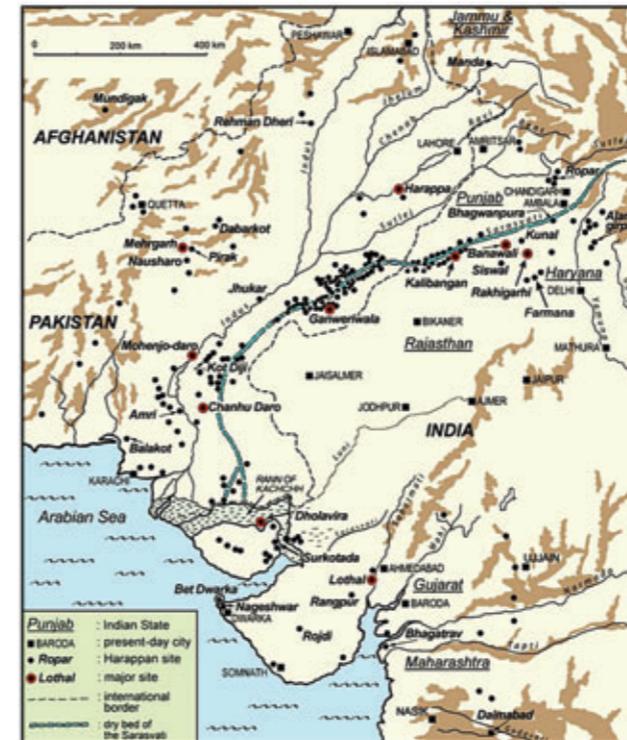
General map of the Indus-Sarasvaticivilization (map by Michel Danino)
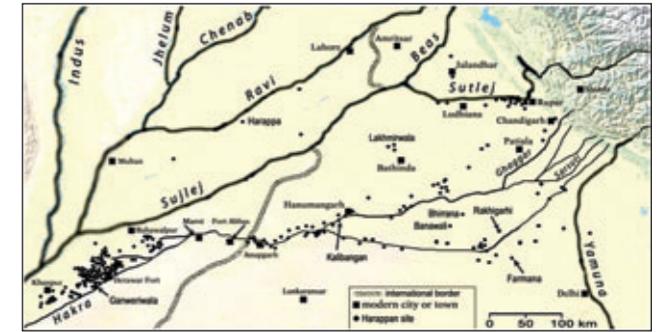
Mature Harappan sites in the Sarasvati basin (map by Michel Danino)

Stein conducted an expedition in the Bahawalpur State— today's Cholistan, an arid region of Pakistan where the Ghaggar's dry bed continues under the name of 'Hakra' (Stein, 1942). There, Stein stumbled upon many ruined sites of Harappan culture. Decades of further explorations both in India and Pakistan have established that the Sarasvati basin was home to at least 360 sites of the Mature (or urban)Harappan phase (2600–1900 BCE). This includes settlements such as Bhirrana, Rakhigarhi, Kunal or Banawali (all in Haryana), Kalibangan (Rajasthan) or Ganweriwala (Cholistan) — which explains the alternative term of 'Indus-Sarasvati Civilization'.

The Sarasvati and the Aryan Issue

Despite the broad consensus, some scholars started in the 1980s questioning this term and the identification between Ghaggar and Sarasvati. What prompted this rather late reaction? The pattern of settlements in the Sarasvati basin now revealed that in its central part - roughly southwest Haryana, southern Punjab and northern Rajasthan - most Harappan sites were abandoned sometime around 1900 BCE, a period coinciding with the end of the urban phase of the Indus civilization. Clearly, the river system collapsed— which archaeologists now see as a contributing factor in the decline of the brilliant Indus civilization.

Let us recall that the Rig-Veda's hymns are commonly said to have been composed by Indo-Aryans shortly after their migration to India around 1500 BCE. However, by that time, the Sarasvati had been reduced to a minor seasonal stream: how then could the said Aryans praise it as a 'mighty river', the 'best of rivers', 'mother of waters',

etc.? There is a chronological impossibility. Either the composers of the hymns lived much earlier, contradicting mainstream Indology, or, as the objectors now asserted, the Ghaggar-Hakra was not the Sarasvati extolled in the Rig-Veda. But their alternative explanations have run against the Rig-Veda's own testimony that the river flowed between the Yamuna and the Sutlej.

New Research on the Sarasvati

Leaving aside the controversy, we now have scientific research combining geology and river studies. Satellite imagery is another useful tool, but cannot by itself date the numerous buried palaeo-channels (ancient waterways) it has brought to light; anyone can today access websites such as Google Earth and view the well-marked bed of the Ghaggar, but when did a perennial river last flow through it?

Recent studies have thrown new light on the ancient river. In 2009, U.K. geologist Peter Clift found that 'between 2000 and 3000 BCE, flow along a presently driedup course known as the Ghaggur-Hakkra River ceased, probably driven by the weakening monsoon and possibly also because of headwater capture into the adjacent Yamuna and Sutlej Rivers' (Clift, 2009).Three years later, Clift's multi-national team, basing itself of U-Pb dating of zircon sand grains, concluded that the Yamuna once flowed into the Ghaggar-Hakra, but switched eastward tens of thousands of years ago; the Sutlej also contributed to the Ghaggar systembut abandoned it 10,000 years ago or earlier (Clift et al., 2012). But the paper remained non-committal as regards the precise time for the drying of the Ghaggar itself.

In 2012, too, LiviuGiosan, Peter Clift and other geoscientists disagreed that 'large glacier-fed Himalayan river watered the Harappan heartland on the interfluve between the Indus and Ganges basins'; rather, 'only monsoonal-fed rivers were active there during the Holocene' (that is, the last 10,000 years or so). In particular, 'rivers were undoubtedly active in this region during the Urban Harappan Phase'. Indeed, the geoscientists found 'sandy fluvial deposits approximately 5,400 [years] old at Fort Abbas in Pakistan, and recent work on the upper Ghaggar-Hakra interfluve in India also documented Holocene channel sands that are approximately 4,300 [years] old.' (Giosan et al., 2012) In a later comment on the paper, Giosan clarified, 'Our

research points to a perennial monsoonal-fed Sarasvati river system with benign floods along its course' (Giosan et al., 2013). The Ghaggar-Hakrawas thus active during the urban Harappan period, although apparently not (or no longer) fed by glacial sources.

The last point remains an object of debate among geologists. What matters is the acknowledgement of a perennial Ghaggar's role in sustaining numerous Harappan urban settlements, and the coincidence between its dwindling down and the withdrawal of Harappan sites from its central basin. This is further supported by another 2012 study, directed by the Indian geologist Rajiv Sinha, which mapped palaeo-river sedimentary bodies in the subsurface by measuring their electrical resistivity (water-bearing sediments having a lower resistivity than dry ones). The study offered 'the first stratigraphic evidence that a palaeochannel exists in the sub-surface alluvium in the Ghaggar valley. The fact that the major urban sites of Kalibangan and Kunal lie adjacent to the newly discovered subsurfacefluvial channel body ... suggests that there may be a spatial relationship between the Ghaggar-Hakrapalaeochannel and Harappan site distribution' (Sinha et al., 2013).

Such a conclusion had been reached by archaeologists long ago, since Kalibangan, for instance, shows no evidence of independent water supply; unlike Mohenjo-daro, it had very few wells, and unlike Dholavira, no reservoirs, yet it was continually occupied for several centuries: for its water supply through the year, it must therefore have depended on the Sarasvati, on whose left bank it lay, with entries into its fortified enclosures facing the riverbed.

Apart from river studies, many palaeoclimatic studies have in recent years pointed to a weakening of the Indian summer monsoon from 2200 BCE onward (Danino, 2015). Whether the long drought that followed is the cause for the break-up of the Sarasvati is likely but remains to be firmly established.

From Sarasvati to Ganga

Two lessons flow from the river's disappearance. The first is that it forced migrations of Harappans in several directions, in particular eastward, crossing Ganga and mingling with agrarian communities long established in the Gangetic plains. The Late Harappans, as they are called, reverted to rural lifestyles but carried some of

their culture with them, which explains the transmission of a host Harappan cultural features, symbols, practices and technologies to the later Ganga-Vindhya civilization. Besides, Indological studies have shown that the sacredness of the Sarasvati and her attributes as a goddess was transmitted to Ganga in the course of centuries.

Secondly, it is now clear that climatic and environmental disruptions played a major part in the break-up of the Indus civilization. No one can deny anymore that we are now undergoing another major climatic change. With human interference (deforestation, excessive damming, etc.) compounding the problem, there have been warnings that Ganga may turn into a seasonal river sometime this century; we must hope that mitigating steps will be urgently taken to save Ganga from becoming another Sarasvati. Harappans had time and space to relocate, if Ganga and some of its tributaries such as the Brahmaputra disappear, we may have neither.

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Aryan Invasion: Myth or Reality

Amitabha Ghosh
Ex-Director, IIT Kharagpur

The thought

There is no theory that is as much emotionally charged and politically loaded as the Aryan Invasion Theory (AIT). Besides, this theory also acts as a major deciding factor in the history of the Indian subcontinent. The theory that was supposed to appear very convincing in the 19th century is now not on that solid a ground after the discovery of the Indus valley sites of Harappa and Mohenjodaro. There have been many more interesting recent discoveries that make it mandatory to revaluate the strengths of AIT. It is, perhaps, still not yet time to come to a decisive final conclusion but it is clear that one has to keep an open mind on the question. In this article it will be shown how the theory developed and what are the possibilities based upon the recent findings.

The topic is extremely complicated and a complete solution to the problem requires expertise in archaeology, linguistics, Sanskrit and Vedic literature, geology and climatology, anthropology and genetics. As a matter of fact expertise in 'history' is, perhaps, least relevant. Of late, application of advanced technology has been able to figure out many interesting findings on the geological and climatic features of ancient times. Genetics, the latest tool has come very handy in unraveling the history of human migration during the ancient times and in finding the genetic linkage among the people of different regions and countries.

THE THEORY: According to the original Aryan Invasion Theory India was invaded around 1500 BC by a nomadic tribe of European / Central Asian origin, called 'Aryans', and thus started the Vedic civilization. They brought Sanskrit language with them and composed the Vedas that later gave birth to the religion we call today 'Hinduism'.

However, as recent discoveries are opening up many new vistas in the pre and proto history of India many eminent archaeologists have felt the need to revise the old version of ancient Indian history though some western and a few Indian 'historians' still harbour extreme dislike for any doubt expressed about the proposal of an Aryan invasion around 1500 BC. The following paragraph from a recent book by the eminent archaeologist Prof. Dilip K. Chakrabarti, Emeritus Professor of South Asian Archaeology, Cambridge University, shows the situation.

"The past is a hotly contested arena of modern times, and the fact that it has become so is in a large measure due to a sense of monolithic, racist part that we have inherited as a colonial legacy in a large part of the world. In the case of India, one immediately realizes that since the beginning of research on the history of ancient India, the story of its conquest by a carefully constructed 'superior' racial and linguistic group called the Aryans has been an overwhelmingly dominant theme and that this conquest and the subsequent assimilation of the various indigenous strands of culture by the conquering Aryans have been said to constitute the very basis of ancient Indian society and history. Even if this theme and approach are true – and as we shall see in a later section they are not – why should those who are considered beyond the Aryan pale accept this reconstruction of the part as their own?"

ORIGIN OF THE THEORY: Till the middle of the 19th century, for 3000 years of recorded history of India, no one ever heard that the Vedic civilization and Sanskrit language were imported by outsiders. In fact no mention of such

English	Sanskrit	Persian	Greek	Latin	Lithuanian	Celtic	Gothic	German
One	Eka	Yok	Els	Unus	Vienas	Oen	Ains	Eins
Two	Dva	Du	Dua	Duo	Dvy	Dau	Twat	Zwei
Three	Tri	Sih	Tries	Tres	Trys	Tri	Threis	Drei
Four	Chatur	Chahar	Tessares	Quartuor	Keturi	Cethir	Fidwar	Vier
Five	Pancha	Panj	Pente	Quinque	Penid	Coic	Fimf	Funf
Six	Sasth	Shash	Ez	Sex	Szezi	Se	Saths	Sechs
Seven	Sapta	Haft	Epta	Septem	Septyni	Secht	Sibun	Sieben
Eight	Ashta	Hasht	Okto	Octo	Osztuani	Ocht	Ahtau	Acht
Nine	Nava	Nuh	Ennea	Navem	Devyni	Noi	Nun	Neun
Ten	Dasha	Dah	Deka	Decem	Deszimt	Deich	Taihun	Zehn

an important landmark event is found in the writings of Greek historians when they came in contact with India in the 3rd century BC. No hint of such a mega event was found in the writing of Megasthenes, the Greek traveler. His and other ancient Greek travelers' accounts indicate that there was a continuous history of about 153 generations of kings reigning for 6451 years till the time of Chandragupta. None of the early travelers (even Alberuni at a later date) even remotely hinted the Vedic literature or the language Sanskrit to have come from outside through any 'Aryan Invasion'. Neither, is there any hint of such a racial migration in the huge volumes of puranic literature of ancient India.

In 1767 a French missionary named Coeurdoux and soon after, in 1786, Sir William Jones, a British judge of the High Court in Calcutta noticed the remarkable similarity of Sanskrit with many non Indian languages. The table above demonstrates this fact.

This finding created a serious problem among the western scholars. Till the 18th century it was taught in the west that the original language was Hebrew as it was spoken by the Almighty and he taught Adam the language. As per the biblical doctrine all people of the world were descendents from Noah's three sons – Shem, Japhet and Ham. Semitics were Shem's descendent and Europeans came from Japhet. The rest of the world's population were Ham's descendents. Sir James and other scholars like Franz Boff, Schelling etc. came to the conclusion that Sanskrit is a Japhetic language. The serious question that emerged was – how did a Japhetic language be spoken by Hamitic people?!

The unavoidable conclusion following the observation was that the language Sanskrit came from outside from somewhere near Europe. And as language can come only through the people who speak it, the people who spoke Sanskrit (termed as 'Aryans') came from outside and entered through the mountain pass in the north west. Their homeland was somewhere in East Europe / Caucasus or Central Asia. These people invaded India around 1500 BC, composed Veda and established the cultural heritage of India that is still continuing. Towards the middle of the 19th century the noted German indologist and Sanskrit scholar Friedrich Max Muller (and few others) proposed the 'Aryan Invasion Theory'. Max Mueller arbitrarily assigned the date 1500 BC and declared that the Vedas were composed between 1200 and 600 BC. Later Max Mueller retracted from his theory because of many inconsistencies it led to and also declared that the dating of 'Rig Veda' was not possible the way he thought, but the British rulers, who colonized India, did not let the theory die. More and more 'scholars' were encouraged to provide further obscure linguistic analyses supporting the theory under the patronage of the British Government. And thus the 'Aryan Invasion Theory' was born.

POLITICAL MOTIVATION BEHIND AIT: The British rulers had a vested interest in propagating the Aryan Invasion Theory in the relatively recent past – 1500 BC. The main purpose was to convince their subjects in India that the British rulers belong to the same race that came and founded the basis of the Indian religion and the Vedic literature & philosophy 3500 years ago. Thus, they have equal moral right to rule India as any other native community of India. There may exist some element of truth in the report that AIT was not just a matter of misguided research but was a conspiracy to distribute deliberate misinformation and the scheme was conceived at a secret meeting on April 10, 1866 in London held in the Royal Asiatic Society. It cannot be denied that there were quite a few British scholars who had genuine interest in resurrecting the lost glory of India and it's rich cultural heritage and philosophy. However, a major section of the

British ruling people did not belong to this class. They were immensely successful in their design as a substantial section of the newly English educated people felt very happy with the suggestion of a kinship with the white rulers though 100 generations before.

Thus, the AIT was popularized to teach people that the original Indian culture and philosophy were inherited from the people who were the same with the Europeans. Though the Indians generally feel overwhelmed and gratified that the European scholars study our ancient language and literature but purpose behind this was not always without ulterior motives. Col Boden, who sponsored the Sanskrit programme at Oxford, stated that 'They should promote Sanskrit learning among the English so as to enable his countrymen to proceed in the conversion of the natives of India to the Christian religion.' It may be painful to many of us to learn that even a scholar like Max Muller (whom we treat as a great admirer of Indian philosophy and cultural heritage) was not completely free from such Eurocentric bias towards Christianity. He wrote to his wife in 1866 while translating Rig Veda – *'This edition of mine and the translation of Veda, will hereafter tell to a great extent on the fate of India and on the growth of millions of souls in that country. It is the root of their religion and to show them what the root is, I feel sure, is the only way of uprooting all that has sprung from it during the last three thousand years.'*

The British rulers also used the theory to alienate the people of the southern part of India by propagating that they were driven away from the north by the invading outsiders (3500 years ago) whose descendents are the people living in the north. It was a very clever way to divide the people and rule. Because of such heavy politicization of an originally linguistic hypothesis at the very formative stage it has never been possible to free the Aryan Invasion Theory from political agenda. Even today any attempt to disprove the theory is considered to be an agenda of the Hindu Nationalistic forces!

POINT SUPPORTING AIT: It must be recognized that there were a number of important points that supported the original AIT. These were as discussed below:

(i) There was no sign of any ancient civilization in India in the 18th and 19th century. One expects some signs of that which can develop a rich philosophy and extensive literature.

(ii) The river 'Sarasvati' is described extensively in Rig Veda and it was treated as 'the river'. But no river in north west India fits the description raising the suspicion that it is outside Indian subcontinent from where the Aryans came.

(iii) Linguistic similarity among the languages in the Indo – European group and the presence of a completely different group of languages in south Indian can be explained by the AIT.

(iv) Apparent difference in looks between the people of north and south India is shown as a natural outcome of the phenomenon of Aryan Invasion.

(v) Sanskrit is such a scientific and rich language and the philosophical aspects contained in the Vedic literature is so intellectually matured that most European scholars had difficulty in accepting that those were the creations of ancient Indians. This very common mindset among the Eurocentric scholars can be evident from one example. In 1860 Rev Ebenezer Burges published a translation of 'Surya Siddhanta' in the Journal of American Oriental Society. The comments of one of the editors, Prof. Whitney, are given below. "We regard the Hindu science as an offshoot from the Greek, planted not far from the commencement of the Christian era, and attaining its fully developed form in the courses of the 5th and 6th centuries. And there can be no question that from what we know in other respects of the character and tendencies of the Hindu mind, we should not at all look to find the Hindus in possession of an astronomical science containing so much of truth. They have been from the beginning distinguished by a remarkable inaptitude and disinclination to observe, to collect facts, to record, to make inductive investigation." Though Rev. Burgess disagreed with such views and presented many evidence to prove both the antiquity and originality of Indian astronomy the majority mindset among the westerners is very appropriately reflected through the comments of Prof. Whitney. Thus, it was very difficult for them to accept that Sanskrit is an original Indian language and Vedas were composed by original Indians. Most of their theories, writings and analyses were full of wishful thinking and unsubstantiated interpretation heavily biased against Indians.

DISCOVERY OF SINDHU – SARASVATI CIVILIZATION: There was no archaeological evidence of any ancient civilization in India when AIT was proposed in the 19th century. However, the scenario got completely changed with the discovery of Harappa and Mohenjodaro in the 1920s. But, the AIT proposers immediately jumped to the conclusion that the highly developed cities in the Indus valley were destroyed by the invading Aryans. They also showed the absence of any horse remains in the Indus valley cities contrasting with the extensive reference to horse in Rig Veda. This, according to them, was a major support for AIT. The Aryans came on swift horses (which was not known to original people of India) and could overrun the country they conquered. Inadequate knowledge in Vedic Sanskrit combined with self imposed confidence resulted in further misinterpretation supporting the AIT. The European scholars thought that 'ayas' described in Rig Veda meant 'iron'. There was no iron made objects in the Indus valley ruins. This they used as a proof that Rig Veda was composed after the era of Indus valley civilization. Unfortunately 'ayas' could have easily meant 'metal' not 'iron'. In fact in the latest literature 'iron' mentioned as 'krisnaayas' or 'shyamayas' and 'copper' is described as 'tamraayas'. Thus, 'ayas' meant 'metal' in Rig Veda. They theorized that the original population of the Indus cities fled to the southern part of India and their descendents are the present day South Indians. Sir Morhimer Wheeler and Sir John Marshal fixed the date of Harappa civilization from 2500 BC to 1500 BC to match it with the suggested date of Aryan Invasion as 1500 BC. Unfortunately, for the AIT protagonists, no evidence for any large scale massacre was found to suggest destruction by invading Aryans. Only 37 skeletons were found in the cities of Harappa and Mohenjodaro. Thus the theory was changed from 'Aryan Invasion' to 'Aryan Migration'.

Figure 1 shows some views of Mohenjodaro and the city plan. Figure 2 shows a view of Harappa and the city plan. Because of the use of a huge amount of bricks from the site for constructing the nearby railway line before the nature of the ruin was recognized, Harappa site was severely damaged. Both these cities were so well planned that very few cities of modern times can match their level of excellence. Though initially only these two cities were discovered and other sites were still unknown this civilization was considered to be confined to Indus valley only and was called 'Indus Valley Civilization'. Subsequently a very large number of settlements belonging to the various stages of Harappan culture have been discovered as indicated in Figure 3.
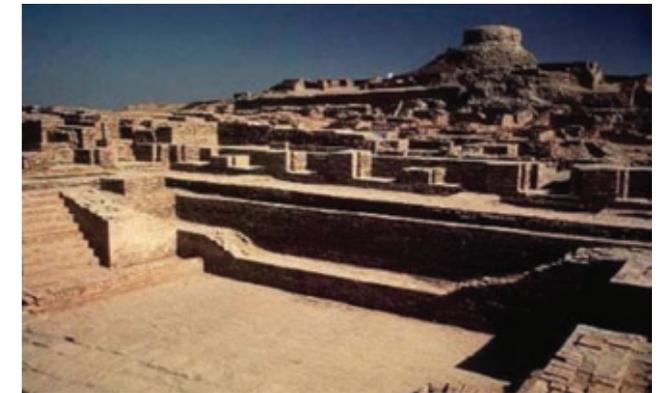
Figure 1(a)

Figure 1(b)

Figure 2(a)

The most important ones have been indicated by boxes. The total number of sites is more than 3000 and many more may still be there undetected. The earliest one has been recently discovered at Mehergarh in Baluchistan which is considered to be about 9000 years old. All the

Figure 2(b)

sites have been classified into three stages – (i) early Harappan, (ii) mature Harappan, and (iii) late Harappan. From early Harappan to mature Harappan phase there was distinct improvement in all facets of the system. However, after the mature phase, 3000 – 2500 BC, things started declining and in the late Harappan stage the decline in all aspects of the civilization was very noticeable. The total area over which all the settlements are distributed is more than 800, 000 sq. kilometers – i.e as big as Western Europe. Table 2 shows the distribution of sites. Considering that a very large number of sites belong to the basin of the (now dried up) Sarasvati basin
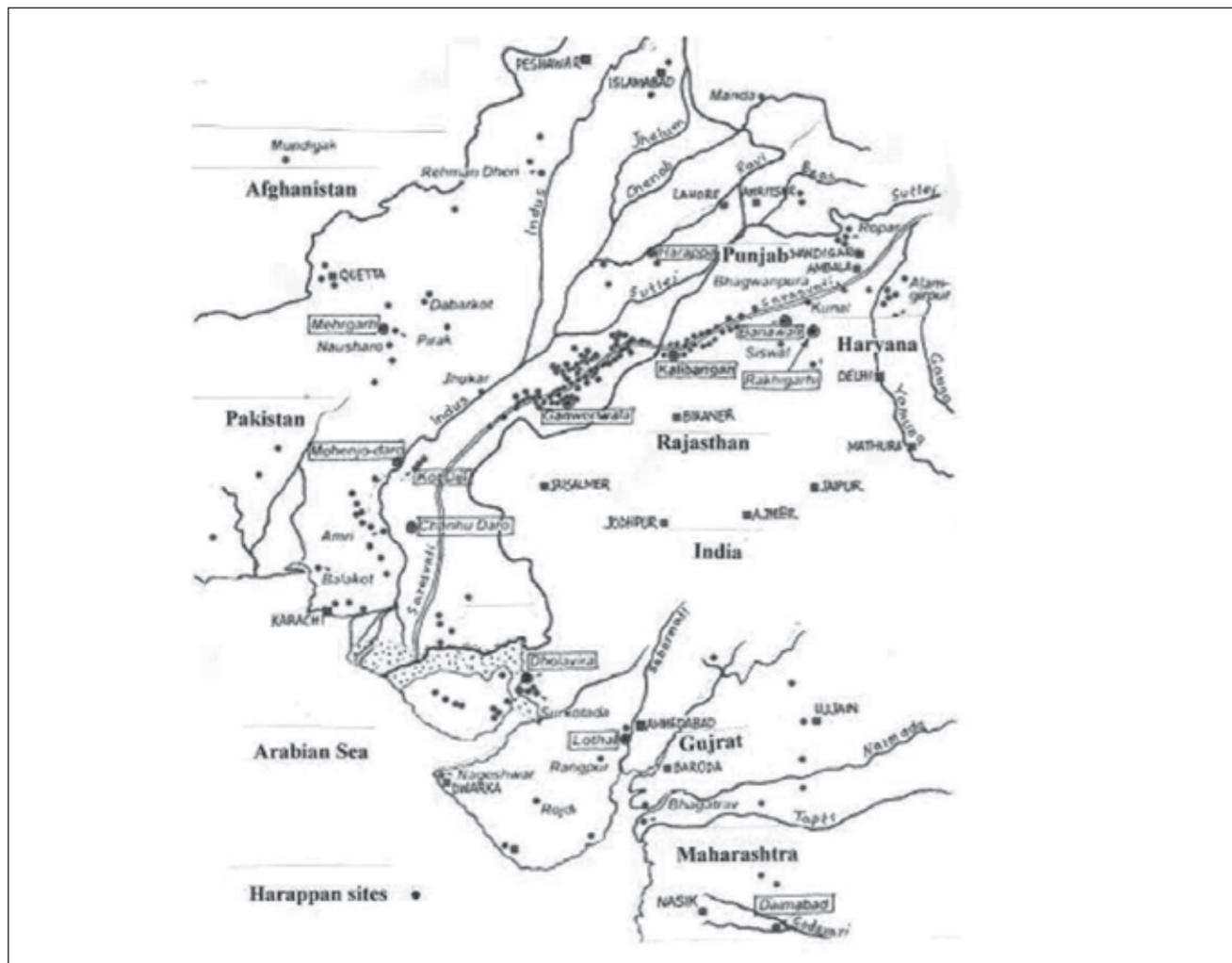
Figure 3

Region	Number of Harappan sites discovered			Total Number
	Early Stage	Mature Stage	Late Stage	
Sarasvati Valley	640	360	1378	2378
Uttar Pradesh	2	32	10	44
Himachal, Jammu, Delhi	1	---	4	5
Gujarat	11	310	198	519
Indus valley & Western Pakistan	385	438	12	835
Total	1039	1140	1602	3781

Figure 4

Figure 5

archaeologists now prefer to use the term 'Sarasvati Sindhu Civilization' instead of simply 'Indus Valley Civilization'.

Mohenjodaro, Harappa and many Harappan sites discovered later were very well planned and big cities with excellent infrastructure. Mohenjodaro was about 3 miles in size and had a large population. Cities like Kalibangan, Lothal, Dholavira also demonstrate very matured and high level city planning. Mehergarh (Figure 4) covered a total area of about 500 acres and is considered to be the largest town in antiquity. It had an estimated population of about 20,000. The discovery of Mehergarh shows the long and continuous civilization that has been existing in India.

It is amazing to recognize the fact that such a huge area was under the same culture. All towns were using same weight and length measuring units. A large number of seals with inscriptions and figures of animals, people and symbols have been found in the Harappan sites. Figure 5 shows a few examples.

Though Indus script is not deciphered till now but it is found that the same script had been in use in all the towns. The people (from the few remains that have been found) were of mixed ethnicity and the society was very civilized. As has been noticed in most ancient societies in India there was no massive royal palaces (like in Egypt); instead the dwellings of the whole population did not demonstrate any major distinction and variation. It is very difficult to accept that such a large and well organized civilization was driven away by some horse riding nomads!

At the matured stage Sindhu – Sarasvati people had extensive trade with West Asian countries as shown in Figure 6.

Many seals and articles, pottery, jewelry etc. of Harappan culture are found in Iran, Mesopotemia, Dilmun, Magan, Margiana, Oxus, Bactria etc. But surprisingly nothing from these countries are found in Harappan settlement (except one cylindrical seal from Mesopotemia). This one sided transmission of articles is very surprising!

HORSE IN ANCIENT INDIA: Horse occupies an important place in Rig Veda but no horse remains have been discovered in Harappan sites initially. So, this became another strong point for the proponents of the 'Aryan Invasion' hypothesis. According to them 'horse' was brought to India by the Aryan invaders. In fact the swift running ability of horse was given as one of the major military advantages of the Aryans that helped them conquer the land.

Subsequently a terracotta figure of a horse driven chariot has been found in Indus valley excavations that demonstrate the existence of horse in India before the Aryans came to India. Even skeletal remains of domesticated horse have been recently discovered in Harappan sites. When one visits the ancient rock shelters at Bhimbethka near Bhopal many of the 9000 year old cave paintings depict horse and horse riding fighters very clearly as shown in Figure 7 (a – c).

Some cave paintings in Nilgiris, Tamil Nadu have been discovered in 2006 which dates back to 2000 BC. Warriors on horse back are also seen in these paintings (Figure 7d). Thus, existence of domesticated horse in India much before 1500 BC is clearly established demolishing the 'horse evidence' of AIT. But it must be also noted that conspicuous absence of an important animal like horse is very intriguing.

ANTIQUITY OF RIG VEDA: Though Max Muller initially dated Rig Veda to 1200 BC subsequently he himself accepted the adhoc nature of his suggestion. He actually mentioned that it is extremely difficult to establish the period of composition of the Vedas. It is extremely important to arrive at a dependable estimate of the Rig Veda's antiquity. There are primarily two major clues in this direction – astronomical description in Rig Veda and the era when Sarasvati flowed as a mighty river.

Astronomical Dating: The earth spins around its own axis once every 24 hrs. i.e. a day. At the same time the axis of the spinning earth also undergoes a slow precessional motion (just like a spinning top). The period of this precessional motion is about 26000 years. Because of this the two


Figure 6


Figure 7(a)

Figure 7(b)

Figure 7(c)

Figure 7(d)

Sl No.	Alignment	Location
1.	Vernal (spring) Equinox	Orion's Head (Mrigasira)
2.	Summer Solstice	Beta Lionis (Uttar Phalguni)
3.	Autumn Equinox	Lambda Scorpionis (Mula)
4.	Winter Solstice	Alpha Pegasis (Purva Bhadrapada)

All these could be observed only around 4000 BC

equinoctial points (when the sun is at an equinoctial point the day and night are equal everywhere) similarly the two days when the day is longest and shortest are called 'summer solstice' and 'winter solstice', respectively shift its location in the backdrop of the fixed stars. As a result the night sky configuration (at a given stage of the night from evening to early morning) changes for a given season. For example at present in the northern hemisphere, the constellation Orion is found to rise in the eastern sky during peak winter. But after 13000 years Orion will be seen in the eastern sky during peak summer evening. In ancient Indian astronomy the ecliptic was marked by 27 asterisms (Nakshatras) and from descriptions in Rig Veda the asterism at the equinoctial points can be identified. It is clearly mentioned in Satapatha Brahmana that Krittika was at the spring equinox. By direct calculation it is found that this could have happened around 3000 – 2800 BC. Rig Veda is much older and certain star alignments that can be identified from Rig Vedic text are shown in Table 3.

Prof. P. C. Sengupta did a painstaking research in the 1940's to show that an annular solar eclipse that took place on the summer solstice day and described in Rig Veda to have been observed by Atri from a cave in high snow clad mountains in the north west Himalaya must have happened in 3928 BC. This was published as a news item in 'Sky and Telescope', v.1, n.5, 1941, Harvard College observatory, Cambridge, Mass, USA.

Rediscovering River Sarasvati: The river Sarasvati, that has been described in Rig Veda as the mightiest of all rivers is perhaps, one of the most mysterious rivers in human history. The proponents of the AIT like Irfan Habib vehemently refuses to believe that such a river ever existed (at least not in India but could be in Iran or Afghanistan). He proclaims "All claims built upon the greatness of river Sarasvati are, accordingly, nothing but castles in the air, however much froth may be blown over them." Apparently he thinks that accepting the existence of mighty Sarasvati, as described in Rig Veda, amounts to taking away the Indus culture from the 'Dravidians' and 'non – Aryans'.

But now there is a serious threat to such a stand as recent scientific investigations have detected the dried up paleochannel of the mighty Sarasvati. The I RS – 1 C satellite image clearly identifies the dried up channel and it shows that the river bed was about 8 km wide in many places indicating its mightiness.
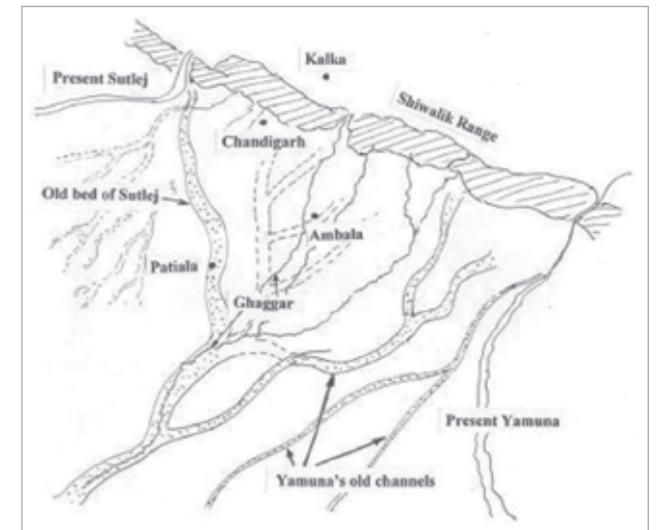
Figure 8
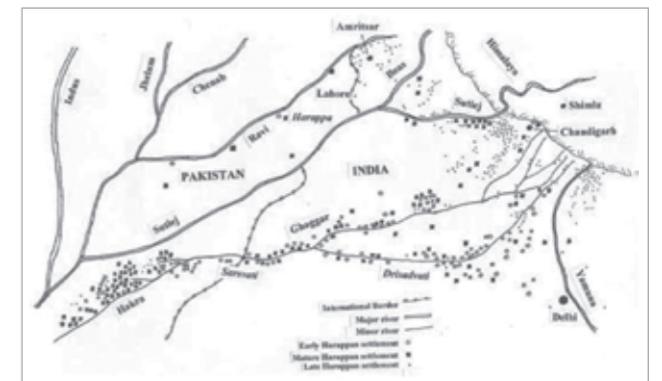
Figure 9

Figure 8 shows the paleochannels of the river discovered recently that clearly indicates that some tectonic upheaval in the Himalaya region forced the river Sutlej and Yamuna to change their courses. Earlier these rivers used to pour their water into Sarasvati making it a big perennial river. Herver Wilhelmy, a noted German geographer, reconstructed the Sarasvati in 1969 by studying the geographical features. Figure 3 shows that a large number of ancient settlements were situated along the bank of the paleochannel that is currently known as Ghaggar – Hakra. Recent hydrological and geological studies have shown that the river stopped being a perennial river in 2500 BC and dried up around 1900 BC. Sutlej met river Indus in the west increasing its water volume, thus causing frequent large scale flooding.

Chart 1

Pre Deluvial Era

Manu Svyambhuba

Priyavrata — Uttanpada

30 generations — *14 generations + 10 Prachetas*

Viswagajyoti — Barhasada

907 years of kingless deluge period

Post Deluvial Era

Kashyapa

3 generations

Manu Vaivaswata

Ila (Budha) — Ikshaku

3 generations

Nahusha

Yayati — *18 generations*

Yadu — Puru

73 generations — *15 generations*

Dusyanta — Mandhata

51 generations — *46 generations*

Divodasa — Rama

8 generations

Andhaka — Kuru

16 generations — *14 generations* — *32 generations*

Shantanu

Bhisma — Vichitrabirya

Krishna — Dhritarashtra — Pandu — Vidura — Brihadvala

Yudhistira Bhima Arjuna Nakula Sahadeva

Abhimanyu

Parikshit

1050 years

Mahapadma Nanda

~100 years

Historical Era

Chandragupta Maurya (321 BC)

Yamuna shifted towards the east and met river Ganga. River Drishadvati (also mentioned in Rig Veda) also dried up around 3000 BC – towards the later part of Rig Vedic era. Furthermore around 2000 BC there started a long dry spell bringing a 300 year long draught in the old Sarasvati basin that led to the massive migration of population towards east – the Ganga Yamuna basin. According to a majority of modern archaeologists the decline of Sarasvati – Sindhu civilization was primarily because of natural causes like recurring floods and draughts, and not due to any invasion by outsiders.

Figure 9 shows the distribution of early, mature and late Harappan settlements and a gradual shift towards the east (away from the deserted basin) can be clearly noticed.

From this rediscovered facts about river Sarasvati it is clear that it was a mighty perennial river only before 2500 BC and Drishadvati dried around 3000 BC. Thus, Rig Vedic texts, which describe these two rivers so vividly must have been composed during 4000 – 3000 BC.

ANCIENT DYNASTIES: Purana describes quite a few long lists of kings starting from Manu Svyambhuba. Megasthenes made a note in his report that he was shown a list of no less than 153 kings covering a period of 6451 years. The puranic list starts with Manu Svyambhuba's son Priyavrata and Uttanapada. Uttanapada dynasty reaches the 907 years of kingless period (deluge period) and afterwards Manu Vaivaswata and his son Ikshaku starts the post deluvial Solar dynasty that rules for around 100 generations. Anyway there are quite a few lists giving the names of kings in the important Solar, Lunar and other dynasties. In many occasions their kingdoms have also been described with locational details. What is important to note is that nowhere was there any indication of any invasion or that these dynasties were set up outside India and then they came to India. Considerable degree of antiquity of the puranic history should also be noted and the occurrence of the deluge is clearly mentioned. A quick glance at the Chart 1 gives some idea about some lines of the Puranic dynasties.

CONTINUITY OF CIVILIZATION: PROTOHISTORIC TO HISTORIC ERA:

One of the greatest mysteries of ancient India is what happened to the great and well developed Sarasvati – Sindhu civilization? Did it vanish and did not have any relation to historic India? Or, it slowly changed (and degraded due to major and disastrous climatic and other

geological changes) and after many centuries led to the growth of the Gangetic valley historical society? It is now more or less established that Rig Vedic civilization was contemporaneous with the Indus Valley civilization. They are located in the same region of India! Now a very amazing paradoxical situation is faced. There was an extensive and rich civilization full of well planned cities that continued for 4000 years but with NO literature. At the same time there existed a group of people in the same region and at the same time with extensive and rich literature but with NO archaeological evidence!!

As opined by most archaeologists the people who settled in the Gangetic plains in the later period of ancient Indian history could be the people who were slowly displaced from the dried up western part of the subcontinent. But because of very major migration and problems associated with resettlement taking a few hundred years there were many changes. However, now it is gradually coming to light that the Indus Valley (or Sarasvati – Sindhu) civilization and the following historical era were not totally delinked. Harappan settlements show many fire alters designed exactly according to Vedic prescriptions. The methods and principles of weight and length measurement in Sarasvati – Sindhu civilization were found to be in use in the Gangetic plain during the early historic period. It is wrong to conclude that the Harappan culture had a different burial system. As a matter of fact both burial and cremation systems were followed as also mentioned in Vedic texts. Many Harappan seals show figures in yogic postures as shown in Figure 10.


Figure 10

Figure 11(a)

Figure 11(b)

The importance of cattle and cow is very clear from the seals. In many seals sacred symbols like swastika and trident are clearly depicted (Figure 11a). The frequent 'endless knot' symbol found in Indus Valley sites are also found in the later historic period (Figure 11b).

There are also many amazing similarities between the Harappan seals and many punch–mark coins of later historic period as shown in Figure 12 a and b. This extensive similarity cannot be explained as simple coincidences.

Apart from the continuity of many symbols and figures from Harappan sites to the early historic period continuity of civilization of the Sarasvati – Sindhu valley and the Gangetic plain can be found from other aspects also. One such matter is the continuity in writing and scripts. Though a completely satisfactory deciphering of the Indus script is still awaited, statistical analysis indicates many similarities between Indus script and Brahmi. It may not be wrong to state that there had been some relationship between the two and it is even possible that Brahmi was derived from the Indus script.
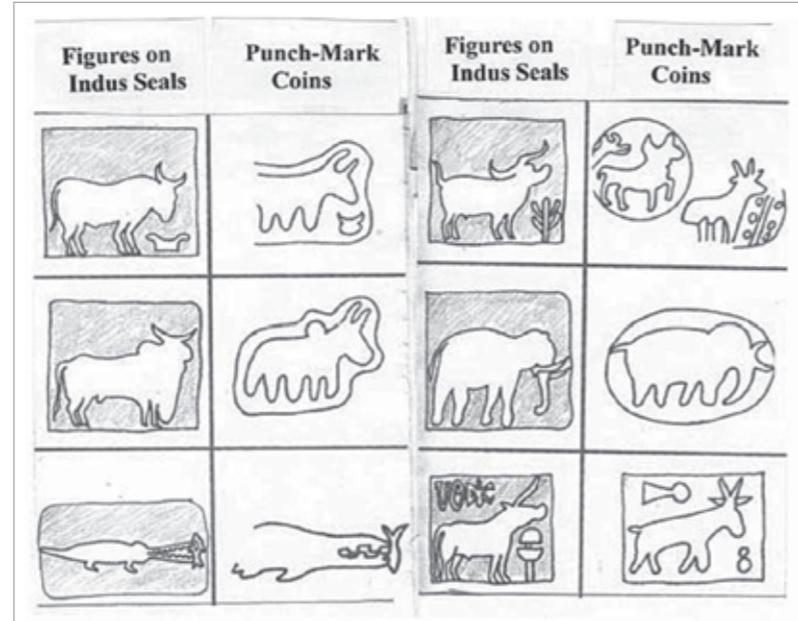
Figure 13 shows this good statistical correlation. However AIT supporters claim that Brahmi script was devised outside India! As there was a gap of 1300 years (mature Harappan stage at 1900 BC to historic India of 600 BC) it is difficult to arrive at any absolutely definite conclusion. But recently inscriptions with Harappan scripts have been found in Dwarka and Vaishali in north Bihar. Similarly Indus script has been found in Daimabad that is dated 1500 BC.

Figure 14 indicates the phenomenon and it is a clear indication of the use of Indus scripts much after the civilization stopped in the Sarasvati–Sindhu basin. Very recently Indus script writings have been discovered in Mayiladuthurai and Melaperumpallem in Tamil Nadu that is dated only 1100 BC! Therefore, there are enough indications of a continuity of civilization from 7000 BC to the early historic India of 600 BC. In Prof. Dilip K. Chakrabarti's language "*We do not suggest that Hinduism, as we find it today, was*
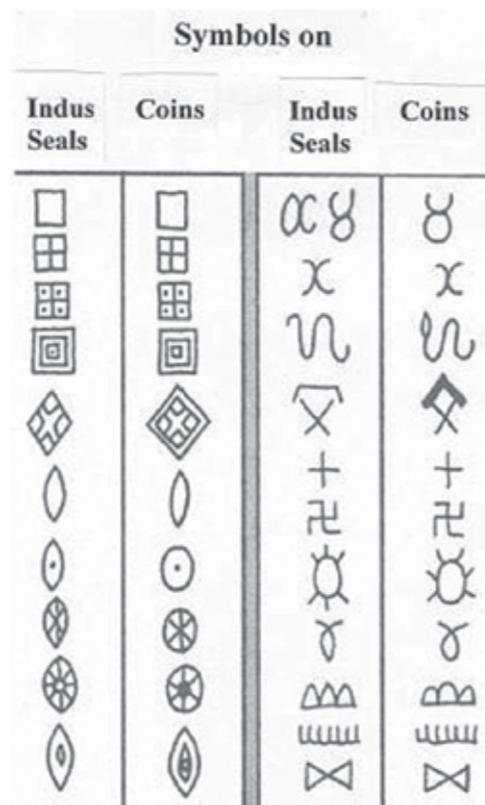
Figure 12(a)

Figure 12(b)

there in the Indus civilization. All that we would say is that some later features of Hinduism have been echoed by 'Indus' finds, and thus this civilization is likely to have contributed to the stream of 'sanatana dharma' or traditional religion of the modern Hindus." Of course, it is needless to mention that there were many changes and transformations due to a long gap and problems associated with resettlement in the Gangetic valley. The shift from west to the east was gradual and most scholars feel that major climatic change was the main reason.

GENETIC SURVEY AND HUMAN MIGRATION: Genetic analysis using DNA markers has developed into a very powerful diagnostic science in recent times. It has been established that every mother donates mitochondrial DNA to her offspring and every father contributes Y – chromosome to his sons. After every few generations DNA experiences some benign mutation. Using these facts the genetic experts have traced the whole migratory history of 'modern human' species. The results are not only amazing but make sense.

The genetic study indicates that a group of modern humans proceeded along the coast of east Africa about 85 to 90 thousand years ago and reached southern Arabia.

It was one of the ice ages (Figure 15) and the sea level was about 350 feet below the present level. This caused the land masses far better connected along the coast. The life style was what the anthropologists call 'beach combing'. It was much

Figure 13

Rank	1	2	3	4	5	6	7	8	9	10
Brahmi sign	ꖧ	ꖋ	ꖃ	ꖓ	ꖕ	ꖗ	ꖙ	ꖛ	ꖝ	ꖟ
Value	s	m	t	n	p	y	v	r	d	c
Percentage	12.6	11.2	8.6	7.9	6.9	6.5	5.1	4.6	4.2	4.0

Rank	1	2	3	4	5	6	7	8	9	10
Indus sign										
Frequency	2245	1254	837	459	411	406	343	292	256	243
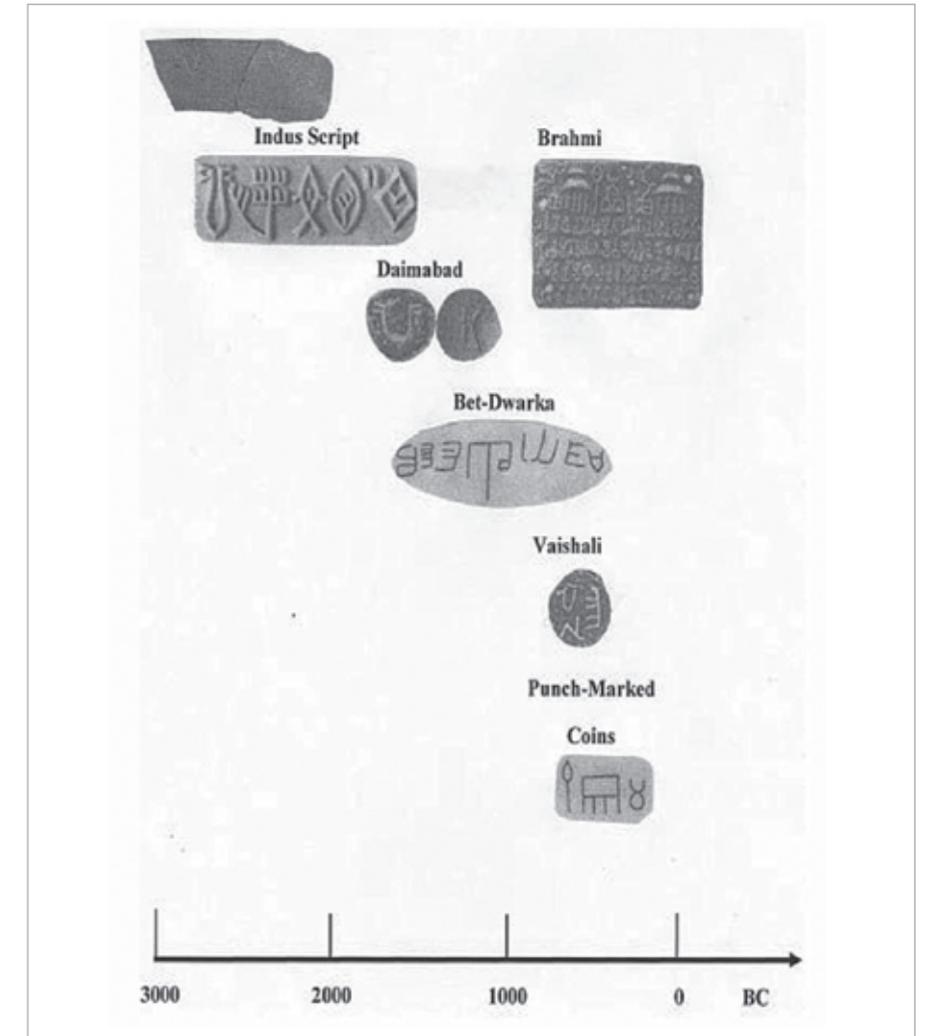
Figure 14

easier to collect sea food from sea; that food was also rich in protein and good for brain development. Due to the ice age condition it was not possible to progress towards the north. Around 80,000 years ago they reached India and proliferated into a number of clans. Some groups continued their journey along the coast and reached southeast Asia and after island hopping arrived at Australia around 65,000 years ago (it was possible as the sea level was much lower again around 65,000 years ago because of another ice age). Some groups did proceed along the banks of major rivers like Indus and Sarasvati and, after crossing the mountains, reached central Asia (Figure 16).

The modern man colonized Europe much later – 20 to 30 thousand years ago. It is, thus, not surprising to find very ancient well developed civilizations in Baluchistan and Sarasvati–Sindhu region. Genetic study has revealed no major migration into India except from Africa 80 thousand years ago. There is no indication of any major genetic disturbance during the 2nd or 3rd millennium BC when the Aryan invasion was supposed to have taken place. However, being still unable to accept that a sophisticated language to be indigenous to India, it is stated in National Geographic News Article in January 10, 2006 that based on the recent genetic study 'India acquired language, not the genes from the west'!! This goes against the principle that a language can migrate only through the migration of the speakers of that language. It has been established that script has gone out of India to south east and central Asia. It is also possible that Indo – European languages grew out of India.

In Vedas Devas are considered as good people and, after fight, the enemies, the Asuras were driven away. In Iranian ancient text Avesta, the Devas are considered bad and Ahuras (Iranians cannot pronounce 's' and pronounce Asura
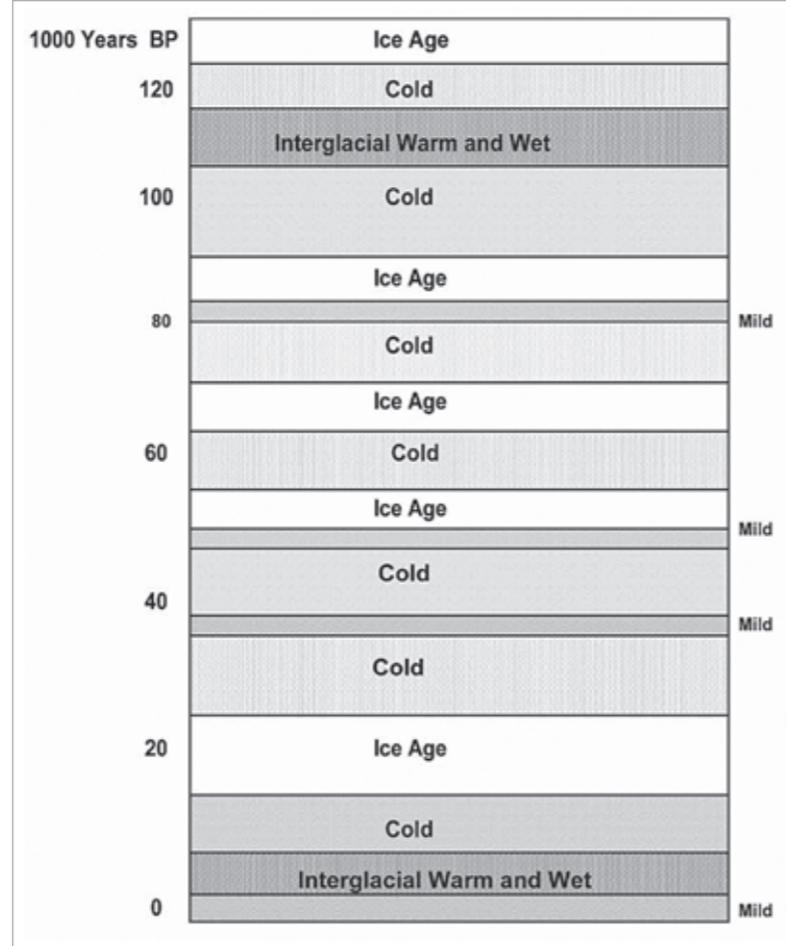
Figure 15

as Ahura) are taken to be good. It may indicate that Iranians migrated out of India after fights with another clan called Deva. May be they remembered the most revered river Sarasvati in their original homeland and gave the name to a local river that was called Harquaity. Since Sanskrit speaking people can pronounce three types of 's' and Iranians cannot pronounce any 's' it appears that the deterioration could be only when the language traveled out of India.

SOME MISCELLANEOUS POINTS AGAINST AIT: Scholars and researchers have raised certain other relevant points questioning the validity of AIT. Some of these are given below:

(I) How come the racial migration was completely forgotten by the whole people in such a short time? There is not the slightest hint that the people of northern India had a different homeland till 1500 BC in the huge amount of Vedic and Puranic literature. Even the Greeks who came to India in the 3rd century BC have not mentioned anything in all their

records. Instead their records indicate that India had a long list of ruling kings for almost 150 generations till the time of Chandragupta Maurya.

(ii) How come all the major geographical entities like rivers, mountains etc. bear only Sanskrit names? It is expected that there should have been names in the language of the people who lived in North West India before the so called 'invasion'. The names like Chicago, Ohio, Illinois, Michigan, Milwaukee, Mississippi, Colorado, Idaho etc. are all from the language of the Native Americans.

(iii) It is expected that the people who composed Vedas would have left some trace of that literature in their original homeland or along their route of migration to India. But there is no trace of any literature that resembles Rig Veda even remotely.

(iv) Even in Vedic literature there is evidence that the people of north India had made a reasonable progress in Astronomy. Such development requires observation over many generations from fixed regions on the surface of the earth. A nomadic wandering people like so called 'Aryans' can hardly develop astronomical science to a level as found in the Vedas.
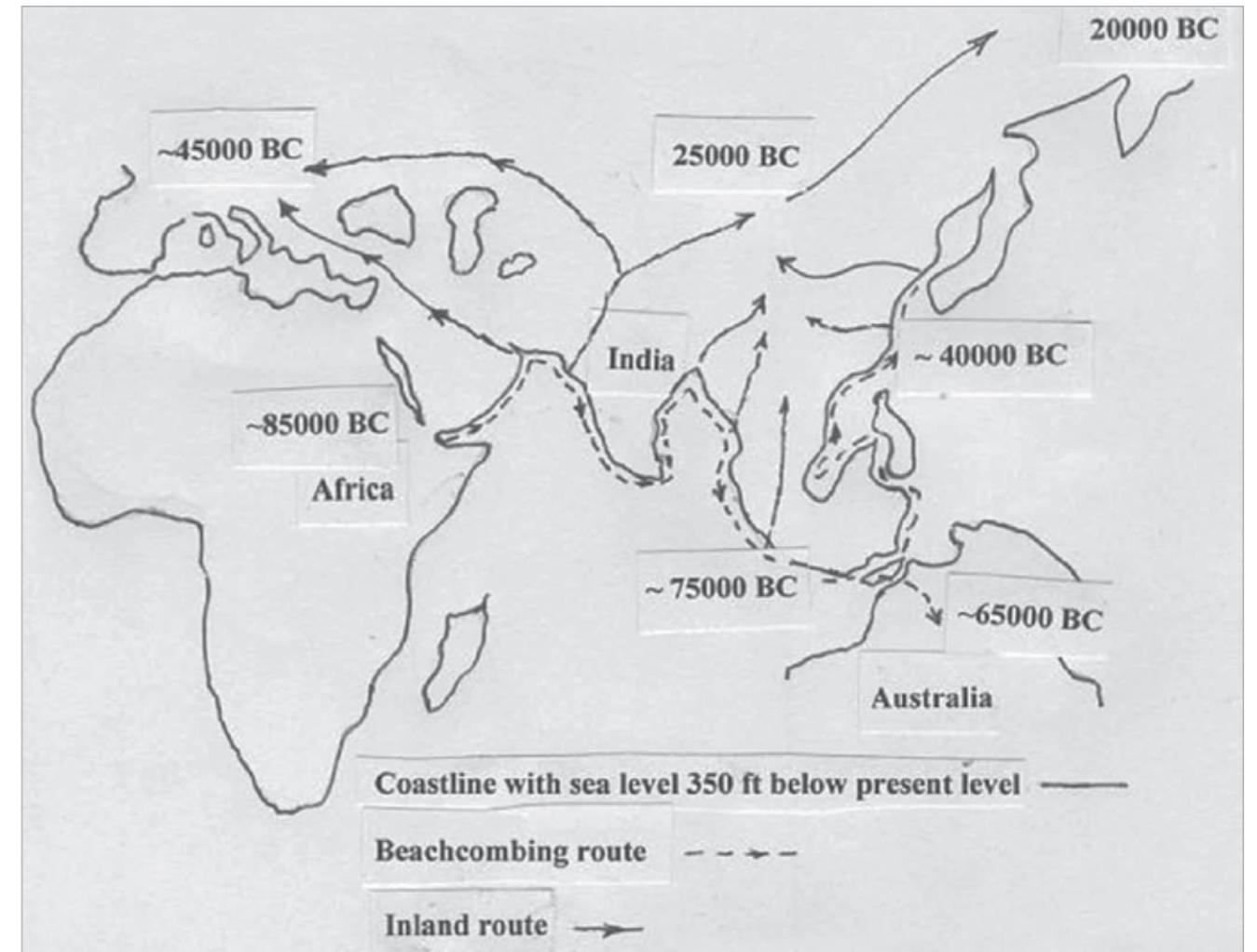
Figure 16

(v) The idea that Rig Veda mention 'iron' and so it has to be of comparatively recent origin (1200 BC) is not correct. Such an idea has been arrived at because of poor comprehension of the language by western scholars. 'Aayas' has been assumed to mean 'iron', but it represents 'metal'.

In the language of Jim G. Shaffer, an American archeologist who has worked extensively on many Indus valley sites – *"Current archeological data do not support the existence of Indo – Aryan or European invasion into South Asia any time in the pre – or proto historic periods. Instead, it is possible to document archaeologically a series of cultural changes reflecting indigenous cultural developments from prehistoric to historic periods."* Similar are the views expressed by many scholars and experts from India and abroad.

CONCLUDING REMARKS: It is true that odds now go very heavily against the typical Aryan Invasion Theory, and in all probability it is nothing but a myth. But still the ancient history of India is very ill understood. There are a number of features in India that is still very difficult to explain. Why the people of South India look different from those in the north? Why India's main language family has two very distinct groups? Why such large numbers of Indus seals do not depict any horse though Rig Veda refers to horse so often? May be there is still a huge amount of evidence of the ancient civilization in India waiting to be unearthed and discovered. Till then ancient history of India will continue to remain shrouded in mystery and controversy. But we must keep our minds open.

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Significance of Palaeography and Linguistic Palaeontology as Important Tools to Decipher Ancient Past

Sudipto Das
Author of *the Ekkos Clan*; Alumnus, IIT Kharagpur and VP Engineering, Mirafra Technologies

Abstract

When it comes to ancient Indian history, there's a lacuna of conventional historical evidences – archaeological, epigraphical, textual etc. –, which makes authentic reconstruction of the past a serious problem. In such scenarios unconventional tools like palaeography and linguistic palaeontology can be of great help. This paper cites a few examples where reconstruction of some aspects of the Indian antiquity is perhaps possible only through these tools. It also touches base on the authenticity of such reconstructions and the need for further researches before they could be accepted universally.

1. Introduction

It's often said that the Indians, in general, have been bad recorders of history. They wrote the first book – the *Rig Veda* – in the world, sometime in 1500 BC, many centuries before anyone else did anything similar. But something which can be treated as a historical record perhaps came more than a millennium later, in the form of Ashokan inscriptions in the 3rd century BC. (I'm not including the much older Indus Valley tablets in the category of historical records, as the Indus Valley script, unlike the Sumerian and Egyptian scripts, hasn't yet been deciphered.)

In the absence of historical also archaeological records it was an extremely daunting task for historians to authentically reconstruct the history of ancient India till the Buddha's time, around 7th century BC. But then, if we allow some degree of creativity alongside conventional scientific enquiry, we may use palaeography and linguistic palaeontology to recreate certain aspects of our ancient past which hasn't left behind any mark otherwise.

2. Palaeography

Dictionary says, Palaeography is the study of the handwritings of the past, and oftent he manuscripts as well, so that they maybe dated read, etc., and may serve as historical and literary sources.

In the recent times a related discipline, sometimes called Digital Palaeography, has come in very handy in analyzing and categorizing old manuscripts. Just discovering that two seemingly unrelated manuscripts use the same writing style can throw up lot of possibilities which can then be researched further to find the connections between them.

2.1 Origin of the Hindu-Arabic Numerals

The earliest evidences of the Hindu numerals are found in the Buddhist caves in the Western India (Ajanta et al) dating to the 1st century AD.

In Greek and Hebrew the first nine alphabets of their lettering system were used to represent the numbers 1 to 9. Another way of representing numbers is

to use the symbols for the first letters of the corresponding words for them. It's like denoting "6" with the symbol "s", the first letter of the word "six", and so on.

In his book "*The Alphabet, An Account of the Origin and Development of Letters*" Isaac Taylor, a famous philologist, pointed out in the eighteen eighties that the old Indian numeral for "four" is actually the letter "*cha*" of the ancient Kharoshti script used in the present day Afghanistan and Pakistan, the ancient Gandhar region during Ashoka, Buddha and earlier. Ashoka's inscriptions found in the Gandhar region were written in this script which died down eventually, while the contemporary Brahmi script survived in the subcontinent as the progenitor of all the later scripts of South and South East Asia. Interestingly, "*cha*" happens to be the first letter of "*cha-tu-r*", which is "four" in Sanskrit.

Similarly, the numerals for five till nine, Isaac showed, were actually the first letters of the corresponding Sanskrit words – *panchan* for five, *shash* for six, *saptan* for seven, *ashtan* for eight and *navan* for nine – in Kharoshti. The symbols for "*sha*" and "*sa*" in Kharoshti seem to have interchanged in the numerals for *shash* and *saptan*, six and seven, as, Taylor points out, the same is true in the languages of the North Western India. The sesymbols (rightmost column in Figure 2 below), the obsolete letters of the ancient Kharoshti script, evolved into the present day Hindu-Arabic numerals used widely across the world, first transported to the Arab world and then to Europe.

So when you write the numerals in English or Arabic, you are actually writing the first letters of the corresponding Sanskrit words, and that too in an ancient Indian script.

The evolution of the numerals for "4" and "5" is shown below, starting from the Kharoshti forms in India in the 1st century to the European forms in 14th century.

Figure 1: Evolution of 4" and "5"

It's worthwhile to reproduce the following from Taylor, depicting the origin of the Hindu-Arabic numerals.

Figure 2: Origin of Hindu-Arabic numerals

Whether Taylor is correct is a matter of conjecture. We haven't come across the same argument anywhere else and we are not sure if this is universally accepted. But the argument does make sense. And if this is indeed true, then a lot needs to be answered as to the significance of Kharoshti script which suddenly disappeared, whereas the contemporaneous Brahmi survived as the progenitor of most of the scripts in South and South East Asia. None of the existing scripts in the present Gandhar region of North Western India is a descendant of Kharoshti.

Taylor classifies Kharoshti not as an Indian script, but as Persian, which, unlike Brahmi, is written from right to left, and is related to the Old Persian cuneiform script. Just before the period of the Ashokan edicts, which use both the Kharoshti and Brahmi scripts, the Greeks had

come to India as a part of Alexander's troupe and many had stayed back. A Greek influence in the Indian numerals would have been very likely. But on the contrary, we find Persian influence.

2.1 Connection between Indus symbols and Brahmi letters

Though the Indus script hasn't yet been deciphered, still its influence on the Brahmi script, which was used in most of Ashokan inscriptions, can't be denied, as shown in the following figure:
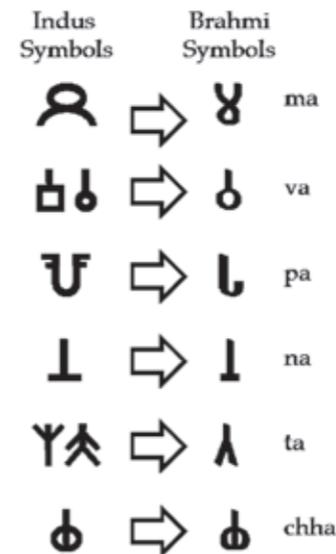
Figure 3: Similarities between Indus symbols & Brahmi letters

Alexander Cunningham, the legendary Director General of the Archaeological Survey of India, proposed a very interesting phenomenon in the book, *Inscriptions of Asoka*, published in 1877. That was soon after the Brahmi and Kharoshti inscriptions had been deciphered by James Princep, someone who has been immortalized through an iconic landmark of Calcutta, the Princep Ghat.

When Cunningham wrote his book, Indus Valley Civilization was yet to be discovered. But he had access to a few seals discovered near Harappa, which he mistakenly dated to 400 BC. But he too didn't fail to notice the similarities between the symbols of the seals and the Brahmi letters. He tried to explain the origin of the Brahmi letters as simplistic pictorial depictions of objects commonly associated with the letters. As an example, the

letter "*ma*" can be associated with *matsya*, fish, and hence its symbol, the first one in the above Figure 3, he conjectured, was derived from a simple pictorial depiction of a fish. He did find a similar symbol in the Harappan seals and concluded they were related.

Many years later, Asko Parpola, in his attempt to connect the language of the Indus Valley with Proto-Dravidian, proposed almost a very similar thing. He studied the various "crab" symbols of the Indus script and, along with some very interesting linguistic connections with old Tamil, he concluded that the crab and fish symbols were related. Even without the linguistic arguments, the similarity between the crab and fish symbols are visible even to laymen, as seen in the below figure.
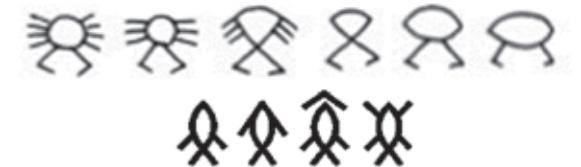
Figure 4: Crab and Fish symbols in Indus script

Interestingly, in Tamil, fish is called *meen*, which is again connected with the "*ma*" sound, as is *matsya* in Sanskrit. If Parpola's hypothesis, that the language of the Indus Valley was Proto-Dravidian, is correct, then the fish or crab symbol in the Indus script might have also carried the sound value of "*ma*", similar to what we find in Brahmi, as concluded by Cunningham.

Till the Indus script is deciphered, many such hypotheses could be formulated, just by studying the symbols. If both Cunningham and Parpola are correct, we have to believe that at least some people in the Indus Valley did speak a Proto-Dravidian language and that some of their symbols were still in use till the 3rd century BC, when the Ashokan edicts in Brahmi were being written. Either of these two propositions would throw up innumerable possibilities for the historians.

3. Linguistic Palaeontology

Linguistic Palaeontology is the study of the linguistic remnants, called linguistic fossils, left behind in the modern languages by their ancient, often extinct, proto historic progenitors and the reconstruction of the remote history of the proto speakers, who've otherwise left no material evidence.

3.1 Dravidian Bengali connection

It's quite interesting that among all the Indo-Aryan languages Bengali is perhaps influenced the most by Dravidian language. This means that there was a considerable Dravidian population in Bengal. This might be really the case if we believe that the oldest lot of the Aryans – may be the Dasa people of BMAC from the first wave of the Aryans – along with a considerable number of Dravidian people preferred to leave Punjab soon after the arrival of the Rig Vedic Aryans. They eventually moved to the eastern part of India and settled in the ancient Vanga and Magadha regions. Close association with a good number of Dravidian people for a very long time induced strong Dravidian aspects into the Magadha Prakrit (the predecessor of Bengali) and the Bengali language.

Following are some of the commonalities between Bengali (Beng.) and Dravidian languages:

- Bengali is the only IE language where the negation is applied after the verb. For example in English we always say "I'll not go"– here the negation "not" appears before the verb "go". Same is true for all Indo-Aryan languages. In Hindi we say, "*Hum nahinjayenge*"– the negation "*nahin*" is applied before the verb "*jayenge*". But in Bengali we say "*Ami jabona*"– the negation "*na*" is applied after the verb "*jabo*". All Dravidian languages have the same structure for negation.

- Similarly the plural forming suffix *ra* in Bengali comes directly from Tamil *ar*. For example *pola* means a boy and *polara* means boys – both *pola* and *ra* are of Dravidian origin.

- Since the time of Buddha in the 6th century BC, Pali, the language of Buddhist scriptures, and the later Magadha Prakrit languages showed some peculiarities that are no doubt Dravidian. We see *dhamma* in place of *dharma, kamma* in place of *karma, Pukkusathi* in place of *Pushkalavati*. Buddhist scriptures are full of such derivatives of the original Sanskrit names or words. Bengali still uses these forms in colloquial conversations. It's surely a Dravidian phenomenon where two consonants can be joined only when they belong to the same *varga*, class. In *dharma r* and *m*, belonging to different *varga* were joined in Sanskrit. Following the Dravidian phonology of joining consonants of same *varga, dharma* is converted to *dhamma*. Same is true for the other words.

In all the above three cases the structure of a language itself is changed by another language. Such changes require very long and extensive interaction between the speakers of the two languages.

In all the other Indo-Aryan languages, the Dravidian influence is restricted only to loan words – mainly names of places, rivers and people and agricultural terms. This implies that the interaction with Dravidian people in these cases has been quite limited. But in case of Bengali there are Dravidian words for a very wide range of things.

- *gurra*, horse in Telegu ~ *ghoda* in Beng., Hindi ~ in Barishal district of Bangladesh *ghoda* is pronounced almost like *gurra*

- *akali*, hunger in Telegu, Tamil ~ *akal* in Beng.

- *koka, kuki*, son/daughter in Tamil ~ *khoka, khuki* in Beng.

- *khadal*, sea in Tamil ~ *khadi* in Beng.

- *khattai*, a piece of wood in Tamil ~ *khonta, peg* in Beng.

- *kutta*, to pick, gather in Tamil ~ *khonta*, to pick up in Beng.

- *gandragol* in Telegu ~ *gandogol*, problem, commotion in Beng.

- *goda*, wall in Telegu ~ *goda* means base or foundation in Beng.

- *pillai*, son in Tamil ~ *pile* in Beng.

- *ban*, rain in Tamil ~ *ban* in Beng.

- *mot*, heavy luggage in Telegu ~ *mot* in Beng.

- *tandu*, central stem of the solid portion of banana plant ~ *thod* in Beng. Interestingly the banana flower and the *tandu* or *thod* are used as vegetables only among the Bengalis and Tamilians.

- *palli*, village in Tamil ~ *palli* in Beng. In Sindh, Punjab, Gujarat and Maharashtra palli is changed to *vali, wara, wada, wadi, wala* etc. But in Bengali it's exactly same.

It's proposed by many, including Parpola, that the proto Bengalis may be the older Indo-Aryan Dasa people of BMAC who were the earlier Indo-Aryans to enter into India and were eventually pushed out later to the east by the later Rig Vedic Aryans. There's a striking aspect in Bengal that links the Bengali people to BMAC.

Below is a seal found in BMAC. It's a Goddess sitting on a lion. Doesn't it look like the Goddess Durga worshiped mainly in the eastern India, especially Bengal and Assam?

Figure 5: BMAC seal of a Goddess on lion: Proto Durga?

The word *durga* means stronghold, fort. It's also the name of an *asura* slain by the goddess Durga, More intriguing is the fact that Durga is also known as Tripura, the protector of the fort, *durga*, the *tripur* of the Dasas of BMAC.

In the *Rig Veda asura* is mentioned as the God of the Dasa people. Subsequently the Rig Vedic Aryans make truce with the Dasas and *asura* is promoted to the ranks of *deva*, the Gods. The term *tripur* is not present in the *Rig Veda*. It appears in the Brahmanas, written some thousand years later than the encounter with the actual *tripur* and Dasas of BMAC. By that time *asura* has again become a demon. But the question is who has kept the memories of *tripur* alive after thousand years? It has to be the Dasa people, the Proto Bengali and the Magadhans, who still remember their ancient religious traditions of BMAC. By this time Anga has again become despised people, hence their God *asura*again becoming a demon is understandable.

3.2 Indus Valley – Dravidian connection

On linguistics terms the *Rig Veda* (RV) can be categorized into three classes:

1. Early (1700 - 1500 BC) - Books 6, 4, 2 & 5
2. Middle (1500 - 1350 BC) - Books 3, 7 & 8
3. Late (1350 - 1200 BC) - Books 1 & 10

Apart from Burushaski, RV has, from the earliest books, a lot of substrates of a language which has similarities with the present day Munda languages. This should be the language of the northern Indus people with whom the Rig Vedic Aryans are likely to have lot of interaction since their early days of settlement in India. We call it a paraMunda language.

RV suddenly has lot of Dravidian substrates/loan words in the books of Middle Age, especially in books 7 and 8. The books of Early Age have virtually no Dravidian substrate. This implies that the Dravidian people would have reached the Punjab and started interacting with the Rig Vedic Aryans only around 1500 BC – the time period of the Middle Age books.

So there seems to be another language in this area – a Proto Dravidian language. Many place names in Punjab, Sindh, Gujarat and Maharashtra still bear the Dravidian *palli,* meaning village. *Palli* has become *wala* in Punjab (Jallian-wala, Gujran-wala, Dogar-wala); *vali* in Maharashtra (Boro-vali, Sara-vali); and *wari-wadi* in Gujarat and Maharashtra (Chanda-wari, Amba-wadi, Dangra-wadi) and Sindh (Kadan-wari, Shanh-wari, Bathe-wari, Fateh-wari, Karde-wari) – *p* of *palli*changes to *v/w* and *l* to *r*. This implies that Sindh, Punjab, Gujarat and Maharashtra are within the locus of the Dravidian people. It's highly possible that they were among the Indus people in Sindh during the last phase of Indus Valley civilization (1900 – 1500 BC) and that they migrated to the Punjab in the north and Gujarat-Maharashtra in south around 1500 BC.

The Meluhhan language of Sindh is still an elusive thing to us. The Indus scripts are yet to be deciphered. But Sumerian records have some words which are believed to be Meluhhan. Some of these words have striking similarities to the present day Burushaski language. Such a connection is possible only if we assume that Burushaski or a related language was spoken in BMAC, whose connection with Indus people is supported by archaeology. Hence a proto Burushaski language is considered as the *lingua franca* of Central Asia before the arrival of the Indo-Aryans.

In Sumerian records there are names of persons with Meluhha as personal names. Urkal and Urdlama are called sons of Meluhha. There's also a village called Meluhha.

The products of Meluhha include

- *gis-ab-ba-me-lu-hha* (*abba* wood from the land of Meluhha),

- *si-in-da* (Sindh wood),

- *gis-ha-lu-ub* (*haluppu* or perhaps Harappa wood),
- *gis-gisimmar* (*shimmar* /*shimmal* wood), etc.

The word Sinda is quite interesting. Burushaski has the word *sinda* for river. It's possible that during the timeline we're talking about, the Proto Burushaski language, the *lingua franca* of BMAC people, had a similar word from which came the Skt. Sindhu, the name of the river that gave the identity to a country, religion and civilization. Monier Williams, in his Skt. dictionary, mentions that the word Sindhu is of improbable origin.

The *shimmar* of *gis-gisimmar* is very likely related to Skt. *Shalmali* (a tree, *Shimul* in Bengali) which seems to be Munda and hence from the North Indus language.

Based on the above discussions a plausible language map of Central Asia and Western India in 1900 BC, just before the arrival of the Indo-Aryans, would be something like this.

The figure 7 shows the language map during 1700 BC. The Indo-Aryans have arrived in BMAC and reached the north western fringes of India, may be Kalash in the Hindukush Mountains.
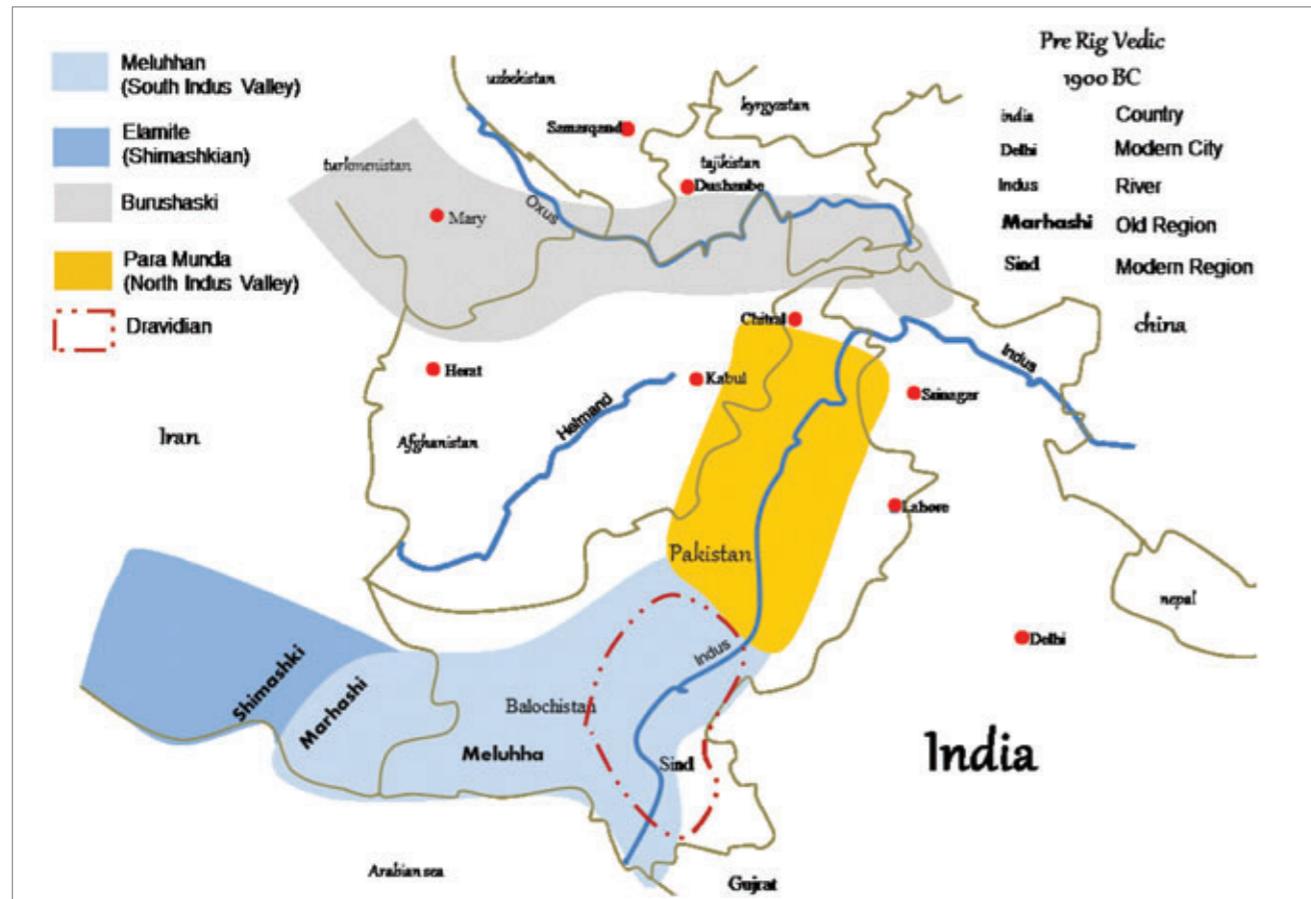
Figure 6: Language map in North Western India around 1900 BC

Meluhhan: Stretching from South Indus, till Eastern Iran, across Balochistan

Elamite: Southern Iran, along the coast of the Arabian Sea west of Marhashi

Burushaski: Across Central Asia

Munda: North Indus Region

Dravidian: South Indus Region
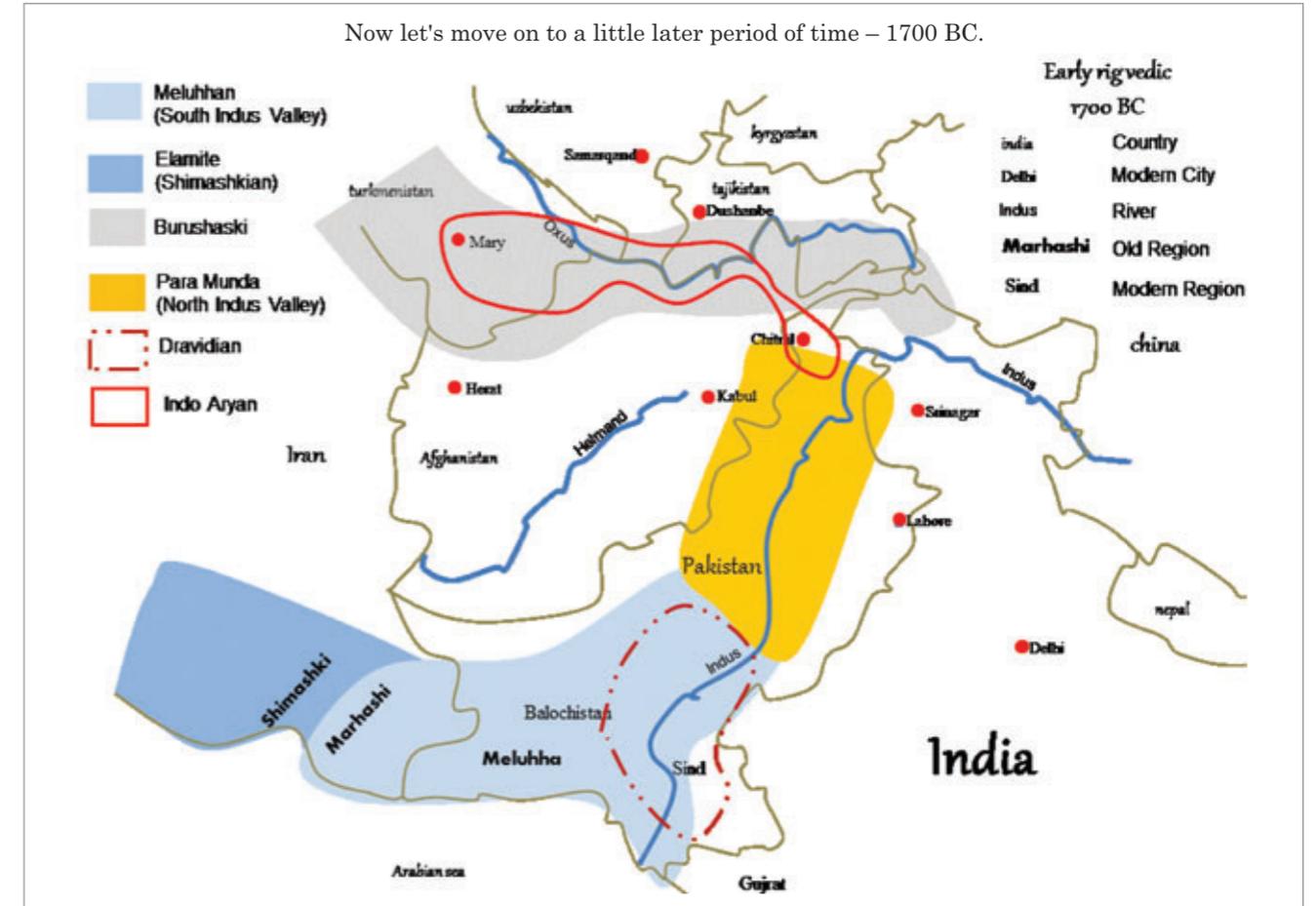
Figure 7: Language Map of North Western India around 1700 BC

This is the early Rig Vedic period where the early books (6, 4, and 2) are being composed. The BMAC substrates have already appeared in Sanskrit. Similarly the Burushaski and Para Munda (Northern Indus Language) substrates are also visible. The Hindukush is probably the place where retroflexion appears for the first time in Sanskrit. This may be an influence of the Burushaski spoken in the Pamir areas north of Hindukush.

Retroflexion has been always considered an Indian phenomenon that differentiates the Indo-Aryan from the other members of the IE languages family. The "*t*" in *vrishti* and the "*d*" in *pinda* need the tip of the tongue to be curled and touched against the top of the mouth to produce the correct sound. It's close to the "*t*" in street and the "*d*" in donkey as pronounced by an English rather

than a French. Most of the European languages don't have these sounds.

Following are some probable Burushaski (Bur.) substrates in Skt.

- Skt. *mesha*, ram ~ Bur. *mesh*
- Skt. *kuhu*, new moon ~ Bur. *kuha*
- Skt. *karpasa*, cotton ~ Bur. *gupas*
- Skt. Sindhu, Indus River ~ Bur. sinda
- Skt. *kilala* (*amrita*) and *kilata* (cheese) ~ Bur. *kilay*, sweet drink ~ Tamil *kilan*, curd
- Skt. *muja*, people and also the Mujavat Mountain, the Meru Mountain ~ *Mruza*, the ancient self-designation of the *Burusho* people who speak Burushaski now ~ Avestan *Muza* ~ Tibetan *Bruza* ~

Skt. *Purusha*, another name for Mount Meru. *Muja*, *Muza*, *Purusha* and *Burusho* all have come from the original word *Mruza*.

Following are some probable Munda substrates in Skt.

Names of people

- Kavasha, son of a slave girl elevated to the rank of Rishi –reminiscent of absorption of local people

- Shambara, name of a chieftain of enemy

- Kushika, name of a lineage of poets

- Kulitara, name of a chieftain of enemy

- Kikata, name of a place despised of in the *Rig Veda*. Interestingly *ki* in Suremian means country.

- Srinjaya, King

- Sribinda, demon; related is Vindhya Mountains; both may be from the same Munda root *bind*

- Kurunga, name of a chieftain of Turvasha, one of the *Pancha Krishti*, the Five People of the *Rig Veda*.

Names of places and rivers

- Rivers Ganga, Gandaki and place names like Magadha, Gandhar – all may have come from the Munda *gad / gand*

- Shatadru (Sutlej) River – old name Shutudri may have come from *she-tu-da*, *tu* means float in Munda

- Vipasha (Beas) River – old name Vipash may have come from Munda *vipaz / vibal.* There's a Vibali River of indefinite origin in the RV. The name Vishpala in RV may also be related

- Kubha and Krumu, modern Kabul and Kurram rivers

Other words, mainly related to plants, animals, agriculture, food and local traditions

- *kimshuka*, name of a flower/tree
- *kinash*, cultivator of land, niggard
- *karambha*, a food
- *shalmali*, tree
- *shakunta, shakuntaka*, bird. Also related is Kunti, a tribal name
- *kaparda*, hair knot in the shape of cowrie shell
- *kumara*, boy
- *kurira*, woman's head dress

- *kulaya*, nest
- *sharvari*, night

There is no direct Meluhhan substrate in Sanskrit. But the Skt. *Mlechchha (*or even *Mridhra)* meaning out-caste may be a derivative of *meluhha*. The reason why it means out-caste is also understandable – the same reason why Finnish *orja,* derived from *arya,* means slave.

Next we fast forward another two centuries and we're in 1500 BC – middle Rig Vedic Age. Here suddenly we see a surge of words of Dravidian origin.

- Skt. *phala*, fruit ~ Tamil (Tam.) *palu*
- Skt. *pinda*, dympling ~ Tam. *pinti*, flour
- Skt. *mayura*, peacock ~ Tam. *mayil* [The Proto Munda*mara* is related]
- Skt. *danda*, stick ~ Telegu *danda* [The Santal (one of the Munda languages) *danta* is related]
- Skt. *ulukhala*, mortar ~ Tam. *ulukkai*
- Skt. *path*, read ~ Tam. *patu*, sing
- Skt. *nagara*, city ~ Tam. *nakar*
- Skt. *kuta*, hammer
- Skt. *kunda*, vessel ~ Tam. *kuttam*

The following figure shows a plausible language map of this era. The Burushaski has been majorly replaced by the Indo-Aryan speech across Central Asia.

In general the Aryans picked mostly names of places (Gandhar, Kikata), rivers (Sindhu, Vipash, Shutudri) and people (Shambar, Pramaganda, Kulitara) and words of local plants (*shalmali*), animals and large number of agricultural terms (*phala*,*ulukhala*, *langal)* from local languages and retained only a few from PIE vocabulary for agriculture like *krish*, *sa* (sow), *sita* (furrow) and *sira* (plough). This is quite natural for immigrating people like the Aryans.

As seen in the Aryan Trail, the Aryans entered India in two waves. Then, around 1500 BC, the Dravidian people appeared in the Punjab and started interacting with the Indo-Aryans. The Rig Vedic Aryans of the second wave were averse to both the newer Dravidians and the older Aryans of the first wave. Gradually they pushed both of them to the periphery of their settlement.

It's possible that the first batch of the Aryans from the first wave, along with the Dravidian people in the Punjab, made way for the younger Rig Vedic Aryans and moved
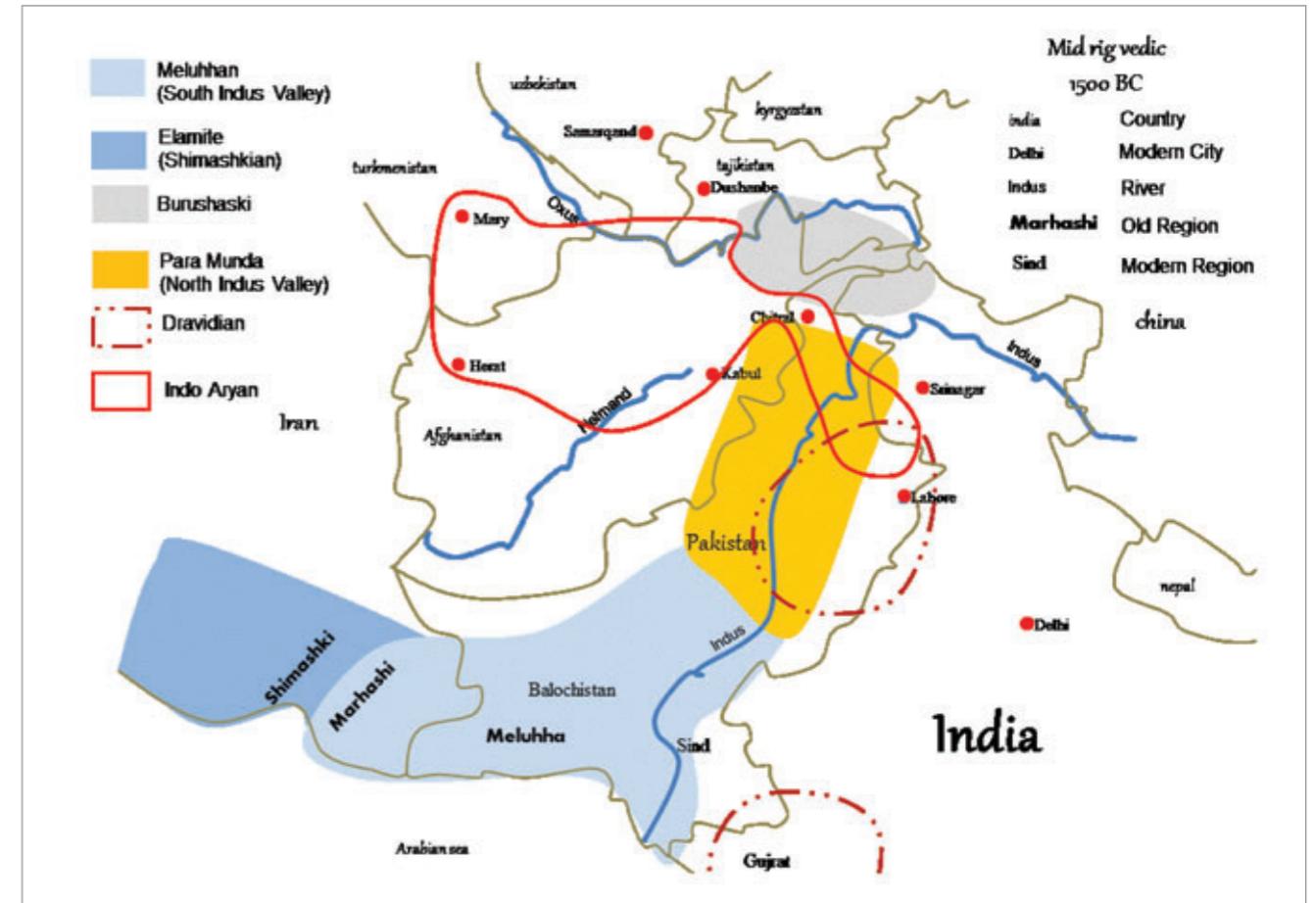
Figure 8: Language Map of North Western India around 1500 BC

out to the peripheries, to the west (towards Gandhar) and east (towards Magadha, Vanga) quite early, may be sometime around 1500 BC. This implies that the Proto Bengali and Magadhan people of the east and the Gandhar people of the west were all the same lot thousands of years back.

The scenario discussed above explains the Bengali-Dravidian connection, and perhaps the India Valley – Dravidian connection too.

Gandhar falls in the area marked "Other Indo-Aryan and Indo-Iranian" in the following diagram. People here now speak mainly Pashto (East Iranian branch of Iranian), Nuristani (Iranian branch) and Khowar and Kalash (Dardic branch of Indo-Aryan).

Eventually more such batches of *despised* people moved out to the south west towards Punjab, Sindh, Gujarat and Maharashtra.

Not all the Indo-Aryans from both the waves – early and late – left the BMAC and Vakhsh areas in Central Asia and Afghanistan and entered India. Lot of them stayed back. They are the people who later became Zoroastrians – in the Rig Vedic time frame we can call them Proto Avestan people.

In the years after the *Rig Veda* the Proto Avestan people gradually separated from the Vedic Aryans due to intellectual conflict between the two groups of the Aryans.

Zarathrustra, the first Prophet of the world and the founder of the Zoroastrian religion, belonged to the former

group. We've observed earlier that the language of Avesta, the earliest texts of the Zoroastrians, has surreptitious similarities to the Rig Vedic language. Most of the philosophic concepts of Avesta more or less have corresponding counterparts in the *Rig Veda*. So it's apt to consider Avestan in the repository of the languages of Aryan Trail.

4. Conclusion

We've presented some conjectural possibilities purely based on linguistic and palaeographic evidences, or rather observations. Most of these possibilities need to be further probed with more material and archaeological evidences. Certain connections, like that between Bengali and Sinhala, purely based on linguistic observations, are too obvious and might not need further corroborations. But inferences, as pointed out by Bijaychandra Mazumdar in his book "*The History of The Bengali Language*" published in 1920, that the name "*Bangla*" or "*Vanga*" is related to the Van Lang kingdom of ancient Vietnam perhaps need much more investigation. We can't throw away such observations because we know for sure that the Vietnamese and the Munda languages, spoken by a large number of tribes across India, belong to the same family.

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Re-cognition: Texts, Iconography and Shape Grammar

From Radical to Co-operative Duality: Moving Towards a Non-Dualistic Interpretation of Classical Yoga

Ian Whicher
Head of the Department of Religion and Cultural Studies, University of Manitoba, Canada

A paradigm shift

Contrary to the arguments presented by many scholars, which associate Patañjali's Yoga exclusively with extreme asceticism, mortification, denial, and the renunciation and abandonment of "material existence" (prakṛti) in favor of an elevated and isolated "spiritual state" (puruṣa) or disembodied state of spiritual liberation, I suggest that Patañjali's Yoga can be seen as a responsible engagement, in various ways, of "spirit" (puruṣa = intrinsic identity as Self, the "seer", pure consciousness, the masculine component of reality) and "matter" (prakṛti = the unmanifest source of psychophysical being as well as manifest life which includes mind, body, all of nature, the feminine component of reality) resulting in a highly developed, transformed, and participatory human nature and identity, an integrated and embodied state of liberated, yet engaged selfhood (jīvanmukti).

Introduction: Examining the Roots of Patañjali's Classical Yoga

This paper centers on the thought of Patañjali (ca second-third century CE), the great exponent of the authoritative classical Yoga school (darśana) of Hinduism and the reputed author of the *Yoga-Sūtra*. I will argue that Patañjali's philosophical perspective has, far too often, been looked upon as excessively "spiritual" or isolationistic to the point of being a world-denying philosophy, indifferent to moral endeavor, neglecting the world of nature and culture, and overlooking the highest potentials for human reality, vitality, creativity, and service. Contrary to the arguments presented by many scholars, which associate Patañjali's Yoga exclusively with extreme asceticism, mortification, denial, and the renunciation and abandonment of "material existence" (*prakṛti*) in favor of an elevated and isolated "spiritual state" (*puruṣa*) or disembodied state of spiritual liberation, I suggest that Patañjali's Yoga can be seen as a responsible engagement, in various ways, of "spirit" (*puruṣa* = intrinsic identity as Self, the "seer", pure consciousness, the masculine component of reality) and "matter" (*prakṛti* = the unmanifest source of psychophysical being as well as manifest life which includes mind, body, all of nature, the feminine component of reality) resulting in a highly developed, transformed, and participatory human nature and identity, an integrated and embodied state of liberated, yet engaged selfhood (*jīvanmukti*).

The interpretation of Patañjali's Yoga *Darśana* presented in this paper--which walks the fine line between an historical and a hermeneutic-praxis (some might say theological or "systematic") orientation--counters the radically dualistic, isolationistic, and ontologically oriented interpretations of Yoga[1] presented by many scholars and suggests an open-ended, epistemologically and morally oriented hermeneutics which, I maintain, is more appropriate for arriving at a genuine assessment of Patañjali's system.

The system of classical Yoga is often reduced to or fitted into a classical Sāṃkhyan scheme--the interpretations of which generally follow along radically dualistic lines. In their metaphysical ideas classical Sāṃkhya and Yoga are closely akin. However, both systems hold divergent views on important areas of doctrinal structure such as epistemology, ontology, ethics, and psychology, as well as differences pertaining to terminology. These differences derive in part from the different methodologies adopted by the two schools: Sāṃkhya, it has been argued, emphasizes a theoretical or intellectual analysis through inference and reasoning in order to bring out the nature of final emancipation, while Yoga stresses yogic perception and multiple forms of practice that culminate in *samādhi*. Moreover, there is clear evidence throughout all four *pādas* of the *Yoga-Sūtra* of an extensive network of terminology that parallels Buddhist teachings and which is absent in the classical Sāṃkhya literature. Patañjali includes several *sūtras* on the "restraints" or *yamas* (namely, nonviolence [*ahiṃsā*], truthfulness [*satya*], non-stealing [*asteya*], chastity [*brahmacarya*], and nonpossession/greedlessness [*aparigraha*]) of the "eight-limbed" path of Yoga that are listed in the *Acārāṅga-Sūtra* of Jainism (the earliest sections of which may date from the third or fourth century B.C.E.) thereby suggesting possible Jaina influences on the Yoga tradition. The topic of Buddhist or Jaina influence on Yoga doctrine (or vice versa) is, however, not the focus of this paper.

It is often said that, like classical Sāṃkhya, Patañjali's Yoga is a dualistic system, understood in terms of *puruṣa* and *prakṛti*. Yet, I submit, Yoga scholarship has not clarified what "dualistic" means or why Yoga had to be "dualistic." Even in avowedly non-dualistic systems of thought such as Advaita Vedānta we can find numerous examples of basically dualistic modes of description and explanation.[2]

Elsewhere[3] I have suggested the possibility of Patañjali having asserted a provisional, descriptive, and "practical" metaphysics; that is, in the *Yoga-Sūtra* the metaphysical schematic is abstracted from yogic experience, whereas in classical Sāṃkhya, as set out in Īśvara Kṛṣṇa's *Sāṃkhyakārikā*, "experiences" are fitted into a metaphysical structure. This approach would allow the *Yoga-Sūtra* to be interpreted along more open-ended, epistemologically and morally oriented lines without being held captive by the radical, dualistic metaphysics of Sāṃkhya. Despite intentions to explain the experiential dimension of Yoga, purged as far as possible from abstract metaphysical knowledge, many scholars have fallen prey to reading the *Yoga-Sūtra* from the most abstract level of the dualism of *puruṣa* and *prakṛti* down to an understanding of the practices advocated. In other words, they have engaged in a top-down reading, which elicits the concrete (action/experience) from the abstract (metaphysics/theory). Then they proceed to impute an experiential foundation to the whole scheme informed not from mystical insight or yogic experience, but from the effort to form a consistent world-view—which rests in a presumption of a disjunctive duality—that culminates in a radical dualistic finality[4] or closure.

Patañjali's philosophy is not based upon mere theoretical or speculative knowledge. It is founded on, and therefore elicits a practical, pragmatic, experiential/perceptual (not merely inferential/theoretical) approach that Patañjali deems essential in order to deal effectively with our total human situation and provide real freedom, not just a theory of liberation or a metaphysical explanation of life. Yoga is not content with knowledge (*jñāna*) perceived as a state that abstracts away from the world removing us from our human embodiment and activity in the world. Rather, Yoga emphasizes knowledge in the integrity of *being and action* and as serving the integration of the "person" as a "whole." Edgerton concluded in a study dedicated to the meaning of Yoga that: ". . . Yoga is not a 'system' of belief or of metaphysics. It is always a way, a method of getting something, usually salvation. . . ."[5] But this does not say enough, does not fully take into account what might be called the integral nature of Patañjali's Yoga. Yoga derives its real strength and value through an *integration* of theory and practice.[6]

Cessation (*nirodha*) and the 'Return to the Source' (*pratiprasava*): Transformation or Elimination/Negation of the Mind?

In Patañjali's central definition of Yoga, Yoga is defined as "the cessation (*nirodha*) of [the misidentification with] the functioning/transformations/fluctuations (*vṛtti*) of the mind/ordinary awareness (*citta*)".[7] What *kind* of "cessation" we must ask is Patañjali actually referring to in his classical definition of Yoga? What does the process of cessation actually entail for the yogī: ethically, epistemologically, ontologically, psychologically, and so on? I have elsewhere suggested[8] that *nirodha* denotes an epistemological emphasis and refers to the transformation of self-understanding brought about through the purification and illumination of

consciousness; *nirodha* is not (for the yogī) the ontological cessation of *prakṛti* (in this case, the mind and *vṛttis*). Thus, seen here, *nirodha* is not, as is often explained, an inward movement that annihilates or suppresses *vṛttis*, thoughts, intentions, or ideas (*pratyaya*), nor is it the nonexistence or absence of *vṛtti*; rather, *nirodha* involves a progressive unfoldment of perception (*yogi-pratyakṣa*) that eventually reveals our authentic identity as being rooted in puruṣa. It is the state of affliction (*kleśa*) evidenced *in* the mind and not the mind *itself* that is at issue. *Cittavṛtti* does not stand for all modifications or mental processes (cognitive, affective, emotive), but is the very seed (*bīja*) mechanism of afflicted identity; the misidentification of consciousness with *prakṛti* from which all other *vṛttis* and thoughts arise and are (mis)appropriated or self-referenced in the state of ignorance (*avidyā*), that is, the unenlightened state of mind. Spiritual ignorance gives rise to a profound dysfunction or misalignment of *vṛtti* with consciousness that in Yoga can be remedied thereby allowing for a proper alignment or "right" functioning of *vṛtti*.[9] It is the *cittavṛtti* as our confused and mistaken identity, not our *vṛttis*, thoughts, and experiences in total that must be brought to a state of definitive cessation. Ordinary awareness consists of our mental patterns that are governed by spiritual ignorance and define our normal sense of self or identity. Patañjali clearly wanted to distinguish that mode of self (=non-self) from pure consciousness (*puruṣa*). Yoga thus purifies and liberates the *cittavṛtti* dynamic from ignorance and enables one, I suggest, to get beyond afflicted identity (as ordinary awareness masquerading as consciousness). This is highly significant to beneficial world engagement because when one engages the world through the lens of an afflicted and deluded identity, the resulting actions and reactions will be similarly afflicted and disordered.

To be sure, there is a suspension and transcendence of all the mental processes as well as any identification with an object (i.e., in *asaṃprajñāta-samādhi*, this being for the final purification of the mind[10]), but it would be misleading to conclude that higher *samādhi* results in a permanent or definitive cessation of the vṛttis in total, thereby predisposing the yogin who has attained purity of mind to exist in an incapacitated, isolated, or mindless state and therefore of being incapable of living a balanced, useful, and productive life in various ways.

The three *guṇas* of prakṛti are purity/light/virtue, dynamic activity, and dullness/inertia/delusion, or *sattva*, *rajas*, and *tamas* respectively. The purpose of the *guṇas* as outlined in YS II. 18 and 21 is to provide experience (*bhoga*) and liberation (*apavarga*) for the unliberated practitioner, that is, they have ultimately a soteriological role. From the perspective of the discerning yogin (*vivekin*), human identity contained within the domain of the three *guṇas* amounts to nothing more than sorrow and dissatisfaction (*duḥkha*).[11] The declared goal of classical Yoga, as with Sāṃkhya and Buddhism, is to overcome all dissatisfaction (*duḥkha*, YS II.16) by bringing about an inverse movement or counter-flow (*pratiprasava*)[12] understood as a "return to the origin"[13] or "process-of-involution"[14] of the *guṇas*, a kind of reabsorption into the transcendent purity of being itself. What does this "process-of-involution"--variously referred to as "return to the origin," "dissolution into the source"[15] or "withdrawal from manifestation"--actually mean? Is it a definitive ending to the perceived world of the yogī comprised of change and transformation, forms and phenomena? Ontologically conceived, *prasava* signifies the "flowing forth" of the primary constituents or qualities of *prakṛti* into the multiple forms of the universe in all its dimensions, i.e., all the processes of manifestation and actualization or "creation" (*sarga*, *prasarga*). *Pratiprasava* on the other hand denotes the process of "dissolution into the source" or "withdrawal from manifestation" of those forms relative to the personal, microcosmic level of the yogī who is about to attain freedom (*apavarga*). Thus, *pratiprasava* refers to the involution, on the personal level, of the essential attributes of *prakṛti* which form nature, materiality, physicality, and cognitivity, both on the cosmic and individual levels.

Does a "return to the origin," *pratiprasava*, culminate in a state of freedom in which one is stripped of all human identity and void of any association with the world including one's practical livelihood? The ontological emphasis usually given to the meaning of *pratiprasava*-- implying for the yogī a literal dissolution *of prakṛti*'s manifestation--would seem to support a view, one which is prominent in Yoga scholarship, of spiritual liberation denoting an existence wholly transcendent (and therefore stripped or deprived) of all manifestation including the human relational sphere. Is this the kind of spiritually emancipated state that Patañjali had in mind (pun

included)? In *YS* II.3-17 (which sets the stage for the remainder of the chapter on yogic means or *sādhana*), Patañjali describes *prakṛti*, the "seeable" (including our personhood), in the context of the various afflictions (*kleśas*) that give rise to an afflicted and mistaken identity of self. Afflicted identity is constructed out of and held captive by the root affliction of ignorance (*avidyā*) and its various forms of karmic bondage. Yet, despite the clear association of *prakṛti* with the bondage of ignorance (*avidyā*), there are no real grounds for purporting that *prakṛti* herself is to be equated with or subsumed under the afflictions. To equate prakṛti with affliction itself implies that as a product of spiritual ignorance, *prakṛti*, along with the afflictions, is conceived as a reality that the yogī should ultimately abandon, condemn, avoid or discard completely. Patañjali leaves much room for understanding "dissolution" or "return to the source" with an epistemological emphasis thereby allowing the whole system of the Yoga *Darśana* to be interpreted along more open-ended lines. In other words, what actually "dissolves" or is ended in Yoga is the yogī's misidentification with *prakṛti*, a mistaken identity of self that--contrary to authentic identity, namely *puruṣa*--can be nothing more than a product of the three *guṇas* under the influence of spiritual ignorance. Understood as such, *pratiprasava* need not denote the definitive ontological dissolution of manifest *prakṛti* for the yogī, but rather refers to the process of "subtilization" or sattvification of consciousness so necessary for the uprooting of misidentification--the incorrect world-view born of *avidyā*--or incapacity of the yogin to "see" from the yogic perspective of the seer (*draṣṭṛ*), our authentic identity as *puruṣa*.

The discerning yogī sees (YS II.15) that this guṇic world or cycle of saṃsāric identity is in itself dissatisfaction (*duḥkha*). But we must ask, what exactly is the problem being addressed in Yoga? What is at issue in Yoga philosophy? Is our ontological status as a human being involved in day to day existence forever in doubt, in fact in need of being negated, dissolved in order for authentic identity (*puruṣa*), immortal consciousness, finally to dawn? Having overcome all ignorance, is it then possible for a human being to live in the world and no longer be in conflict with oneself and the world? Can the *guṇas* cease to function in a state of ignorance and conflict in the mind? Must the guṇic constitution of the human mind and the whole of prakṛtic existence disappear, dissolve for the

yogi? Can the ways of spiritual ignorance be replaced by an aware, conscious, nonafflicted identity and activity that transcend the conflict and confusion of ordinary, saṃsāric life? Can we live, according to Patañjali's Yoga, an embodied state of freedom?

"Aloneness" (*kaivalya*): Implications for an Embodied Freedom

In the classical traditions of Sāṃkhya and Yoga, *kaivalya*, meaning "aloneness,"[16] is generally understood to be the state of the unconditional existence of *puruṣa*. The "aloneness" that *kaivalya* is understood to refer to, is often misconstrued as a disconnection from others and severance from world engagement. However, in the Yoga Sūtra, *kaivalya* can refer more precisely to the "aloneness of seeing" (*dṛśeḥ kaivalyam*) or "oneness of life" which, as Patañjali states, follows from the disappearance of ignorance (*avidyā*) and its creation of *saṃyoga*[17]--the conjunction or apparent conflation of the seer (*puruṣa*) and the seeable (i.e. *citta, guṇas*)--explained by Vyāsa as a mental superimposition (*adhyāropa*, YB II.18). "Aloneness" thus can be construed as *puruṣa*'s innate capacity for pure, unbroken, non-attached seeing/perceiving, observing or "knowing" of the content of the mind (*citta*).[18] In an alternative definition, Patañjali explains *kaivalya* as the "return to the origin" (*pratiprasava*) of the *guṇas*, which have lost all soteriological purpose for the *puruṣa*, the seer, as it were, having recovered its transcendent autonomy.[19] This *sūtra* (*YS* IV.34) also classifies *kaivalya* as the establishment in one's "own form/nature" (*svarūpa*), and the power of higher awareness (*citiśakti*).[20] Although the seer's (*draṣṭṛ/puruṣa*) capacity for "seeing" is an unchanging yet dynamic power of consciousness that should not be truncated in any way, nevertheless our karmically distorted or skewed perceptions vitiate against the natural fullness of "seeing." Patañjali defines spiritual ignorance (*avidyā*), the root affliction, as: "seeing the non-eternal as eternal, the impure as pure, dissatisfaction as happiness, and the non-self as self" (*YS* II.5). Having removed the "failure-to-see" (*adarśana*, or lack of vision/clarity about the nature of self and reality), the soteriological purpose of the *guṇas* for the saṃsāric condition of the mind is fulfilled; the mind is relieved of its former role of being a vehicle for *avidyā*, the locus of egoity and misidentification, and then the realization of pure seeing--the nature of the seer alone--takes place.

According to yet another *sūtra* (*YS* III.55), we are told that *kaivalya* is established when the *sattva* of consciousness has reached a state of purity analogous to that of the *puruṣa*.[21] Through the process of subtilization or "return to the origin" (*pratiprasava*) in the *sattva*, the transformation (*pariṇāma*) of the mind (*citta*) takes place at the deepest level bringing about a radical change in perspective: the former impure, fabricated states constituting a fractured identity of self are dissolved resulting in the complete purification of mind. Through knowledge (in *saṃprajñāta-samādhi*) and its transcendence (in *asaṃprajñāta-samādhi*), self-identity overcomes its lack of intrinsic grounding, a lack sustained and exacerbated by the web of afflictions in the form of attachment, aversion, and the compulsive clinging to life based on the fear of extinction. The yogī is no longer dependent on liberating knowledge (mind-*sattva*),[22] and is no longer attached to the constant fluctuations of the mind and its thought processes(*vṛtti*) as a basis for self-identity. Cessation, it must be emphasized, does not mark a definitive disappearance of *the guṇas* from *puruṣa's* viewand the yogi's expereince.[23] For the liberated yogī, the *guṇas* cease to exist in the form of *avidyā* and its mental impressions (*saṃskāras*), *vṛttis*, and false or fixed ideas (*pratyaya*) of selfhood that formerly veiled true identity. The changing guṇic modes cannot alter the yogī's now purified and firmly established consciousness. The mind has been liberated from the egocentric world of attachment to things that function under the purview of *prakṛti*. Now the yogī's identity (as *puruṣa*), disassociated from ignorance, is untouched, unaffected by qualities of mind,[24] uninfluenced by the *vṛttis*which are constituted of the three *guṇas*. The mind and *puruṣa* attain to a sameness of purity (YS III.55), of harmony, balance, evenness, and a workability together: the mind appearing in the nature of *puruṣa*.25

Kaivalya, I suggest, in no way destroys or negates the personality of the yogin, but is an *unconditional state in which all the obstacles or distractions preventing an immanent and purified relationship or engagement of person with nature (prakṛti) and spirit (puruṣa) have been removed*. The mind, which previously functioned under the sway of ignorance coloring and blocking our perception of authentic identity, has now become purified and no longer operates as a locus of misidentification, confusion, and dissatisfaction (*duḥkha*). *Sattva*, the finest quality (*guṇa*) of the mind, has the capacity to be perfectly

lucid/transparent, like a dust-free mirror in which the light of *puruṣa* is clearly reflected and the discriminative discernment (*vivekakhyāti*)26 between *puruṣa* and the *sattva* of the mind (as the finest nature of the seeable) can take place.[27]

The crucial (ontological) point to be made here is that in the "aloneness" of *kaivalya prakṛti* ceases to perform an obstructing role. In effect, *prakṛti* herself has become purified, illuminated, and liberated[28] from *avidyā*'s grip including the misconceptions, misappropriations, and misguided relations implicit within a world of afflicted identity. The mind has been transformed, liberated from the egocentric world of attachment, its former afflicted nature abolished; and self-identity left alone in its "own form" or true nature as *puruṣa* is never again confused with all the relational acts, intentions, and volitions of empirical existence. There being no power of misidentification remaining in *nirbīja-samādhi*,[29] the mind ceases to operate within the context of the afflictions, karmic accumulations, and consequent cycles of *saṃsāra* implying a mistaken identity of selfhood subject to birth and death.

The *Yoga-Sūtra* has often been regarded as calling for the severance of *puruṣa* from *prakṛti*; concepts such as liberation, cessation, detachment/dispassion, and so forth have been interpreted in an explicitly negative light. Max Müller, citing Bhoja Rāja's commentary[30] (eleventh century CE), refers to Yoga as "separation" (*viyoga*).[31] More recently, numerous other scholars[32] have endorsed this interpretation: that is, the absolute separateness of *puruṣa* and *prakṛti*. In asserting the absolute separation of *puruṣa* and *prakṛti*, scholars and non-scholars alike have tended to disregard the possibility for other (fresh) hermeneutical options. Indeed, this radical, dualistic metaphysical closure of sorts surrounding the nature and meaning of Patañjali's Yoga has proved detrimental to a fuller understanding of the Yoga Darśana by continuing a tradition based on an isolationistic, one-sided reading (or perhaps misreading) of the *Yoga-Sūtra* and Vyāsa's commentary. Accordingly, the absolute separation of *puruṣa* and *prakṛti* can only be interpreted as a disembodied and non-relational state implying death to the physical body. To dislodge the yogī from bodily existence is to undermine the integrity of the pedagogical context that lends so much credibility or "weight" to the Yoga system. I am not here implying a simple idealization of Yoga pedagogy thereby overlooking the need to

incorporate a healthy critical approach to the guru-disciple dynamic. Rather, I am suggesting that it need not be assumed that, in Yoga, liberation coincides with physical death.[33] This would only allow for a soteriological end state of "disembodied liberation" (*videhamukti*). What is involved in Yoga is the death of the atomistic, egoic identity, the dissolution of the karmic web of *saṃsāra* that generates notions of one being a subject trapped in the prakṛtic constitution of a particular body-mind.

The reason for challenging such an isolationistic understanding of Patanjali's highly nuanced system is as follows:Not being content with mere theoretical knowledge, Yoga is committed to a practical way of life. To this end, Patañjali included in his presentation of Yoga an outline of the "eight-limbed" path (*aṣṭāṅga-yoga*)[34] dealing with the physical, moral, psychological, and spiritual dimensions of the yogin, an integral path that emphasizes organic continuity, balance, and integration in contrast to the discontinuity, imbalance, and disintegration inherent in *saṃyoga*.

The idea of cosmic balance and of the mutual support and upholding of the various parts of nature and society is not foreign to Yoga thought. Vyāsa deals with the theory of "nine causes" (*nava kāraṇāni*) or types of causation according to tradition.[35] The ninth type of cause is termed *dhṛti*--meaning "support" or "sustenance." Based on Vyāsa's explanation of *dhṛti* we can see how mutuality and sustenance are understood as essential conditions for the maintenance of the natural and social world. There is an organic interdependence of all living entities wherein all (i.e., the elements, animals, humans, and divine bodies) work together for the "good" of the whole and for each other.

Far from being misconceived exclusively as an introverted path of withdrawal from life, classical Yoga acknowledges the intrinsic value of "support" and "sustenance" and the interdependence of all living (embodied) entities, thus upholding organic continuity, balance, and integration within the natural and social world. Having achieved that level of insight (*prajñā*) that is "truth-bearing" (*ṛtaṃbharā*),[36] the yogin perceives the natural order (*ṛta*) of cosmic existence, "unites" with, and embodies that order. To fail to see clearly (*adarśana*) is to fall into disorder, disharmony, and conflict with oneself and the world. In effect, to be ensconced in ignorance implies a

disunion with the natural order of life and inextricably results in a failure to embody that order. Through Yoga one gains proper access to the world and is therefore established in right relationship to the world. Far from being denied or renounced, the world, for the yogin, has become transformed, properly engaged.

We need not read Patañjali as saying that the culmination of all yogic endeavor--*kaivalya*--is a static finality or inactive, isolated, solipsistic state of being. *Kaivalya* can be seen to incorporate an integrated, psychological consciousness along with the autonomy of pure consciousness, yet a pure consciousness to which the realm of the *guṇas* (e.g., psychophysical being) is completely attuned and integrated. On the level of individuality, the yogī (yoginī) has found his (her) place in the world at large, benevolently"fitting into the whole."[37]

In the last chapter of the *Yoga-Sūtra* (*Kaivalya-Pāda*), "aloneness" (*kaivalya*) is said to ensue upon the attainment of *dharmamegha-samādhi*, the "cloud of dharma" *samādhi*. At this level of practice, the yogin has abandoned any search for (or attachment to) reward or "profit" from his or her meditational practice; a non-acquisitive attitude (*akusīda*) must take place at the highest level of yogic discipline.[38] Vyāsa emphasizes that the identity of *puruṣa* is not something to be acquired (*upādeya*) or discarded (*heya*).[39] The perspective referred to as "*Pātañjala Yoga Darśana*" culminates in a permanent state of clear "seeing" brought about through the discipline of Yoga. Yoga thus incorporates both an end state or "goal" and a process.[40]

Dharmamegha-samādhi presupposes that the yogī has cultivated higher dispassion (*para-vairāgya*)--the means to the enstatic consciousness realized in *asaṃprajñāta-samādhi*.[41] Thus, *dharmamegha-samādhi* is more or less a synonym of *asaṃprajñāta-samādhi* and can even be understood as the consummate phase of the awakening disclosed in enstasy, the final step on the long and arduous yogic journey to authentic identity and "aloneness."[42] A permanent identity shift--from the perspective of the human personality to *puruṣa*--takes place. Now free from any dependence on or subordination to knowledge or *vṛtti*, and detached from the world of misidentification (*saṃyoga*), the yogī yet retains the purified guṇic powers of virtue including:

(i)   illuminating "knowledge of all"[43] (due to purified *sattva*);

(ii) nonafflicted activity[44] (due to purified *rajas*);

(iii) a stable body-form (due to purified *tamas*).

YS IV.30 declares: "From that [*dharmamegha-samādhi*] there is the cessation of afflicted action."[45] Hence the binding influence of the *guṇas* in the form of the afflictions, past actions, and misguided relationships is overcome; what remains is a "cloud of dharma" which includes an "eternality of knowledge" free from all impure covering (*āvaraṇa-mala*, YS IV.31) or veiling affliction and where "little (remains) to be known."[46] The eternality or endlessness of knowledge is better understood metaphorically rather than literally: It is not knowledge expanded to infinity but implies *puruṣa*-realization which transcends the limitations and particulars of conventional knowledge (*vṛtti*).

The culmination of the Yoga system is found when, following from *dharmamegha-samādhi*, the mind and actions are freed from misidentification and affliction and one is no longer deluded/confused with regard to one's true form (*svarūpa*) or intrinsic identity. This clarity about identity is highly significant to self-less action in the world. This is due to the fact that at this stage of practice the yogī is disconnected (viyoga) from all patterns of action motivated by *egoity*. According to both Vyāsa[47] and the sixteenth century commentator Vijnāna Bhikṣu,[48] one to whom this high state of purification takes place is designated as a *jīvanmukta*: one who is liberated while still alive (i.e., embodied or living liberation). Engagement with the world at large by such individuals occurs without selfishness, greed, insecurity, narcissism, false perception, delusion, or wrong motivation.

By transcending the normative conventions and obligations of karmic behavior, the yogī acts morally not as an extrinsic response out of obedience to an external moral code of conduct, but as an intrinsic response and as a matter of natural, purified inclination. The stainless luminosity of pure consciousness is revealed as one's fundamental nature. The yogī does not act as others do who are bound by the spiritual ignorance inherent in normal existence in saṃsāra, and ceases to act from the perspective of a delusive sense of self confined within *prakṛti*'s domain. Relinquishing all obsessive or selfish concern with the results of activity, the yogī remains wholly detached from the egoic fruits of action.[49] This does not imply that the yogī loses all orientation for action. It is important to remember that it is only attachment (and

compulsive, inordinate desire or craving), not action itself, that sets in motion the law of moral causation (karma) by which a person is implicated in *saṃsāra*. The yogī is said to be non-attached to either virtue or non-virtue, and is no longer oriented within the ego-logical patterns of thought as in the epistemically distorted condition of *saṃyoga*. This does not mean, as some scholars have misleadingly concluded, that the spiritual adept or yogī is free to commit immoral acts,[50] or that the yogī is motivated by selfish concerns.[51] Actions must not only be executed in the spirit of unselfishness (i.e., sacrifice) or detachment, they must also be ethically sound, reasonable and justifiable. Moreover, the yogī's spiritual journey--far from being an "a-moral process"[52]--is a *highly moral process*! The yogī's commitment to the sattvification of consciousness, including the cultivation of moral virtues such as compassion (*karuṇā*)[53] and nonviolence (*ahiṃsā*),[54] is not an "a-moral" enterprise, nor is it an expression of indifference, aloofness, or an uncaring attitude to others. Moral disciplines are engaged as a natural outgrowth of intelligent, (*sattvic*) self-understanding, insight that arises out of highly advanced consciousness, and commitment to self-transcendence that takes consciousness out of (ec-stasis) its identification with the rigid structure of the monadic ego, thereby reversing the inveterate tendency of this ego to inflate itself at the expense of its responsibility in relation to others.

Having defined the "goal" of Yoga as "aloneness" (*kaivalya*), the question must now be asked: What kind of "aloneness" was Patañjali talking about? "Aloneness," I suggest, is not the isolation of the seer (*draṣṭṛ, puruṣa*) separate from the seeable (*dṛśya, prakṛti*), as is unfortunately far too often maintained as the goal of Yoga. Rather, it refers to the "aloneness" of the power of "seeing" (*YS* II.20, 25) in its innate purity and clarity without any epistemological distortion and moral defilement. *In other words, "aloneness" actually refers to an absolute "oneness" of life which reveals itself* through *the power of seeing, a full vision which includes both consciousness and manifest or unmanifest existence.* The cultivation of *nirodha* uproots the compulsive tendency to reify the world and oneself (i.e., that pervading sense of separate ego irrevocably divided from the encompassing world) with an awareness that reveals the transcendent, yet immanent seer (*puruṣa*).

Through clear "seeing" (*dṛśi*) the purpose of Yoga is fulfilled, and the yogī, free from all misidentification and impure karmic residue (as in the former contextual sphere of *cittavṛtti*), gains full, immediate access to the world. By accessing the world in such an open and direct manner, in effect "uniting" (epistemologically) with the world, the yogī ceases to be encumbered by egoism (i.e., *asmitā* and its egoic attitudes and identity patterns) which, enmeshed in conflict and confusion and holding itself as separate from the world, misappropriates the world. The sacrifice of egoity/afflicted identity for the purpose of identifying as *puruṣa* is precisely what renders *prakṛti* sacred and ultimately reveals her intrinsic significance and value. By implication, in "aloneness" (*kaivalya*) sacrifice becomes an effortless, automatic (spontaneous) sanctification of the totality of life. Yoga can be recognized as a highly developed and integrated state of mystical illumination that extends and enhances our self-identity. The yogī can dwell in a state of balance and fulfillment serving others while feeling/being at home in the world. Freedom denotes at transformation of our entire way of being or mode of action as embodied within the lived world itself.

Yoga can be seen to unfold--in the heightened state of consciousness called *samādhi*--states of epistemic oneness that reveal the non-separation of knower, knowing, and the known (YS I.41) grounding our identity in a nonafflicted mode of action. *Kaivalya* implies a power of "seeing" in which the dualisms rooted in our egocentric patterns of attachment, aversion, fear, and so forth have been transformed into unselfish ways of being with others.[55]

The psychological, ethical, and social implications of this kind of identity transformation are, needless to say, immense. I am suggesting that Yoga does not destroy or anesthetize our feelings and emotions thereby encouraging neglect and indifference toward others. On the contrary, the process of "cessation" (*nirodha*) of the endless fluctuations of the mind steadies one for a life of compassion, discernment, and service informed by a "seeing" that is able to understand (literally meaning "to stand among, hence observe")--and is in touch with--the needs of others. What seems especially relevant for our understanding of Yoga ethics is the enhanced capacity generated in Yoga for empathic identification with the object one seeks to understand. This is a far cry from the portrayal of the yogī as a disengaged figure,

psychologically and physically removed from the human relational sphere, who in an obstinate and obtrusive fashion severs all ties with the world. Such an image of a wise yogin merely serves to circumscribe our vision of humanity and, if anything else, stifle the spirit by prejudicing a spiritual, abstract (and disembodied) realm over and against nature and our human embodiment. In Yoga philosophy, "seeing" is not only a cognitive term but implies purity of mind, that is, it has moral content and value. Nor is "knowledge" (*jñāna, vidyā*) in the Yoga tradition to be misconstrued as a "bloodless" or "heartless" gnosis.

I wish to argue therefore that through the necessary transformation of consciousness brought about through yogic discipline, an authentic and fruitful coherence of self-identity, perception, and activity emerges out of the former fragmented consciousness in *saṃyoga*. If Patañjali's perception of the world of forms and differences had been destroyed or discarded, how could he have had such insight into Yoga and the intricacies and subtle nuances of the unenlightened state?[56] If through *nirodha* the individual form and the whole world had been canceled for Patañjali, he would more likely have spent the rest of his days in the inactivity and isolation of transcendent oblivion rather than undertake the effort to systematize and present Yoga philosophy to others! Rather than being handicapped by the exclusion of thinking, perceiving, experiencing, or activity, the liberated yogī actualizes the potential to live a fully integrated life in the world. I conclude here that there is no reason why the liberated yogī cannot be portrayed as a vital, creative, thoughtful, empathetic, balanced, happy, and wise person. Having adopted an integrative orientation to life, the enlightened being can endeavor to transform, enrich, and ennoble the world. I am therefore suggesting that there is a rich affective, moral, and cognitive as well as spiritual potential inherent in the realization of *puruṣa*, the "aloneness" of the power of consciousness/seeing.

Yoga presupposes the integration of contemplation and activity; there can be no scission between *theoria* and *praxis*. The *Yoga-Sūtra* is a philosophical text where *praxis* is deemed to be essential. Without actual practice the theory that informs Yoga would have no authentic meaning. Yet without examination and reflection there would be no meaningful striving for liberation, no "goal," as it were, to set one's sight on. In an original, inspiring,

and penetrating style, Patañjali bridges metaphysics and ethics, transcendence and immanence, and contributes to the Indic and global fold a form of philosophical investigation that, to borrow J. Taber's descriptive phrase for another context, can properly be called a "transformative philosophy." That is to say, it is a philosophical perspective which "does not stand as an edifice isolated from experience; it exists only insofar as it is realized in experience."[57]

Conclusion

To conclude, it can be said that *puruṣa* indeed has some precedence over *prakṛti*

in Patañjali's system, for *puruṣa* is what is ordinarily "missing" or concealed in human life and is ultimately the state of consciousness one must awaken to in Yoga. The liberated state of "aloneness" (*kaivalya*) need not denote either an ontological superiority of *puruṣa* or an exclusion of *prakṛti*. *Kaivalya* can be positively construed as an integration of both principles--an integration or "absolute oneness of life" that, I have argued, is what is most important for Yoga. I have proposed that the *Yoga-Sūtra* does not uphold a "path" of liberation that ultimately renders *puruṣa* and *prakṛti* incapable of "co-operating" together. Rather, the *Yoga-Sūtra* seeks to "unite" these two principles without the presence of any defiled understanding, to bring them "together," properly aligning them in a state of balance, harmony, and a clarity of knowledge in the integrity of being and action. Isolationism may not be and indeed does not seem to be the experience of those who have undertaken these practices at a deeper and mature level.

The purified mind, one that has been transformed through yogic discipline, is certainly no ordinary worldly awareness nor is it eliminated for the sake of pure consciousness. To confuse (as many interpretations of Yoga have unfortunately done) the underlining purificatory processes involved in the cessation of ignorance/afflicted identity as being the same thing as (or as necessitating the need for) a radical elimination of our psychophysical being--the vehicle under the realm of prakṛti through which consciousness discloses itself--is, I suggest, to misunderstand the intent of the *Yoga Sūtra* itself. There are strong grounds for arguing (as I have attempted to show) that through "cessation" *prakṛti* herself (in the form of the guṇas that constitute the makeup of the yogī's body-mind) is liberated from the grip

of ignorance rooted in lower levels of consciousness or afflicted identity. Vyāsa explicitly states (*YB* II.18) that emancipation happens in the mind and does not literally apply to *puruṣa*--which is by definition already free and therefore has no intrinsic need to be released from the fetters of saṃsāric existence. The liberated one "realizes" and thereby experiences, this freedom.

Both morality and perception (cognition) are essential channels through which human consciousness, far from being negated or suppressed, is transformed and illuminated. Yoga combines discerning knowledge of self and reality with an emotional, affective, and moral sensibility allowing for a participatory epistemology that incorporates a moral plenitudefor empathic identification with the world; that is, with the objects or persons one seeks to understand. The enhanced perception gained through Yoga must be interwoven with Yoga's rich affective and moral dimensions to form a spirituality that does not become entangled in a web of antinomianism, but which retains the integrity and vitality to transform our lives and the lives of others in an effective manner. In Yoga proper there can be no support, ethically or pedagogically, for the misappropriation or abuse of *prakrti* for the sake of freedom *or puruṣa*-realization. By upholding an *integration of the moral and the mystical*, Yoga supports a reconciliation of the prevalent tension within Hinduism between (1) spiritual engagement and self-identity within the world (*pravṛtti*) and (2) spiritual disengagement from worldliness and self-identity that transcends the world (*nivṛtti*). Yoga discerns and teaches a balance between these two apparently conflicting orientations.

This paper has attempted to counter the radically dualistic, dissociative and isolationistic interpretations of Yoga presented by many scholars—which render the full potentialities of our human embodiment as constrained within a radical, rigid, dualistic metaphysical structure-- and to propose instead an open-ended, morally and epistemologically oriented hermeneutic that frees Yoga of the long-standing conception of spiritual isolation, disembodiment, self-denial, and world-negation and thus from its pessimistic image. Our interpretation does not impute that *kaivalya* denotes a final incommensurability between spirit and matter. While Patañjali can be understood as having adopted a provisional, practical, dualistic metaphysics, there is no proof that his system either ends in duality or eliminates the possibility for an

ongoing cooperative duality. Yoga is not simply "*purusa*-realization"; it equally implies "getting it right with *prakṛti*".

To be sure, the yogic path in all of its knowledge, power and glory must be transcended. One must, as it were, step outside of the vehicle of *prakṛti* and dwell as the consciousness of *puruṣa* in true form (*svarūpa*). Yet I want to suggest that transcendence need not be taken to mean a "static finality": abiding in nonafflicted, disengaged, formless, transcendent bliss. Rather, more elliptically, Patañjali may well have set the stage for an inclusive awakening allowing for a convergence and engagement in life, a "growing up" in life with an integrity and fullness that perhaps knows no bounds. Now that, I would like to suggest, is a matured Yoga, the possibility of which we must not overlook or close the door on.

As well as being one of the seminal texts on yogic technique and transformative/liberative approaches within Indian philosophy, Patañjali's Yoga-Sutras has to this day remained one of the most influential spiritual guides within Hinduism. In addition to a large number of people within India, millions of Westerners are actively practising some form of Yoga influenced by Patañjali's thought clearly demonstrating Yoga's relevence for today as a discipline which can transcend cultural, religious and philosophical barriers. The universal and universalizing potential of Yoga makes it one of India's finest contributions to our modern/postmodern struggle for self-definition, moral integrity and spiritual renewal. The main purpose of this paper has been to consider a fresh approach in which to reexamine and reassess Classical Yoga philosophy, and to rearticulate in a fuller way what I have elsewhere referred to as the integrity of the Yoga *Darśana*.[58]

Endnotes

1 See Whicher (1998).

2 See, for example, Śankara's (ca eighth-ninth century CE) use of *vyāvahārika* (the conventional empirical perspective) in contrast to *paramārthika* (the ultimate or absolute standpoint).

3 See Whicher (1998).

4 See in particular: Feuerstein (1980: 14, 56, 108); Eliade (1969: 94-95, 99-100); Koelman (1970: 224, 251); and G. Larson (1987: 13) who classifies Patañjali's Yoga as a form of Sāṃkhya.

5 F. Edgerton (1924), "The Meaning of Sāṃkhya and Yoga," AJP 45, pp. 1-46.

6 As argued in Whicher (1998).

7 YS I.2 (p. 4): *yogaś cittavṛttinirodhaḥ*. The Sanskrit text of the *Yoga-Sūtra* of Patañjali and the *Yoga-Bhāṣya* of Vyāsa is from *The Yoga-Sūtras of Patañjali* (1904), K. S. Āgāśe ed. (Poona: Ānandāśrama) Sanskrit Ser. no. 47. The modifications or functions (*vṛtti*) of the mind (*citta*) are said to be fivefold (YS I.6), namely, 'valid cognition' (*pramāṇa*, which includes perception [*pratyakṣa*], inference [*anumāna*] and valid testimony [*āgama*]), 'error'/'misconception' (*viparyaya*), 'conceptualization' (*vikalpa*), 'sleep' (*nidrā*) and 'memory' (*smṛti*), and are described as being 'afflicted' (*kliṣṭa*) or 'nonafflicted' (*akliṣṭa*) (YS I.5). *Citta* is an umbrella term that incorporates 'intellect' (*buddhi*), 'sense of self' (*ahaṃkāra*) and 'mind-organ' (*manas*), and can be viewed as the aggregate of the cognitive, conative and affective processes and functions of phenomenal consciousness, i.e., it consists of a grasping, intentional and volitional consciousness. For an in-depth look at the meaning of the terms *citta* and *vṛtti* see I. Whicher (1998). In the first four *sūtras* of the first chapter (*Samādhi-Pāda*) the subject matter of the *Yoga-Sūtra* is mentioned, defined and characterized. The *sūtras* run as follows: *YS* I.1: "Now [begins] the discipline of Yoga." *YS* I.2: "Yoga is the cessation of [the misidentification with] the functioning/transformations of the mind." *YS* I.3: "Then [when that cessation has taken place] there is abiding in the seer's own form (i.e., *puruṣa* or intrinsic identity)." *YS* I.4: "Otherwise [there is] conformity to (i.e., misidentification with) the functioning [of the mind]." *YS* I.1-4 (pp. 1, 4, 7, and 7 respectively): *atha yogānuśasanam; yogaś cittavṛttinirodhaḥ; tadā draṣṇuḥ svarūpe'vasthānam; vṛttisārūpyam itaratra*. For a more comprehensive study of classical Yoga including issues dealt with in this paper see Whicher (1998).

8 See Whicher (1998).

9 See Whicher (1998).

10 See chapter 6 in Whicher (1998).

11 *YS* II.15 (p. 74): *pariṇāmatāpasaṃskāraduḥkhair guṇavṛttivirodhāc ca duḥkham eva sarvaṃ vivekinaḥ*. "Because of the dissatisfaction and sufferings due to change and anxieties and the latent impressions, and

from the conflict of the transformations of the *guṇas*, for the discerning one, all is sorrow alone."

12 Patañjali uses the term *pratiprasava* twice, in *YS* II.10 and IV.34.

13 See Chapple and Kelly (1990) p. 60.

14 Feuerstein (1979a) p. 65.

15 Cf. U. Arya (1986) pp. 146, 471.

16 The term *kaivalya* comes from *kevala*, meaning 'alone'. Feuerstein (1979a: 75) also translates *kaivalya* as "aloneness" but with a metaphysical or ontological emphasis that implies the absolute separation of *puruṣa* and *prakṛti*.

17 *YS* II.25 (p. 96): *tadabhāvāt saṃyogābhāvo hānaṃ taddṛśeḥ kaivalyam*.

18 *YS* II.20 and IV.18.

19 *YS* IV.34 (p. 207): *puruṣārthaśūnyānāṃ guṇānāṃ pratiprasavaḥ kaivalyaṃ svarūpapratiṣṭhā vā citiśaktir iti*.

20 See n. 19 above.

21 *YS* III.55 (p. 174): *sattvapuruṣayoḥ śuddhisāmye kaivalyam iti*. One must be careful not to characterize the state of *sattva* itself as liberation or *kaivalya*, for without the presence of *puruṣa* the mind (as reflected consciousness) could not function in its most transparent aspect as *sattva*. It is not accurate, according to Yoga philosophy, to say that the *sattva* is equivalent to liberation itself. The question of the nature of the *guṇas* from the enlightened perspective is an interesting one. In the *Bhagavadgītā* (II.45) Kṛṣṇa advises Arjuna to become free from the three *guṇas* and then gives further instructions to be established in eternal *sattva* (beingness, light, goodness, clarity, knowledge), free of dualities, free of acquisition-and-possession, Self-possessed (*nirdvandvo nityasattvasthoniryogakṣema ātmavān*). It would appear from the above instructions that the nature of the *sattva* being referred to here transcends the limitations of the nature of *sattva-guṇa* which can still have a binding effect in the form of attachment to joy and knowledge. It is, however, only by first overcoming *rajas* and *tamas* that liberation is possible.

22 *YB* III.55 (p. 175): *nahi dagdhakleśabījasya jnāne punar apekṣā kācid asti*. "When the seeds of afflictions have been scorched there is no longer any dependence at all on further knowledge."

23 H. Āraṇya writes (1963: 123) that in the state of *nirodha* the *guṇas* "do not die out but their unbalanced activity due to non-equilibrium that was taking place … only ceases on account of the cessation of the cause (avidyā or nescience) which brought about their contact."

24 *YB* IV.25 (p. 201): *puruṣas tv asatyām avidyāyāṃ śuddhaś cittadharmair aparāmṛṣṭa*.

25 *YB* I.41.

26 *YS* II.26.

27 *YS* III.49.

28 Vijñāna Bhikṣu insists (YV IV.34: 141) that *kaivalya* is a state of liberation for both *puruṣa* and *prakṛti* each reaching its respective natural or intrinsic state. He then cites the *Sāṃkhya-Kārikā* (62) where it is stated that no *puruṣa* is bound, liberated or transmigrates. It is only *prakṛti* abiding in her various forms that transmigrates, is bound and becomes liberated. For references to Vijñāna Bhikṣu's *YV* I have consulted T. S. Rukmani (1981, 1983, 1987, 1989).

29 *YS* I.51 and III.8; the state of *nirbīja* or "seedless" samādhi can be understood as the liberated state where no "seed" of ignorance remains, any further potential for affliction (i.e., as mental impressions or *saṃskāras*) having been purified from the mind.

30 *RM* I.1 (p. 1).

31 Müller (1899: 309).

32 See, for example, Eliade (1969), Koelman (1970), Feuerstein (1979a), and Larson (1987).

33 I am here echoing some of the points made by Chapple in his paper entitled, "Citta-vṛtti and Reality in the Yoga Sūtra" in Sāṃkhya-Yoga: Proceedings of the IASWR Conference, 1981 (Stoney Brook, New York: The Institute for Advanced Studies of World Religions, 1983), pp. 103-119. See also Chapple and Kelly (1990: 5) where the authors state: " … *kaivalyam* … is not a catatonic state nor does it require death." *SK* 67 acknowledges that even the "potter's wheel" continues to turn because of the force of past impressions (*saṃskāras*); but in Yoga, higher dispassion and *asaṃprajñāta* eventually exhaust all the impressions or karmic residue. Through a continued program of ongoing purification Yoga allows for the possibility of an embodied state of freedom utterly unburdened by the effects of past

actions. As such Yoga constitutes an advance over the fatalistic perspective in Sāṃkhya where the "wheel of *saṃsāra*" continues (after the initial experience of liberating knowledge) until, in the event of separation from the body, *prakṛti* ceases and unending "isolation" (*kaivalya*) is attained (*SK* 68). In any case, the yogic state of supracognitive *samādhi* or enstasy goes beyond the liberating knowledge of viveka in the Sāṃkhyan system in that the yogī must develop dispassion even toward discriminative discernment itself. For more on an analysis of the notion of liberation in Sāṃkhya and Yoga see C. Chapple's chapter on "Living Liberation in Sāṃkhya and Yoga" in *Living Liberation in Hindu Thought*, ed. by Andrew O. Fort and Patricia Y. Mumme (Albany: State University of New York Press, 1996).

34 *YS* II.29; see the discussion on *aṣṭāṅga-yoga* in chapter 4 of Whicher (1998).

35 *YB* II.28 (pp. 99-101).

36 *YS* I.48.

37 See K. Klostermaier (1989), "Spirituality and Nature" in Hindu Spirituality: Vedas Through Vedānta ed. by Krishna Sivaraman (London: SCM Press) pp. 319-337.

38 *YS* IV.29 (p. 202): *prasaṃkhyāne'py akusīdasya sarvathā vivekakhyāter dharmameghaḥ samādhiḥ*.

39 *YB* II.15 (p. 78): *tatra hātuḥ svarūpamupādeyaṃ vā heyaṃ vā na bhavitumarhati*. "Here, the true nature/identity of the one who is liberated cannot be something to be acquired or discarded."

40 Thus the term "yoga" (like the terms *nirodha* and *samādhi*) is ambiguous in that it means both the processes of purification and illumination and the final result of liberation or "aloneness."

41 *YB* I.18.

42 See Feuerstein (1980: 98).

43 *YS* III.49 and III.54.

44 *YS* IV.7; see also *YS* IV.30 (n. 45 below).

45 *YS* IV.30 (p. 202): *tataḥ kleśakarmanivṛttiḥ*. Thus, it may be said that to dwell without defilement in a "cloud of dharma" is the culminating description by Patañjali of what tradition later referred to as living liberation (*jīvanmukti*).

46 *YS* IV.31 (p. 203): *tadā sarvāvaraṇamalāpetasya jñānasyānantyājjñeyam alpam*.

47 See *YB* IV.30 (pp. 202-203*): kleśakarmanivṛttau jīvanneva vidvānvimukto bhavati*. On cessation of afflicted action, the knower is released while yet living."

48 *YV* IV.30 (pp. 123-124). Elsewhere in his *Yoga-Sāra-Saṃgraha* (p. 17) Vijñāna Bhikṣu tells us that the yogin who is "established in the state of *dharmamegha-samādhi* is called a *jīvanmukta*" (… *dharmameghaḥ samādhiḥ … asyāmavasthāyāṃ jīvanmukta ityucyate*). Vijñāna Bhikṣu is critical of Vedāntins (i.e. Śaṅkara's Advaita Vedānta school) that, he says, associate the *jīvanmukta* with ignorance (*avidyā-kleśa*)--probably because of the liberated being's continued link with the body--despite Yoga's insistence on the complete overcoming of the afflictions.

49 This is the essence of Kṛṣṇa's teaching in the *Bhagavadgītā* on *karmayoga*; see, for example, *BG* IV.20.

50 See R. C. Zaehner (1974), *Our Savage God* (London: Collins) pp. 97-98.

51 See B.-A. Scharfstein (1974), *Mystical Experience* (Baltimore, MD: Penguin) pp. 131-132.

52 See Feuerstein (1979a: 81).

53 *YS* I.33 (p. 38): *maitrīkaruṇāmuditopekṣāṇāṃ sukhaduḥkhapuṇyāpuṇyaviṣayāṇāṃ bhāvanātaś cittaprasādanam*. "The mind is made pure and clear from the cultivation of friendliness, compassion, happiness and equanimity in conditions or toward objects of joy, sorrow, merit or demerit respectively."

54 *YS* II.35.

55 *YS* I.33; see n. 53 above.

56 Although the historical identity of Patañjali the Yoga master is not known, we are assuming that Patañjali was, as the tradition would have it, an enlightened Yoga adept.

57 J. Taber (1983). *Transformative Philosophy: A Study of Śaṅkara, Fichte and Heidegger* (Honolulu: University of Hawaii Press) p. 26.

58 See Whicher (1998).

Time, Space and Structure in Ancient India

Subhash Kak
Regents Professor and Ex-Head of Computer Science Department at Oklahoma State University

Abstract

This essay uses Vedic and classical sources to describe the recursive model of the universe of ancient India that delineated connections between time, space and structure. This model was based on an assumed equivalence of the outer and the inner cosmoses and it is embodied in Indian architecture, music, and art. Early evidence for it comes from the very organization of the Ṛgveda and in the details of the great Agnicayana ritual of the Vedic period. We suggest that the same cosmic vision characterizes the Sindhu-Sarasvati (Harappan) civilization as evidenced by the use of astronomical alignments, specific proportions and recursion. We summarize evidence on the use of the same unit of length (dhanus) with its 108 parts both in the Sindhu-Sarasvati and the historic periods. The use of a scale with 108 divisions is significant because it reflects fundamental ideas related to the nature of the cosmos. This parallel, by itself, could be a coincidence, but when viewed together with the continuity in religion, art, and architecture, it demonstrates a shared vision of the universe. It is further shown how a similar tripartite and recursive basis describes the Śri Cakra.

Introduction

The ancient world did not have a split between the sacred and the temporal. The temple served as the place where time-bound ritual was conducted and keeping time was one of its functions. The English word *temple* is derived from the Latin *templum,* which is sacred space, facing west, that was marked out by the augurs. In the east-west orientation of the axis of the temple that is strictly true only on the two equinoxes is the acknowledgement of concern with time and the seasons. In India, the temple is likewise associated with the east-west axis and we can trace its origins to priests who maintained different day counts with respect to the solstices and the equinoxes. Specific days were marked with ritual observances (Caland, 1931). Some ritual included construction of altars that coded knowledge related to the motions of the sun and the moon and supposed correspondences with the inner cosmos.[1]

The Agnicayana altar, the centre of the great ritual of the Vedic times that forms a major portion of the narrative of the Yajurveda, is seen as the prototype of the temple and of the Indian tradition of architecture (Vāstu). The altar is first built of 1,000 bricks in five layers (that symbolically represent the five divisions of the year, the five physical elements, as well as five senses) to specific designs (Kak, 2005a). The Agnicayana ritual is based upon the Vedic division of the universe into three parts of earth, atmosphere, and sky, which are assigned numbers 21, 78, and 261, respectively; these numbers add up to 360, which is symbolic representation of the year. These triples are seen in all reality, and they enlarge to five elements and five senses in further emanation.

In the ritual at home, the householder employed three altars that are circular (earth), half-moon (atmosphere), and square (sky) (Figure 1), which are like the head, the heart, and the body of the Cosmic Man (Puruṣa). In the Agnicayana ritual, the atmosphere and the sky altars are built afresh in a great ceremony to the east. The numerical mapping is maintained by placement of 21 pebbles around the earth altar, sets of 13 pebbles around each of 6 intermediate (13×6=78) altars, and 261 pebbles around the great new sky altar called the Uttara-vedi. The Uttara-vedi is the precursor to the temple structure. It also symbolizes the patron in whose name the ritual is being performed.
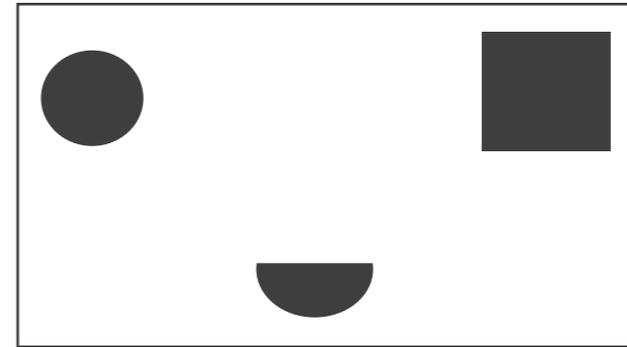

Figure 1. The three altars of the Vedic house: circular (earth, body), half-moon (atmosphere, prāna), square (sky, consciousness)

191 Book 10	114 Book 9
104 Book 7	92 Book 8
87 Book 5	75 Book 6
62 Book 9	58 Book 4
43 Book 2	191 Book 1

Figure 2. The Ṛgveda as an altar

The foundations of Vedic representation and ceremony are the notions of *bandhu-* (equivalence or binding between the outer and the inner), *yajña* (transformation), and *parokṣa* (paradox). The five layers of the altar represent the physical world, and the number of consecrated bricks in the five layers is related to numbers derived from the year count of 360. To represent two more layers of reality beyond the purely objective, a sixth layer of bricks that includes a hollow brick with an image of the golden Purusha inside is made, some gold chips scattered and the fire placed, which constitutes the seventh layer (ŚB 10.1.3.7). The two layers beyond denote completion, for seven was taken as a measure of the whole.[2]

Recursion

The central idea of this scheme is that of *recursion,* or repetition in scale and time. The universe is taken to be mapped into the individual; it is also symbolically represented in the creative arts, as in music, dance, sculpture, and sacred architecture (Kak, 2002; Kak, 2006) In literature, we see recursion in the *story within story* genre in the Vedic hymns, the Epics, the Yoga Vāsiṣṭha, and the Purāṇic texts.[3]

Not only is the temple a symbolic representation of the cosmos, the Ṛgveda itself was planned as a five-layered altar by stacking up the 10 books in pairs, two books to a layer, as shown in Figure 2. These hymn numbers have several symmetries, such as pairs of hymn numbers differing by 12, 17 and 29, and the numbers have an astronomical basis that is described at length in *The Astronomical Code of the Ṛgveda* (Kak, 2000).

The separations diagonally across the two columns are 29 each for Book 4 to Book 5 and Book 6 to Book 7, and they are 17 each for the second column for Book 4 to Book 6 and Book 6 to Book 8. Books 5 and 7 in the first column are also separated by 17; Books 5 and 6 as well as 7 and 8 are separated by 12; Books 5 and 7 add up to the total for either Book 1 or Book 10. Another regularity is that the middle three layers are indexed by order from left to right whereas the bottom and the top layers are in the opposite sequence.
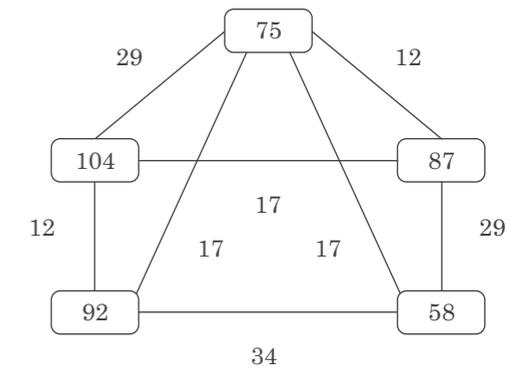

Figure 3. The Ṛgveda books 4-8 as a graph

The relationship between the hymn numbers for the books 4-8 looks particularly striking when viewed through the graph of Figure 3, where the numbers on the edges represent the difference between the corresponding node numbers.

The total number of hymns, 1017, is 3339, where 339 is the number of sun-disks from sunrise to sunset on a typical day (or similarly of moon-disks). The origin of the number 339 becomes evident if the sun were to be approximately 108 times its diameter away from the earth (which is astronomically true) as $108 \pi \approx 339$. Note also that the sum of the sky and the atmosphere numbers is $261+78 = 339$, indicating that the choice of the three numbers had an observational basis.

With the temple viewed as a map of the universe, the main altar corresponds to the sun and the door at the west corresponds to the earth. The origin in India of the measure of 108 as the distance in sun-diameters from the earth to the sun may be the discovery that a pole of a certain height removed to a distance of 108 times its height has the same angular size as the sun or the moon. It led to a conceptual framework for the sun-earth-moon system that became a part of Indian cosmology. It was further assumed that beyond our system existed other worlds.[4]

Owing to assumed recursion, the number 108 characterizing the cosmos is associated with the gods and the activities of humans. It shows up as the number of beads in the Indian rosary (telling of beads is to make a symbolic journey across the worlds), the number of dance movements of the Nāṭya Śāstra, the names of the God and the Goddess, the number of pilgrimages, the number of spiritual masters, and so on. There are also 108 divisions of the zodiac and 108 rhythmical patterns (tālas) of music. With the human body described by a measure of 108, the weak points of the body are counted in the Āyurveda system to be 107.

Each of the 27 nakṣatra divisions of the zodiac is further divided into 27 upa-nakṣatras (ŚB 10.5.4.5). The time measures are defined in a sequence with multiples of 30.

Ritual and Plan of the Temple

We now briefly summarize our work on the axis and the perimeter of the sacred ground as available to us in the Śatapatha Brāhmaṇa, which validates the astronomical interpretation of 108. The Agnicayana ritual, as sacred theatre, was performed in a special area where the three fires of the yajamāna are established in the west in an area called Prācīnavaṃśa, "Old Hall" whose dimensions are in the canonical ratio of 1:2.

The Prācīnavaṃśa has dimensions of 20×10. Three steps

from it to the east (ŚB 3.5.1.1) is the Mahāvedi, which is an isosceles trapezoid of spine 36 and the two sides of 30 and 24 units, representing the ratio of 5/4. To see the significance of the plan, we draw the sacred ground within a rectangular area (Figure 4).

To obtain accord with the measures which are multiples of 6, the left area is increased by an additional one step to the west to become 24×30 as in Figure 4, which is described as an appropriate proportion for a house in later texts such as Varāhamihira's Bṛhat Saṃhitā (53.4) (Bhat, 1995). The Prācīnavaṃśa's contribution to the perimeter is 24+30+24=78, which is the atmosphere number that was mentioned earlier. This is also in accord with the notion that the Prācīnavaṃśa is tripled in size in the completion of the Mahāvedi, going from 10×20 to 30×60. The distance to the high altar on the extreme right (with dimensions of 66) from the axis at the left is 54 units. The high altar is where the main ritual is performed and, symbolically, it represents the sun. The separation of the high altar from the doorway to the left is representative of the distance to the sun and the perimeter is representative of the circuit of the sun.

Thus the basic temple plan contains two significant numbers, 180 and 54, which, when doubled, correspond to astronomical knowledge related to the 360 days of the year (attested in the Ṛgveda) and the number 108 (distance to the sun in sun-diameters).
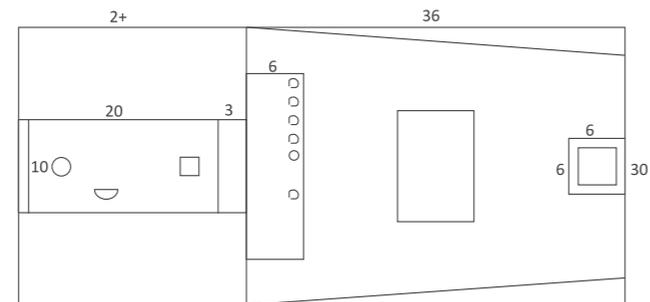

Figure 4: The temple plan: The perimeter is 180 units and the axis is 54 units to the high altar

The proportion of 1:2 for the altar ground is attested in later texts such as the Bṛhat Saṃhitā and Śilpa Prakāśa (Kaulacāra, 1966). The altar ground is also associated with ratios of 5/4, 3/2, and so on, which emerge out of the interplay of numbers such as 30 days of the month, 180 days of the half-year, 12 months of the year, and so on. It

must be remembered that astronomical numbers are also associated with the ratios of the seven notes of the octave (Kak, 2003).

The temple itself, in its three-dimensional form, codes several rhythms of the cosmos and specific alignments related to the geography of the place and the presumed linkages of the deity and the patron. The architecture may also incorporate themes related to royal power if it was built at the behest of a king.

As mentioned before, in the Vedic system the earth was assigned the form of circle and the sky the form of square. The main altar in the temple has a square form because it represents the sky, with the four corners standing for the four cardinal directions or the set of two equinoxes and two solstices.

Buildings to be used by humans are to depart from the perfect, square form. The breaking of the symmetry is to connote energy and change. According to the Bṛhat Saṃhitā (chapter 53), the length of a king's palace is greater than the width by a quarter (1 + ¼ = 5/4), or in other words the proportions are 5:4. Likewise, the length of the general's palace exceeds the width by a sixth (1 + 1/6 = 7/6), or has proportions 7:6; the proportions for the houses of ministers and princes are 9:8 and 4:3, respectively. For lesser officials as well as citizens, other proportions are prescribed.

Recursion and the Śri Cakra

Yantras have been used in India to represent esoteric knowledge, and the basis of this esoteric knowledge is cosmology. The Śri Cakra or Śri Yantra (Figure 5) is the tripartite division of the universe into earth, atmosphere, and the sun mirrored in the individual by the body, the breath, and the inner lamp of consciousness. It may also be seen as the three main divisions of the body into the head, the chest, and the lower trunk. Its basic form is that of three triangles, two pointing downwards and one upwards. Within each triangle are two other triangles, of alternating opposing polarity in terms of the direction of pointing that represents male and female principles. All together, this adds up to 9 interpenetrating triangles (5 downward pointing Śakti principle and 4 upward pointing Śiva principle), which through their overlaps constitute a total of 43 small triangles. Right through the middle of this is the dot, the *bindu,* who is Śiva, the witness, or consciousness.[5]
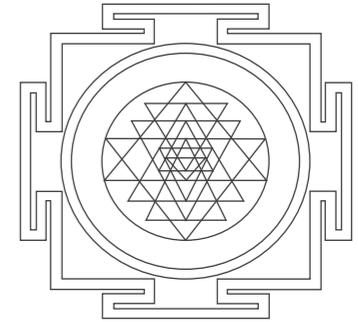
Figure 5. The Śri Cakra

These triangles formed by the intersection of the nine triangles are surrounded by a circle of 8 petals that, in turn, is surrounded by a 16-petalled circle (petals not shown in the figure above). At the outermost are lines, which are called the *bhūpura* (the city of the earth, or the body). The yantra is also categorized into 9 coverings (āvaraṇas), where the *bhūpura* is the outer covering. These 9 coverings have 108 presiding Goddesses. In the Sri Cakra pūjā they are systematically worshipped one by one with their names and mantras.

The presiding deity of Sri Cakra is Lalitā Tripura Sundarī, who is the Goddess in her playful aspect as the transcendent beauty of the three worlds. These three worlds are the three gunas of *sattva*, *rajas* and *tamas*; or sun (heavens), moon (atmosphere), and fire (earth); will (*icchā*), knowledge (*jñāna*) and action (*kriyā*); intellect, feelings, and sensation; subject (*mātā*), instrument (*māna*), and object (*meya*) of all things; or waking (*jāgrat*), dreaming (*svapna*) and dreamless sleep (*suṣupti*) states. Her five triangles represent the *pañca bhūtas* (five elements). She holds five flowery arrows, noose, goad and bow. The noose is attachment, the goad is revulsion, the bow is the mind and the flowery arrows are the five sense objects.

The Śri Cakra ritual infuses the design of the yantra with chant, representing the union of space and sound. Its closed, concentric circuits correspond to the nine planes of consciousness of the spiritual seeker. Each plane is a stage on the ascent of one's being toward the inner self.

Cosmic Vision in the Sindhu-Sarasvati World

Does a cosmic vision characterize the Sindhu-Sarasvati (Harappan) civilization also? For this we need evidence of

astronomical alignments, use of specific proportions, and that of the important concept of recursion.

Archaeologists agree that there is continuity in religion, art, and culture (Rao, 1991; Kak, 1992; Bisht, 1999; Kenoyer, 1998; Lal, 2005) between the Sindhu-Sarasvati period of the third millennium BC and the later historical period. We saw that the number 108 is central to Indian cosmology; it is also an essential component of the Indian system of length units going back to the Harappan period. Although this in itself does not establish that the Harappan cosmology is identical to the Vedic (for the use of the number 108 could be a coincidence), but other cultural correspondences suggests that it was so. The evidence from Dholavira, as described later in this section, suggests that the idea of recursion was part of the worldview of the Harappans.

Maula (1984) presents evidence on the use of great calendar stones, in the shape of ring, which served to mark the beginning and end of the solar year in Mohenjo-Daro indicating that astronomy had moved beyond marking the motions of moon. For comparison, note that the astronomical basis of the Vedic ritual was the reconciliation of the lunar and solar years.

Wanzke (1984) argues that Mohenjo-Daro and other sites show slight divergence of 1° to 2° clockwise of the axes from the cardinal directions. He suggests that this might have been due to the orientation of Procyon and Aldebaran, two bright stars that were prominent in the direction of the setting sun during 2500 BC to 1500 BC, indicating once again astronomical reasoning of the kind to be found in the design of Hindu temples.

It is significant that yantric buildings have been discovered in North Afghanistan that belong to a period that corresponds to the late stage of the Sindhu-Sarasvati civilization (Kak, 2005b) providing architectural evidence in support of the idea of recursion at this time. Although these building are a part of the Bactria-Margiana Archaeological Complex (BMAC), their affinity with ideas that are also present in the Sindhu-Sarasvati system shows that these ideas were widely spread.

Some Harappan seals are generally accepted to have an astronomical basis, and the beginnings of the Vedic nakshatra system are seen in the third millennium BC. There is also continuity in the system of weights and lengths between the Harappan period and the later historic period (Mainkar, 1984).

Danino provides an analysis of the unit of length at Dholavira that is in accord with unit from the historical period (Danino, 2008). He shows that the unit that best fits the Dholavira dimensions is 190.4 cm, which when divided by 108 gives the Dholavira aṅgula of 1.763 cm. The subunit of aṅgula is confirmed when one considers that the bricks in Sindhu-Sarasvati follow ratios of 1:2:4 with the dominating size being 7 14 28 cm (Kenoyer, 1998, page 57). These dimensions can be elegantly expressed as 4 8 16 *aṅgulas*, with the unit of *aṅgula* taken as 1.763 cm. The ivory scale at Lothal has 27 graduations in 46 mm, or each graduation is 1.76 mm.

Figure 6 is the general plan of Dholavira, which consists of three "towns" in accord with Vedic ideas (Bisht, 1999). Figure 7 presents the proportions for the three towns of Dholavira and shows how they are related. The Dholavira system of units, due to Danino, is clearly shown in Figure 8. It was found by using units that led to integer counts for lengths with a small margin of error.

The feature of recursion in the three towns, or repeating ratios at different scales, is significant because we have already noted it in the Vedic world view. Specifically, the design is characterized by the nesting proportion of 9:4 across the lower and the middle towns and the castle. The proportions of 5/4, 7/6, and 5/4 for the lower town, the middle town, and the castle may reflect the measures related to the royal city, the commander's quarter, and the king's quarter, respectively. We don't know if the choice of the other proportions in Figure 8 had similar underlying logic.
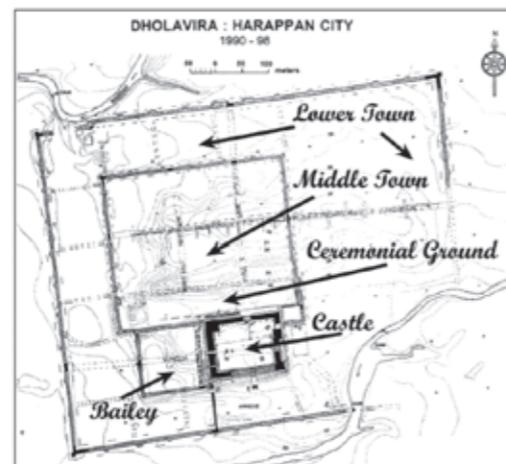
Figure 6. Map of Dholavira (Bisht, 1997)
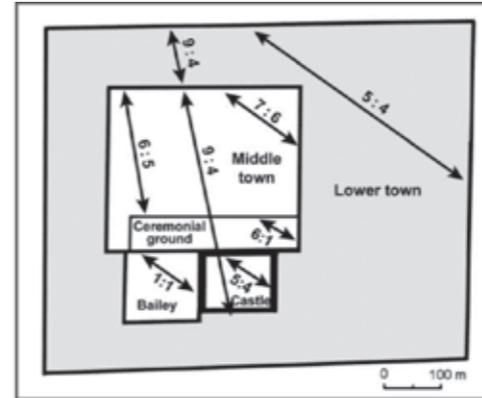
Figure 7. Proportions from Dholavira (Danino)

Danino's analysis of the Dholavira length unit D shows that it corresponds to the Arthaśāstra 2.20.19 measure of dhanus that equals 108 aṅgulas. This scale is confirmed by a terracotta scale from Kalibangan and the ivory scale found in Lothal. The Kalibangan scale (Balasubramaniam and Joshi, 2008) corresponds to units of 17.5 cm, which is substantially the same as the Lothal scale and the small discrepancy may be a consequence of shrinkage upon firing.
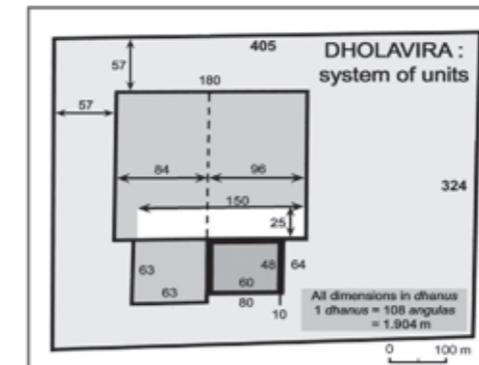
Figure 8. The dimensions of Dholavira in terms of dhanus (Danino)

Pant and Funo (2005) find continuity between the grid and modular measures in the town planning of Mohenjodaro and Kathmandu Valley. They find the measure of 19.2 meters as a unit in quarter-blocks of the town; this is nearly the same as the unit characteristic of the dimensions of Dholavira. It shows that the traditional architects and town planners have continued the use of the same units over this long time span.

Historic Period

Balasubramaniam has found new evidence supporting the continuing use in the historical period of the 108-sub-unit based measurement scheme in a variety of monumental architecture. He found (Balasubramaniam, 2008) confirmation of the use of the unit of dhanus (D) in the Delhi iron pillar (Figure 9), and he showed that its dimensions are elegantly related to D.

Underground base:	4/5 D
Height of main pillar:	12/5 D
Capital:	4/5 D
Diameter at foundation:	3/9 D
Diameter at ground:	2/9 D
Diameter at the top:	1/9 D
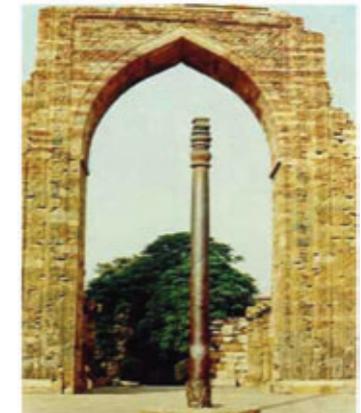
Figure 9. The Delhi Iron Pillar

The division of D into 108 parts is established by the fact that the diameter at the top, at the ground and the base are multiples of 12 aṅgulas.

Recursion in the Deogarh temple

The Daśavatāra Viṣṇu temple at Deogarh (Vats, 1952) is one of the oldest surviving temples from India, and it is dated to about 500 AD (Figures 10 and 11). It is significant that this temple is modular with the basic shape repeated to different scales. Lubotsky (1996) has identified it with the Sarvatobhadra temple described in the Viṣṇudharmottara Purana.[6]

Lubotsky identifies the overall system of the temple with the Pāñcarātra doctrine and shows that it incorporates the four emanations of Viṣṇu. Meister (1988) shows how

Figure 10. The Deogarh temple
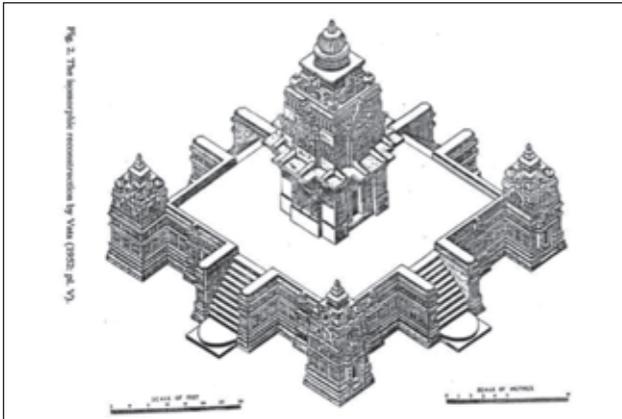
Figure 11. Reconstruction of Deogarh temple by Vats

this temple creates a model that makes symbolic substitutions in stone of complicated architectural forms. At the overarching level, the central structure is repeated to a lesser scale in the four directions. This idea is to be found in the architecture of other temples as well.

The idea of recursion underpins Indian arts (Vatsyayan, 1997), as it does cosmology and medicine (Kak, 2005c) in the historic period.

Conclusions

The aim of this essay is to show continuity from the Sindhu-Sarasvati phase of the third millennium BC to the historic period in the ideas of tripartite division and of recursion. Dholavira presents a general plan of the city in terms of its three divisions where the proportions are defined recursively and in ratios that are also to be found in the Vedic temple. We argue that the notion of the

equivalence of the microcosm and the macrocosm, which is at the heart of the tripartite division and recursion in the Vedic period, had currency in the Sindhu-Sarasvati phase.

More specifically, we find the use of the same unit of length (dhanus) with its 108 parts both in the Sindhu-Sarasvati and the historic periods. The use of a scale with 108 divisions is significant because it reflects fundamental ideas related to the nature of the cosmos. This parallel, by itself, could be a coincidence, but when viewed together with the continuity in religion, art, and architecture, it demonstrates a common vision of the universe.

Endnotes

1. The correspondences are also seen in Indian medicine and music. There are analogs of the outer cosmos in body, brain, and mind.

2. The symbolic meaning of this is that the ceremonies of the great altar subsume all ritual (Kak, 2008). We do not know if the choice of seven as marking completion was due to its numerical basis as a deviser of the length of the year (7×52=364) or seven colors, or seven notes of the octave.

3. It is also true of popular literature as in the examples of the Pañcatantra or the Kathā-sarita-sāgara.

4. The universe is seen to extend infinitely although its basis is the transcendent Brahman.

5. The material world, represented by physical nature, is complete. Śiva is consciousness who is the source of creativity and freedom but it is not to be found in nature if sought there which is why Śiva is shown as dimensionless point. When free, the person is in harmony with Śiva and, therefore, not free in a deliberate individualistic sense. When not free, the person acts according to the causal chains to which he is connected, and he feels that the decision was his alone. This is a fundamental paradox of nature.

6. The Bṛhat Saṃhitā 53.31 calls a building with a verandah running all around as "sarvatobhadra".

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Conference on **SINDHU-SARASVATI VALLEY CIVILIZATION: A REAPPRAISAL,** Loyola Marymount University, Los Angeles, February 21 & 22, 2009.

Subhash Kak, Regents Professor of Electrical and Computer Engineering, Oklahoma State University, Stillwater, OK 74078, USA

Presenting Mathematics in Metrical form

K. Ramasubramanian

Professor, Department of Humanities and Social Sciences, IIT Bombay

Wisdom revived

Be it principles of arithmetic, algebra, geometry, mensuration or combinatorics, Indian mathematicians over several centuries seem to have developed the skills of couching them in the form of beautiful verses, with high poetic value. So much so, when the mathematicians of the Kerala School emerged around the 14th century, they easily managed to succinctly present even the infinite series for π and other trigonometric functions in the form of nice metrical compositions. In what follows, we present a few examples from the works of Bhaskara just to enable the readers to have a flavour of how mathematics can be beautifully blended with poetry, as well as very practical and interesting examples so as to make its learning more enjoyable.

Introduction

The art of blending mathematics with poetry seems to have been practised in India at least from the time of *Vedanga Jyotisa* in the second millennium BCE. Blending poetic form with brevity was the hall mark of the classic *Aryabhatiṣya* (c. 499 CE) of Aryabhata which presented all of the then known mathematics and astronomy in just 108 verses. This trend was successfully taken forward by the later astronomers and mathematicians such as Bhaskara-I, Brahmagupta, Lalla *Mahavira, Srıdhara* and a host of others, and it reached its pinnacle by 12th century with the compositions of Bhaskaracarya (b. 1114), whose 900th anniversary celebrations are on for paying tributes to his immortal compositions.

Be it principles of arithmetic, algebra, geometry, mensuration or combinatorics, Indian mathematicians over several centuries seem to have developed the skills of couching them in the form of beautiful verses, with high poetic value. So much so, when the mathematicians of the Kerala School emerged around the 14th century, they easily managed to succinctly present even the infinite series for π and other trigonometric functions in the form of nice metrical compositions. In what follows, we present a few examples from the works of Bhaskara just to enable the readers to have a flavour of how mathematics can be beautifully blended with poetry, as well as very practical and interesting examples so as to make its learning more enjoyable.

Solving linear equations

We all know that those who study science, engineering, economics or commerce would frequently encounter equations involving one or more variables and hence have to necessary master the skills in solving them. However, it is a misconception that those who are dealing with arts, literature or history need not bother themselves to acquire skills in solving equations. This becomes clearly evident when one looks at the examples provided by Indian mathematicians drawn from daily experiences, starring the flora and fauna that everyone of us are likely to encounter on a day to day basis. In what follows, we provide a few examples given by *Bhaskara* in his *Lılavatı* as an illustration of the procedure for solving linear equations.

Example 1:

अमलकमलराशेः त्र्यंशपञ्चांशषष्ठैः
त्रिनयनहरिसूर्या येन तुर्येण चार्या।
गुरुपदमथ षड्भिः पूजितं शेषपद्मैः
सकलकमलसङ्ख्यां क्षिप्रमाख्याहि तस्य॥

From a bunch of lotuses [plucked from a lotus pond], one-third were offered to Siva, one-fifth to Visnu, one-sixth to the Sun, and one-fourth to the Goddess (Arya). With the remaining six, the feet to the guru was worshiped. Tell me quickly the total number of lotuses [that were plucked from the pond].

A representation of the huge lotus pond that is conceived by Bhaskaracarya in the above example is depicted in Figure 1. Let x be the total number of lotuses that were plucked from this pond. Then as per the description given in the above verse, the number of lotuses that were offered to the four deities is

$$\left(\frac{1}{3} + \frac{1}{5} + \frac{1}{6} + \frac{1}{4} \right) x = \frac{57}{60} x \tag{1}$$

It is further stated that the remaining flowers were offered at the feet of the guru and that the number was 6. Hence we have the following equation,

$$\left(1 = \frac{57}{60} \right) x = 6, \tag{2}$$

which on solving gives $x = 120$.

Figure 1: A lotus pond of the kind described by Bhaskara in his illustrative example.

Example 2:

यूथार्ध सत्रिभागं वनविवरगतं कुञ्जराणां च दृष्टं
पञ्चाग्रश्चैव नद्यां पिबति च सलिलं सप्तमांशेन मिश्रः।
पद्मिन्यां चाष्टमांशः स्वनवमसहितः क्रीडते सानुरागो
नागेन्द्रो हस्तिनीभिः तिसृभिरनुगतः का भवेद्यूथसङ्ख्या॥

Of a group of elephants, it was noted that half, and one-third of the half went into a cave. One-sixth of them, along with one-seventh of one-sixth were found drinking water in a river. One-eighth, and one nineth of one-eighth were noted to be sporting in a pond full of lotuses. The king of elephants was found majestically marching with three female elephants following him. [If this was the situation, let me know], what is the strength of the elephant herd?

The situation imagined by Bhaskara is schematically shown in Figure 2. If x is the total number of elephants in the elephant herd, the number of elephants belonging to the four different groups engaging themselves in four different activities are denoted by the four terms in equation (3) given below. Since this is equal to the total sum x, we have the following equation

$$\frac{x}{2} \left(1 + \frac{1}{3} \right) + \frac{x}{6} \left(1 + \frac{1}{7} \right) + \frac{x}{8} \left(1 + \frac{1}{9} \right) + 4 = x \tag{3}$$

When simplified and rearranged, the above equation reduces to

$$\left(1 - \frac{251}{252} \right) x = 4, \tag{4}$$

which yields $x = 1008$.

Figure 2: An elephant herd of the kind described by Bhaskara in his illustrative example.

Solving quadratic equations

Consider a quadratic equation of the form (with constant on one side and the unknown on the other),

$$Ax^2 + Bx = C \tag{5}$$

The verse given by Bhaskara that presents the solution to the above quadratic runs as follows:

गुणघ्नमूलोनयुतस्य राशेः दृष्टस्य युक्तस्य गुणार्धकृत्या।
मूलं गुणार्धेन युतं विहीनं वर्गीकृतं प्रष्टुरभीष्टराशिः॥

But for certain finer details, the solution given in the verse above may be represented as

$$x = \frac{\left[-B \pm \sqrt{(4AC + B^2)} \right]}{2A} \qquad (5)$$

In order to illustrate the application of the above formula, Bhaskara presents several interesting examples chosen from nature as well as itihasas and puranas. We present below one such example:

पार्थः कर्णवधाय मार्गणगणं क्रुद्धो रणे सन्दधे
तस्यार्धेन निवार्य तच्छरगणं मूलैश्चतुर्भिर्हयान्।
शल्यं पद्भिरथेषुभिस्त्रिभिरपि च्छत्रं ध्वजं कार्मुकं
चिच्छेदास्य शिरः शरेण कति ते यानर्जुनः सन्दधे॥

Arjuna turning furious in the war, shot a quiver of arrows in order to kill Karna. With half of the quiver, he countered the arrows shot by Karn.a. With four times ´the square root of the [total] arrows he killed Karna's horses. He finished Salya. (Karna's charioteer) with six arrows. He used one arrow each to destroy the top of . the chariot, the flag, and the bow of Karna. Finally he severed the head of Karn. a with one arrow. How many arrows did Arjuna discharge?

Figure 3, schematically depicts the battle between Arjuna and Karna that is described in the above verse. Let x denote the total number of arrows discharged by Arjuna. The details of the purpose for which the quiver of arrows were utilized by Arjuna as stated in the verse, when expressed in the form of an equation translate to,

$$\frac{1}{2} + 4\sqrt{x} + 6 + 3 + 1 = x \qquad (7)$$

This results in the following the quadratic equation:

$$x - 8\sqrt{x} - 20 = 0, \qquad (8)$$

whose solutions are $\sqrt{x} = (10, -2)$. Of the two, we can only consider the +ve value, since the number of arrows shot cannot be −ve. Hence, $x = 100$ is the answer.

Concluding Remarks

Among the various subjects that are taught in schools, mathematics is the one that has been generating a sense of fear in a large number of the students. Only a small fraction of students at the primary and secondary school level feel comfortable learning mathematics. The rest of them consider it to be boring—if not dreadful—and hardly enjoy the 'rythm' or 'rigour' of mathematics.

Why is it that only a small section of student community seems to enjoy learning mathematics, whereas a large section just wants to somehow score enough to get through the exam? Several educationists, as well as large international organizations are working towards finding a satisfactory answer to this question. While it is true that the natural ability to learn a particular subject varies from individual to individual, it is also equally true that children loose interest because of the way mathematics is being taught in many schools today.

Most of the teachers while teaching mathematics, simply ask the students to memorize certain formulae, and then give a set of exercises to practice the application of such formulae in their multivarious forms. They hardly present any problems or examples that could be directly related to practical life. If one could present illustrative examples as given in *Līlavatī*, drawn from day to day life, the level of abstraction can be brought down significantly and thereby enable the students to develop interest in learning mathematics.

An additional feature of Indian mathematics is that it has been couched in the form of beautiful verses. This beautiful blend of poetry and mathematics seems to be a peculiar feature, that could enable the students to easily remember various formulae. The act of memorizing formulae through verses besides generating fun, could also be of help in training the intellectual faculties. Also it is highly probable that this integration of poetry and practical examples with mathematics, can give the students an the opportunity to experience an "Aha!" moment rather than an "Oho!" moment, and it is worth trying!

Figure 3: The battle between Arjuna and Karn. a described by Bhaskara.

Technology and Tradition:
Spatio-temporal mapping of Temple Architecture in South and Southeast Asia

Sambit Datta

Professor of Architecture, School of Built Environment, Curtin University, Australia

Abstract

Mapping the fragmented and heavily eroded remains of early temple architecture across space and time poses several challenges. This paper describes an ongoing research project that addresses these challenges through the analysis and reconstruction of shape and form from digital datasets. The project re-assembles ambiguous and fragmentary evidence from temple sites in India, Java and Cambodia to provide a robust and empirical understanding of the lineage and connections between the temple building traditions of South and Southeast Asia. The significance of the project lies in its emphasis on the application of modern technological tools that quantify the results, the degree of accuracy and ambiguity in the reconstruction across the acquisition, processing and reconstruction phases. To quantify the process of establishing formal continuity, the method combines image-based analysis methods with flexible graphical simulation techniques for geometric reconstruction. A key aspect of the method is the maintenance of multiple "ground truths" from plural sources of partial evidence. The paper summarizes some early results in the geometric modeling of early temples and concludes with an overview of how technology can assist in the spatio-temporal mapping of traditional architecture in South and Southeast Asia.

Keywords: *Digital data acquisition, flexible modeling, heritage reconstruction and visualization, traditional architecture, geometry processing and algorithms.*

1. Introduction

The early temple architecture of Southeast Asia, presents a remarkable and intriguing body of evidence in support of inter-Asian connections (Sarkar, 1970'; Chihara, 1996; Smith, 1999; Dumarçay, 2004; Chapman 2012). Seen as a collective corpus, these sites establish a consistent pattern of religious, cultural and technological ideas that transcend national or geographic boundaries (Haendel, 2012). The temples of Southeast Asia are obviously derivative from Indic canon and yet profoundly original and different from the corpus of the subcontinent. Further, the regional nuances of these temples, whether in Java, Cambodia or Champa, defy obvious and linear connections within these traditions and with the pan-Indic corpus. While epigraphists, Sanskritists and historians have made significant connections between these temple building traditions, much work remains to be done on the compositional and architectural linkages along the trading routes of South and Southeast Asia.

This paper presents our findings on the reconstruction processes suitable for explaining architectonic connections between building traditions in South and Southeast Asia. It forms part of a larger project on understanding the compositional and architectural linkages between the temple building traditions of South and Southeast Asia (Datta and Beynon, 2014). The architecture of individual temples owe their compositional characteristics to adherence to canonical treatises, the interpretation of priest-architects or the usage of earlier examples as architectural models for later ones (Meister, 1979; Meister, 1985).By focusing digital methods of spatio-temporal mapping through plans, layout and proportion of wall ensembles, superstructure form and constructional and ornamental motifs, the study shows how the earliest Southeast Asian temples represent lineages that were constantly being adapted and refined from their genesis of the archetypal Brahmanic / Hindu temple.

The fragmented discontinuity of textual accounts, lack of graphical representations and heavily eroded early remains render the process of establishing the lineage of formal continuity between canon and construction difficult. The increasing convergence of technological methods and the study of the built environment presents new methods for understanding the architecture and urbanism of "old" Asia as well as its prospects for its future (Evans et al, 2013). One such convergence is the virtualization of the material culture of the past (Affleck et al, 2005; Malpas, 2008). Digital reconstruction is a well-established methodology in the study of historical structures. Reconstructions have a wide number of applications in the scholarly study of past architecture, formulation of theoretical positions, conservation and physical restoration of monuments as well as virtual simulations for mass consumption in galleries and museums. Therefore, a wide range of methods, datasets, work flows and outputs has been proposed to fit these applications.

One area of work that has received relatively less attention is the virtual re-assembly of historic structures from deformed and partial datasets. In particular, the assumptions of accuracy and ambiguity in recovering robust geometric information from acquired point cloud datasets remain a significant problem.

A second challenge faced in digital reconstruction is the interrogation of surface geometry information for the recovery of structural and architectonic details from digital datasets (Daniells et al, 2008). This is further compounded in historic buildings, where missing information, fragmented and heavily eroded and loss of structural and formal integrity through the ravages of time render the process of establishing formal continuity between artifact and reconstruction difficult. In this context, computational techniques that can re-assemble fragmentary evidence, provide robust and empirical methods to fill in missing information and generate and test the accuracy and ambiguities in the digital reconstruction of geometry are necessary. This work contextualizes these methods through an examination of how digital modeling methods and workflows can afford and extend the classical tools of architectural analysis and comparison.

Computational means of acquisition such as photogrammetry, combined with parametric modelling and simulation become useful methods for projective reconstruction from multiple sources of partial evidence (Debevec et al, 1996). Datta and Beynon (2005) demonstrate the

Fig 1 .The spatial spread of early temple architecture extends from the Western edge of Pakistan to the eastern coastline of Vietnam. The key sites from the fifth century to the tenth century are indicated with reference to their proximity to present day urban centres (source: Datta and Beynon, 2014).

application of a hybrid computational approach to the problem of recovering the surface geometry of early temple superstructures. The approach combines field measurements of temples with close-range architectural photogrammetry. The datasets are processed with rule-based generation and parametric modeling techniques.

It has been speculated whether the architecture of these temples owe their compositional characteristics to adherence to treatises, the interpretation of priest-architects or the usage of earlier examples as architectural models for later ones. In the absence of local textual records, the evidence embedded in the geometric and material composition of the surviving monuments is the main, and sometimes the only evidence by which a more conclusive understanding of the relation between theory and practice in these buildings might be developed (Beynon and Datta, 2008). The motivations for the reconstruction and recovery of the three dimensional forms are to develop a digital dataset of early Indian

antecedents, test new technologies for the acquisition of built heritage and develop new methods for comparative analysis of built form geometry

2. Overview of Methodology

This section presents a digital workflow methodology developed for modelling and reconstruction of models from raw datasets of historic buildings. The translation or "reverse" modeling of the temple from existing conditions to a conjectural reconstruction rests on a number of important assumptions. These assumptions are necessary to quantify the accuracy of the translation process as well as address the ambiguities involved in working with deformations and missing information. At one end of this spectrum is the raw model, a direct representation of the current temple as a dense point cloud or surface mesh with textures. The accuracy provided by such an approach is valid in cases where the veracity and integrity of the site is preserved and for
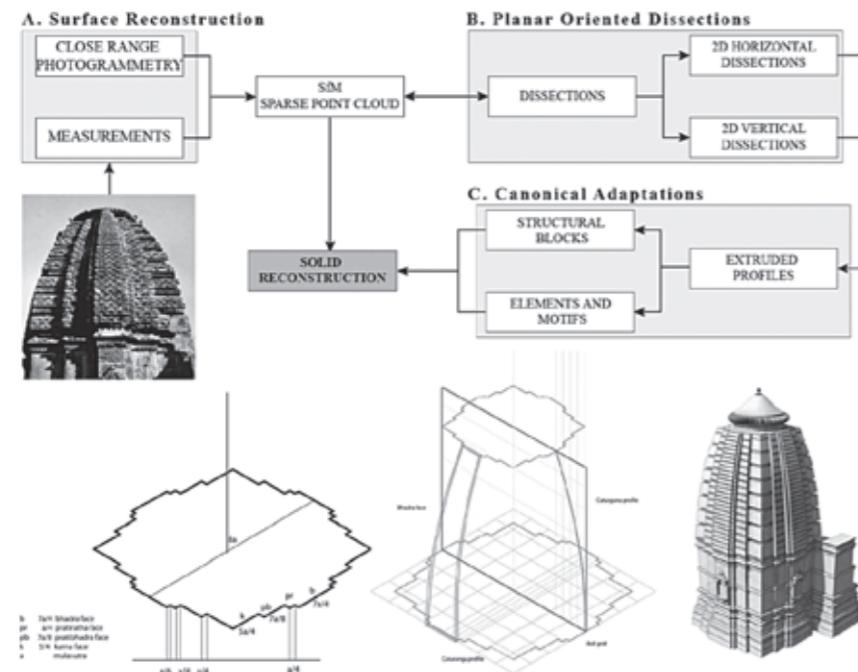

Fig 2. Solid Reconstruction Workflow. Surface reconstruction is developed from field measurements and close range photogrammetry. A sparse point cloud is developed using Structure-from-Motion (SfM) technique. A set of horizontal and vertical dissections is developed from the raw point data. Extruded Profiles are used to generate solid elements of the temple geometry. The elements are assembled into a flexible reconstruction model (far right).

visualization. At the other end of the spectrum is a conjectural representation as a three dimensional reconstruction based on primary or fragmentary secondary sources. This approach is mostly used in cases of insufficient or missing information. Between the raw and speculative representations, lies a number of intermediate or hybrid strategies that seek to combine elements of both and develop a stepwise strategy based on well-founded assumptions. The digital reconstruction requires bringing together fragments of evidence from field measurements, relating these to mathematical and geometric descriptions in canonical geometry and proposing "best-fit" models. It is this third "hybrid" approach that is developed in this project (Datta and Beynon, 2005).

The elements of the workflow are illustrated through the analysis of a digital reconstruction of the structural geometry of a ninth century stone temple in Western India (Figure 2). To determine the form and shape of the temple, surface reconstruction is developed from field measurements and close range photogrammetry (Streilein and Niederöst, 1998). Analysis and fitting of object geometry into a sparse point cloud, generated from data using Structure-from-Motion (SfM) techniques, provides a set of horizontal and vertical dissections aligned to the raw point data. Extruded Profiles are used to generate solid elements of the temple geometry. The elements are assembled into a model two and three-dimensional geometric dissections from the temple are analyzed and compared to measure and reconstruct their geometric properties (Datta & Beynon, 2014). Fragments of evidence are brought together from field measurements, relating these to mathematical and geometric descriptions in canonical texts and proposing "best-fit" models. These digital models permit the creation of 3D reconstruction models such as:

- Raw surface reconstruction. Datasets of the temple surface geometry recovered from point cloud data acquired through field measurements and close range photogrammetry;

- Recovery of Dissections. Close-fit planar dissections reconstructed by correlating raw surface reconstructions from point cloud data;

- Canonical Adaptations. Solid structural blocks and architectural elements adapted from surface and dissection data to create extruded solid parts for

simulation of conjectural reconstruction. Simulation of archetype from assembled solid parts.

Dissections are structured collections of planar two dimensional points, lines, curves and planes that are oriented in three-dimensional space. Drawing upon previous studies of geometry and mathematical schema, horizontal and vertical dissections are developed from an analysis of the sparse point clouds generated using image-based methods (Debevec et al, 1996; Streilein and Niederöst, 1998). Dissections provide a new theoretical and methodological bridge to decimate the raw point cloud data and generate the planar, oriented control geometries underlying the construction of temple architecture (Datta, 2007:447-449). In the reconstruction of temple architecture, dissections are used to bring together fragments of the raw surface reconstruction, relating these to mathematical and geometric descriptions in canonical texts and proposing "best-fit" constructive and parametric profiles.

3. Virtual reconstruction of temple architecture

Virtual reconstruction models play a key aspect in establishing the architectonic ideas underlying the earliest Indic, Javanese and Khmer temples and their relationships to canonical texts (Datta et al, 2008).To recover the constructive principles underlying this temple, field measurements and close-range photogrammetry were combined with rule-based abstraction, and parameterized models. Two and three-dimensional reconstructed geometries from temple are analysed and compared to measure their geometric similarities and differences.

The Visnu Temple at Deogarh, Central India, is among the earliest extant structural temple from the Gupta period in South Asia. Scholars of Gupta temple architecture distinguished three general types. The first of these is the temple with a square garbhagrha and flat roof, generally provided with a porch, such as Temple No. 17 at Sanchi and the Kankali Devi temple at Tigowa. The second type was provided with a superstructure or Sikhara, examples being the Visnu temple at Deogarh and the brick temple at Bhitargaon. In addition to these two, attention has been drawn to a third type of temple with a covered circumambulatory path, best illustrated by the Parvati temple at Nachna-Kuthara discovered by
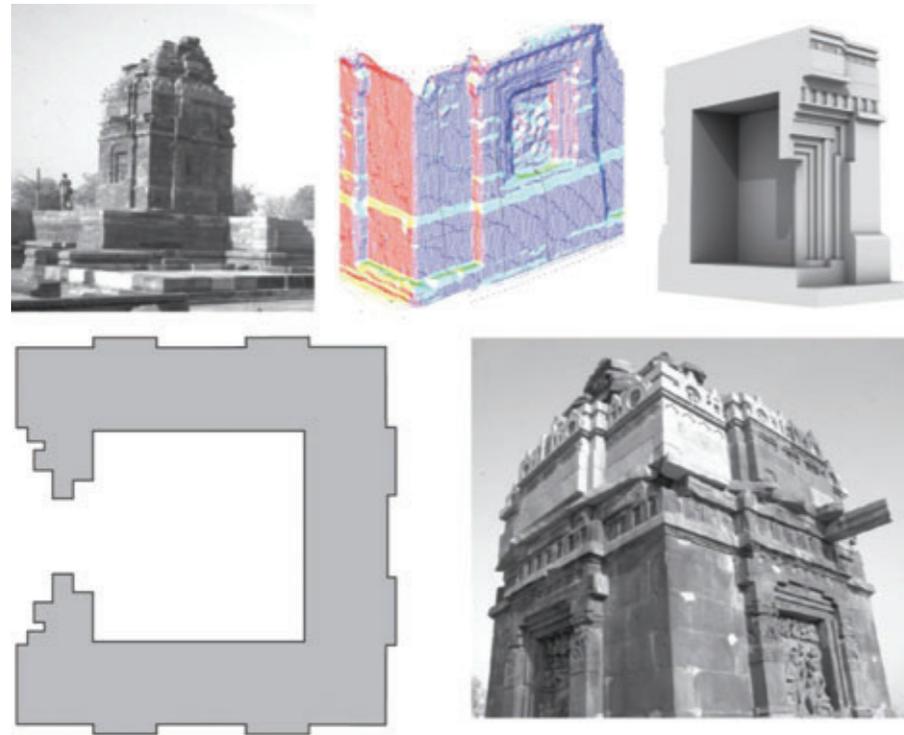
Fig 3. The Vishnu temple at Deogarh (top left), dense point cloud set of external surface geometry (top centre) and conjectural sectional drawing of the east-west axis. Reconstructed plan profile at *skandha* of The Vishnu Temple in Deogarh today (bottom left). The reconstructed geometry of the superstructure is reconstructed by recovering schematic geometries from existing motif fragments. (bottom right).

Cunningham in I883. This temple had, in addition, a plain square chamber, possibly with a flat roof superimposed over the sanctum forming a second storey (Figure 2). The cuboidal cella sits on a solid *jagati* (platform) with a distinctive *vedibandha* molding which is partially buried and yet to be analysed. The jangha or wall portion of the sanctuary is largely bare and simple. The distinctive *candrasala* motif appears on the superstructure tiers. The Vamana temple at Marhia and the Siva temple at Bhumara have similar bases, treatment of wall and motifs. However, the most significant aspect of this sanctuary is the phamsana (tiered pyramidal) superstructure with a distinctive molding. In contrast to flat roofed temples, and the more developed superstructures at Sambor Prei Kuk and at Phnom Kulen, this temple is surmised to have had a tiered pyramidal form of superstructure, known from earlier wooden temples adopted in stone.

The Visnu temple at Deogarh is analysed through field measurements and dense point cloud generation of external surface geometry (top centre). A conjectural sectional drawing of the east-west axis is generated from this analysis (Figure 3, top right). Reconstructed plan profile at skandha of the Vishnu Temple in Deogarh today (Figure4, bottom left) is developed from the analysis of the sparse point cloud. The reconstructed geometry of the superstructure is then reconstructed by recovering schematic geometries from existing motif fragments (bottom right) as developed in Datta (2007). The significance of the temple reconstruction lies the early date of the architectural composition (Chandra, 1970) beginnings of its superstructure, a pyramidal composition in three tiers, known as Phamsana in the literature, contemporaneous with the development of the majestic temple complexes of the Gupta period (Figure 3).

4. Early Temples of Java

The remains of many temples have been found in various locations in Central and Western Java. The three major temple locations in Central Java are the Dieng Plateau, the northern slopes of Mount Ungaran and the Prambanan plain (Degroot, 2009). More recently, interest in Javanese temple sites has shifted again, partially to a reassessment of their cultural and social contexts (Haendel 2012; Degroot, 2012). A recent study of *Candi, Space and Landscape* that has been most useful in combining extensive survey material with a discussion of contextual issues is Véronique Degroot's work on the distribution, orientation and spatial organization of Central Javanese temple remains (Degroot 2009; 2012).

It has been surmised that Candi Gatotkaca represents a unique variation found at Dieng, an amalgam of the prevalent square and cruciform shape of Candi Sembadra (see Figure 4). Candi Gatotkaca has a base pithā in two distinct parts, and is barely wider than the body of the cella above. There is evidence of the remains of a lower base level or jagati embedded in the ground forming a square about a metre wider than the temple (Figure 4, top left).Surface reconstruction is developed from field measurements and close range photogrammetry. A set of horizontal plan dissections is developed from the raw data correlated with site measurements. Extruded Profiles are used to generate solid elements of the temple geometry. The elements are assembled into a physical prototype model (Figure 4).
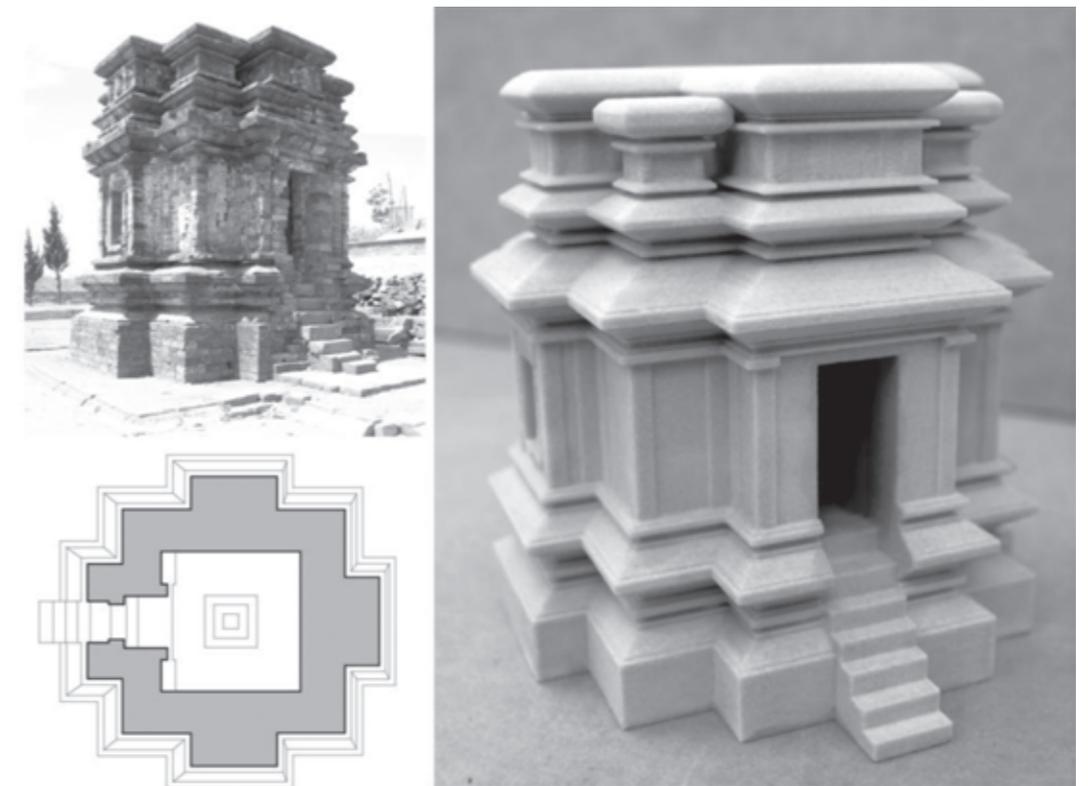

Fig 4. Re-modelling the Candi Ghatotkacha, Dieng Plateau, Java. Surface reconstruction is developed from field measurements and close range photogrammetry. A set of horizontal plan dissections is developed from the raw data correlated with site measurements. Extruded Profiles are used to generate solid elements of the temple geometry. The elements are assembled into a physical prototype model.

5. Pre-Angkorian Temples in Cambodia

The temple of Kuk Preah Thiet is located in Hanchey (Han Chei) about twenty kilometres north of Kompong Cham, occupying a prominent hilltop on the west bank of the Mekong river. While presently dominated by a modern *wat*, Hanchey is significant as the location of three pre-Angkor shrines, each in a distinctly different idiom, as well as the remains of several other buildings that have yet to be fully investigated. There is a brick temple (original name unknown, now referred to as Hanchey A), a small cubic stone-slab cella known as Hanchey B (Indorf 2006: 30-31), and the most unusual stone temple of Kuk Preah Thiet. Two inscriptions on the inner door pillars of Hanchey A were among the first discovered and were long considered as the most ancient in Cambodia (Snellgrove 2004: 36-37).

Historically, Hanchey seems to have been an area where different Khmer polities converged in the fifth to eighth centuries, though never a major centre of power itself. Down the hill and closer to the banks of the Mekong is the temple of Kuk Preah Thiet. Attributed to the ruler Bhavavarman (though dateable to well after his death) these inscriptions indicate that the site, if not the temples themselves, dates back to the second half of the sixth century. The pre-angkorian shrine of Kuk Preah Thiet, therefore represents one of the earliest known stone temples in Southeast Asia. It is lithic in its conception, constructed of dressed stone (Figure 5) and has a storeyed pyramidal superstructure composed of tiers. The elements of this shrine can be traced to many antecedents in the Gupta period. However, the early date of the temple, its well developed superstructure and its proximity to known Gupta examples, makes it a crucial example of the pre-Angkorian temple corpus.

A cubic temple with a pyramidal roof, Kuk Preah Thiet is constructed of dressed basalt blocks. Kuk Preah Thiet is in its present state reconstructed, though at the time of the authors' visit, so inadequately founded that the building is at risk of collapse. The ruinous state of the temple, in an advanced state of collapse, makes dimensional correlation very difficult. Structural deformation, missing elements, surface erosion of the soft volcanic basalt stone, contribute to the difficulties in establishing accurate measures. To investigate the inherent ambiguity in establishing accurate measures, the virtual reconstructions, in particular the recovery of schematic profile information, can play a key role in establishing the architectonic ideas underlying the temple. Secondly, the reconstructions can be used to establish its relationship to earlier Indic, Javanese and Khmer temples as well as dimensional correlation with prescriptions in surviving temple construction manuals.

Parmentier's seminal report *L'art khmèr primitif* (1927) provides a comprehensive account of the temple. Photographs, a measured plan with dimensions and a conjectural elevation of Kuk Preah Thietare documented (Figure 5, top left). Comparing the temple, ninety years later, there is considerable structural deformation and separation of the basalt blocks. The geometry of the temple is reconstructed by fitting schematic geometries from image-based analysis to sparse structure-from-motion datasets (Figure 5, bottom centre, bottomright).

6. Virtual Reconstruction and Spatio-temporal mapping: A Discussion

The paper has touched upon the study of compositional connections between the early temples of Southeast Asia and their Indic models. The context, mapping and techniques used present an interesting series of findings. Classical Gupta temples (such as the Gupta temple at Deogarh) are the earliest known structural temples in India. These stone temples, are raised on significant plinths, have an ambulatory and follow a trabeated form of construction in imitation of timber construction. These temples reveal the beginnings of stone experimentation as well as superstructure development, capped by pyramidal tiers, probably in imitation of wooden roofs.

The use of canon in the formal composition of the temple is evident in the formal layout and geometry of the plan, the structuring, sequence and shape of the base mouldings, the elaboration of the tiered superstructure, the elements of the entrance doorways and the use of distinctive motifs such as the *candrasalas*. In particular the canonical adaptations of the plan form are evident through 500 years of development arcross various sites in South and Southeast Asia (Figure 6). This mapping demonstrates

Fig 5. Parmentier's 1927 photograph of the original temple ensemble (top left), measured drawing of the plan of Kuk Preah Theit Temple, Hanchey, Cambodia (top centre) and conjectural drawing of the east facade (source: Parmentier, 1927). The Kuk Preah Theit Temple in Hanchey, Cambodia today (bottom left). The geometry of the temple is reconstructed (bottom right) by fitting schematic geometries from image-based analysis to sparse structure-from-motion datasets (bottomcentre).

Fig 6. Temporal distribution map of thirty-two temples spread over nine significant sites in India, Indonesia and Cambodia. The dataset is based on archival research; field measurements, virtual modeling and an analysis of plan geometry. (source: Datta and Beynon, 2014)

the spatio-temporal connections between South and Southeast Asian temple architecture. The digital reconstruction methods present new possibilities for interpreting the formal and geometric basis of temple form, forms collections across time and space as well as urban and settlement aggregations. This paper presents an overview of our research findings on the reconstruction of compositional and architectural linkages from an analysis and comparision of temple geometry. The digital reconstruction models and their analysis present new and extensible possibilities for interpreting the formal and geometric basis of the built environment and its transformation.

The computational approaches described in this paper presents the creation of stepwise, partial three-dimensional models of geometry recovered from the existing condition survey of temple sites demonstrate:

1. the recovery of the architectural geometry of ruined temples from digital datasets using sparse unstructured point cloud processing;

2. recording the genesis and evolution of the geometric, structural and ornamental techniques used in temple construction and conception; and

3. comparative analysis of the complex and problematic linkages between canonical prescriptions of ideal form with the analysis of data recovered from the surviving monument. In particular, the accuracy and ambiguity of geometric reconstruction is addressed in the analysis.

Much of the computational work on point cloud processing has been in the creation of surface meshes, texture mapping and establishing ground truths. To develop these experimental methods into a robust and reliable methodology for architectural analysis, the processing of sparse unstructured point clouds requires new and automated ways of developing plan and section schematics. We have presented one possible way of how this may be achieved in the case of reconstruction from partial information through the following requirements:

Ground plane and orientation. Establishing the ground plane and the vertical and horizontal axis of the temple using 3-point correlation.

Assumption of symmetry relations. The basic symmetries of the temple are assumed to be regular around the axis. In the case of plans, the entrance

doorway and the wall extents and axial constraints are used to fit planar rectangular grids around both axis.

Assumptions of proportional relationships. Manual field measurements are used to scale the proportions of parts and establish proportionate ratios for alignment and fitting of parts.

Structural integrity assumptions. The deformation of the basalt block construction is assumed to be dry wall masonry with a nominal 2 mm joint. The blocks are assumed to be regular cuboids and aligned to fit the assumed orientations in both directions. Offsets are handled with proportionate ratios, usually integer ratios, unless field evidence for alternate systems are available.

Simplification of element geometry. Complex elemental geometry such as lintels, and doorframes are simplified to regular profile extrusions. Detailed carvings and relief motifs are abstracted to simple profile extrusions.

The advantage of this process of stepwise reconstruction is partly a matter of speed, both of data collection and of making geometric comparisons, and partly a new experimental method for interrogating the architecture of the past, focusing on analysis of plans, layout and proportion of wall ensembles, superstructure form and constructional and ornamental motifs.

The results described in this paper recover the geometric basis of this architecture will be pieced together from diagrams and canonical descriptions, rule-based generation of idealized form models and close-range architectural photogrammetry of temple remains. Through a comparison of the relationships between cosmology, geometry and physical form using computational methods, in these early sites with both Indian and Southeast Asian models, it is intended that the generative role of geometry within the architectural historiography of Brahminic temples can be clarified and more fully developed. The knowledge embedded in the architectural remains can be 'read' through these computational means to inform, posit or refute positions on their formal derivation. Finally, promoting a better understanding of Asia's shared cultural past can significantly enhance the socio-cultural and economic ties in the rapidly developing Asia-Pacific region.

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Urban systems:
Continuity and Change

Project Varanasi

Rajeev Sangal
Director, IIT (BHU), Varanasi ; Vice Chancellor, BHU, Varanasi and Professor,
Computer Science and Engineering

Humanities through Varanasi

A large project of this kind will naturally need inter-disciplinary inputs. It will require cross disciplinary insights. The project would look for niche areas of work, which would connect scholarship to society using different disciplines.

Work is being carried out on a large number of carefully selected projects.

The research projects collectively create a larger picture of times and society. Five example group projects which would be started immediately are outlined next.

Introduction

Project Varanasi seeks to undertake the study of the extra-ordinary city of Varanasi and its surroundings in all its aspects -- the living aspects as well as the dead, contemporary as well as the immortalized, its knowledge of the inner world as well as its indifference to the external conditions, its glory as well as its wretchedness. It will address its communities as well as the individuals, its crafts as well as the industry and its relation with its traditions as well as with modernity.

It tries to connect with the local surroundings ranging from the city of Varanasi to the larger eastern region of India. It can draw its topics from the city and the region, and their relation with the country and outside.

It will require creative scholarship to be carried out through a critical enquiry, cutting across disciplines. It would promote synergistic studies connecting humanities with science and technology. Such studies undertaken for a city and the Eastern region would, hopefully, throw new light on existing issues and problems of the other region, the country and the contemporary human society.

Such a study would also help create a new generation of people rooted in a new ethos. People with such an ethos would be better connected to society, and are likely to be better professionally.

It would also serve as a platform for engineering students for creative combination of humanities with science and technology. Such a platform would create conditions for unearthing interdisciplinary insights and confluence of disciplines. Theory should help with practice, and practice should lead to theorizing.

Areas of Work

A large project of this kind will naturally need inter-disciplinary inputs. It will require cross disciplinary insights. The project would look for niche areas of work, which would connect scholarship to society using different disciplines.

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Group Project 1: Ganga

This Group Project primarily focuses on ecology but in the context of Varanasi, also on spirituality and culture. It addresses issues related to water flow, pollution, sewage treatment and sanitation on the one hand, and spirituality and festivals linked with the river, on the other hand.

Specific sub-projects related to science and engineering for measurement, modelling, and intervention to make the river clean would be defined. Work would be carried out through student projects as UG/PG/PhD level.

Group Project 2: Varanasi City

This Group Project addresses the living functioning city of Varanasi. It addresses urban design, public spaces around ghats, road traffic and transport, and also the temples and people and their behaviour at market place.

Group Project 3: Craft Communities

Study will be made of craft communities through such clusters as toy makers, saree weaving, boats men, etc. It will include a study of implements and equipment, their work places, graphic designs, as well as social relations within and outside the community.

Group Project 4: Ramayana & Literature

A study of Ramayana & literature from this city, which at the same time is national as well as universal. Such a study will yield connections with contemporary life leading to an understanding of character, human relationships, family as well as society. Through this, one could incorporate elements in education that enhance human sensibilities and human values.

This project would also be used to connect young people with language and literature of Hindi and other languages spoken in Varanasi and surrounding region.

A translation effort which would use machine translation tools would also be set up. Students from IIT (BHU), BHU and other institutions as well as at large (thru internet) would be involved through crowd sourcing effort in translation of high quality.

Group Project 5: Sarnath

A study of Sarnath means studying the material and building of Sarnath as well as philosophy, history and art. Related Buddhist communities of Tibet and Bhutan might also be explored, so also connections with Japan, Korea and China.

Conclusion

Project Varanasi provides a platform for studies to be carried out in real life, naturally cutting across disciplinary lines. Thus it provides a great learning environment. That such learning also becomes useful to the city is an added bonus.

We look forward to the project and hope that it will make a difference in the lives of people both materially as well as mentally.

Banaras, the Cultural Capital of India: Visioning Cultural Heritage and Planning

Rana P. B. Singh

Professor, Cultural Geography and Heritage Studies, and Head, Dept. of Geography, Banaras Hindu University, Varanasi

Abstract

From India 32 properties are enlisted in WH List (till February 2015), however 'The Riverfront Ghats of Varanasi' has not yet been proposed for inclusion, mostly due to political complexity and lack of strong movement from the stakeholders. Framing tourism and cultural development in holistic frame for national and international resource within the purview of the ancient roots of heritage properties and traditions of spirituality, sacrality and pilgrimages that have a long tradition and continuity in India, Ministry Tourism and Culture, and Ministry of Urban Development, Government of India, have recently conceptualised two innovative and appropriate national programmes of interfacing and counter-depending missions of (i) Heritage city Development and Augmentation Yojana (HRIDAY), and (ii) Pilgrimage Rejuvenation And Spiritual Augmentation Drive (PRASAD). In both of these programmes the ministries of Culture and Tourism and Urban Development will collaborate to strengthen and promote the heritage sites and centres of pilgrimage-tourism in making the environment green and sustainable while befitting into the roots of culture, traditions and society and also image of the site. This essay attempts to critically examine the rationales for proposing Varanasi as a heritage city in the WH List and the problems faced in this process since last fourteen years. In this context the status of Varanasi on the scale of UNESCO-WH List, the implications of the past and on-going Master Plans and City Development Plan (JNNURM), governance strategies and issues of public awareness are critically examined, and further visions of recent programmes of HRIDAY and PRASAD are appraised in the purview of Varanasi.

Keywords: heritagescapes, heritage planning, HRIDAY, contestation, Master Plan, PRASAD, public participation, stakeholders.

1. The Master Plan and Heritage Zones

People say, "By seeing Banaras, one can see as much of life as the whole India can show". In fact, Banaras is an archetype of all India, but it is full of complexity and contrasts resulting too difficult in comprehension for those who stand outside the Indian tradition. Vārānasi, popularly called Kāshi or Banāras (wrongly spelt as *Benares* in anglicised way), known as the Cultural Capital, Heritage city of India and one of the oldest living cities of the world, records a continuous settlement history since *ca.* 1000 BCE. However, the present city has grown mostly during the early 18th century. Varanasi acquired status of a 'million+ city' (as Urban Agglomeration, VUA) in 1991 and recorded a population of 1,435,113 people in 2011. Administratively, the VUA (82º 56'E – 83º 03'E and 25º 14'N – 25º 23.5'N) consists of a Municipal Corporation (MC), an Out Growth (OG), four Contiguous Towns (CT), two Notified Areas (NA), one Municipal Board (MB), and one Cantonment Board (CB) [cf. Singh 2015a]. The city's population consists of predominantly of Hindus (63 per cent), substantial Muslims (32 per cent) and other religious groups. There are *ca.* 3,300 Hindu sanctuaries, and 1,388 Muslim shrines and mosques (more than in any city in the world). Existence of 4 universities and 3 deemed universities, 150 Muslim schools, *ca.* 100 Sanskrit *pathashalas* (traditional schools), and 50 Inter and Degree colleges make the place a 'City of Culture and Learning'. The vividness and multiplicity, and the diversity and unity are easily envisioned in its practising religions, performing cultures, functioning society and regulating economy – altogether making a cultural mosaic or universe of '*heritagescapes*', in which age-old festivities and performances play a major role (cf. Singh 2009c, pp. 17-18). In the *Master Plan 2011*, around 0.95% (i.e. 82.50ha) area out of 8,645 ha was allocated under historical, heritage and archaeological uses, which in *Master Plan 2031* has been reduced in ratio to reach only 0.38% (i.e. 92.40ha) out of the proposed total covering area of 24,646 ha.

As the city has grown in area, population, business and administrative functions, its influence extends beyond the municipal limits. From a city with a single core (CBD, i.e. Chauk), it has now acquired the character of an Urban Agglomeration (UA) that spread over an area of 119.52 sq. km. And then there is a much larger area called Varanasi Development Region (477.34 sq. km) over which it has no formal control but to which it sends its products and from which it draws its food and other requirements. What happens in the region has implications for the city and its people and *vice versa*. With further improvement of the GT road (National Highway 2) into a super highway, the future expansion of the city will continue to be on all sides surrounding the city.

In 1982 the Varanasi Development Authority (VDA, formed in 1974) made an assessment of the earlier plans
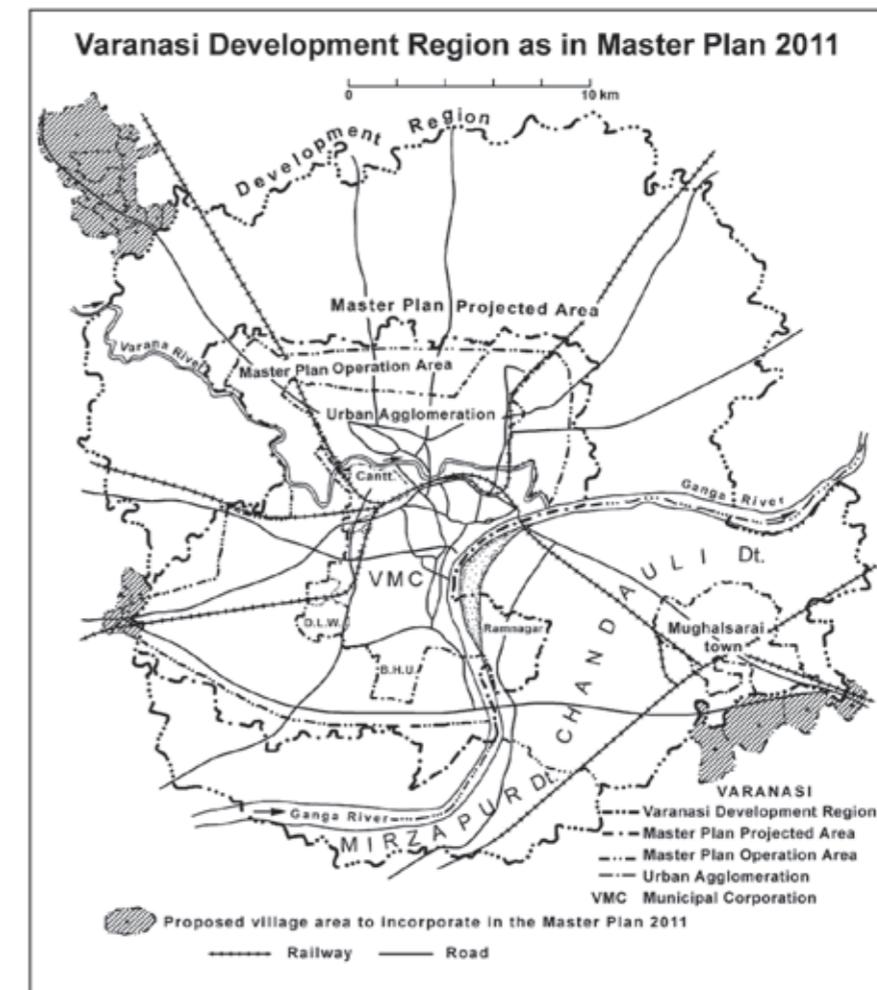

Fig. 1. Varanasi, Development Region: Development Plan, 2011-2021.

of the city. And, under its direction, the Town & County Planning Organisation (TCPO) prepared a comprehensive Master Plan of Varanasi 1991-2011, during which time the population of Varanasi Agglomeration is expected to double (cf. Singh 2009c, p. 327). The five-tier areal units are defined on the basis of administration and planning strategy, taking **Varanasi Development Region**, VDR (as in Master Plan 2011, and further apprehended in 2031) as the outer limit. From lower to higher hierarchy they are: Varanasi City Municipal Corporation 86.45 sq. km, Varanasi Urban Agglomeration, VUA 119.52 sq km, Varanasi Master Plan - Operative Area 144.94 sq. km, Varanasi Master Plan - Projected Area 179.27 sq. km, and the outer most Varanasi Development Region, VDR 477.34 sq. km (Fig. 1).

Under the '*Master Plan 2011*' the expanded area proposed for Greater Varanasi is 179.27 km^2, however the land use categories planned do not fit the standard norms of ecological balance in the minimum threshold. The most noticeable change during the 1991-2011 Plan is the expansion of the area of the city (+112%). The major changes since 1991 as introduced after 1988, indicate a catastrophic increase of land under government and semi-government uses (+390.50 per cent), and public and community facilities (+190.63 per cent). The increasing pace of population results to increase area under residential uses up to 253.63 per cent over 1988 (cf. Singh 2009c: 327). This catastrophic change spoils the ecological system of land use; the most crucial group is parks and open ground that records a decrease of over 60 per cent in comparison to 1999. Similarly a great loss of agriculture and open land within the master plan area, at a rate of above 40 per cent, is again a great warning. In addition to the city's population, everyday about 45,000 commuters visit the city; this numbers increases to 65,000 during festive season.

Fig. 2. Varanasi, Development Plan 2011.

For the first time in the history of Master Plans for Varanasi, some strategies of urban heritage and heritage zoning were proposed in the recent Master Plan (1991-2011; Singh 2009c, p. 327, cf. Fig. 2) to maintain and preserve the ancient glory of Varanasi, and to identify necessary facilities and infrastructure and various heritage complexes (cf. Rana and Singh 2000: 150-154). A little over 2% of the total area is proposed under tourism and heritage zone. More emphasis has been laid on the government and semi-government uses.

According to the zoning plan, five heritage zones can be identified in Varanasi (Fig. 2):

1.1. Riverfront Ghats (stairways to the riverbank)

The riverfront heritage covers the portion of the city stretching within 200 m from the river bank. Eighty-four riverfront *ghats* cover a length of 6.8 km along the crescent-shaped bank of the River Ganga, *Ganga-ji* (*Ganges* in anglicised way, devotionally called Ganga-Ji), from the confluence of Asi drain in the south to the confluence of the Varana river in the north (Fig. 3). Here the riverfront is overlooked by lofty palatial buildings built mostly by kings and lords from different parts of India between 18th and 20th centuries, and the area along the *ghats* is dominated by various shrines and temples. One of the most impressive buildings is the Darbhanga Palace, presently called 'Brij Rama Palace' (now owned by the Clarks' Hotel
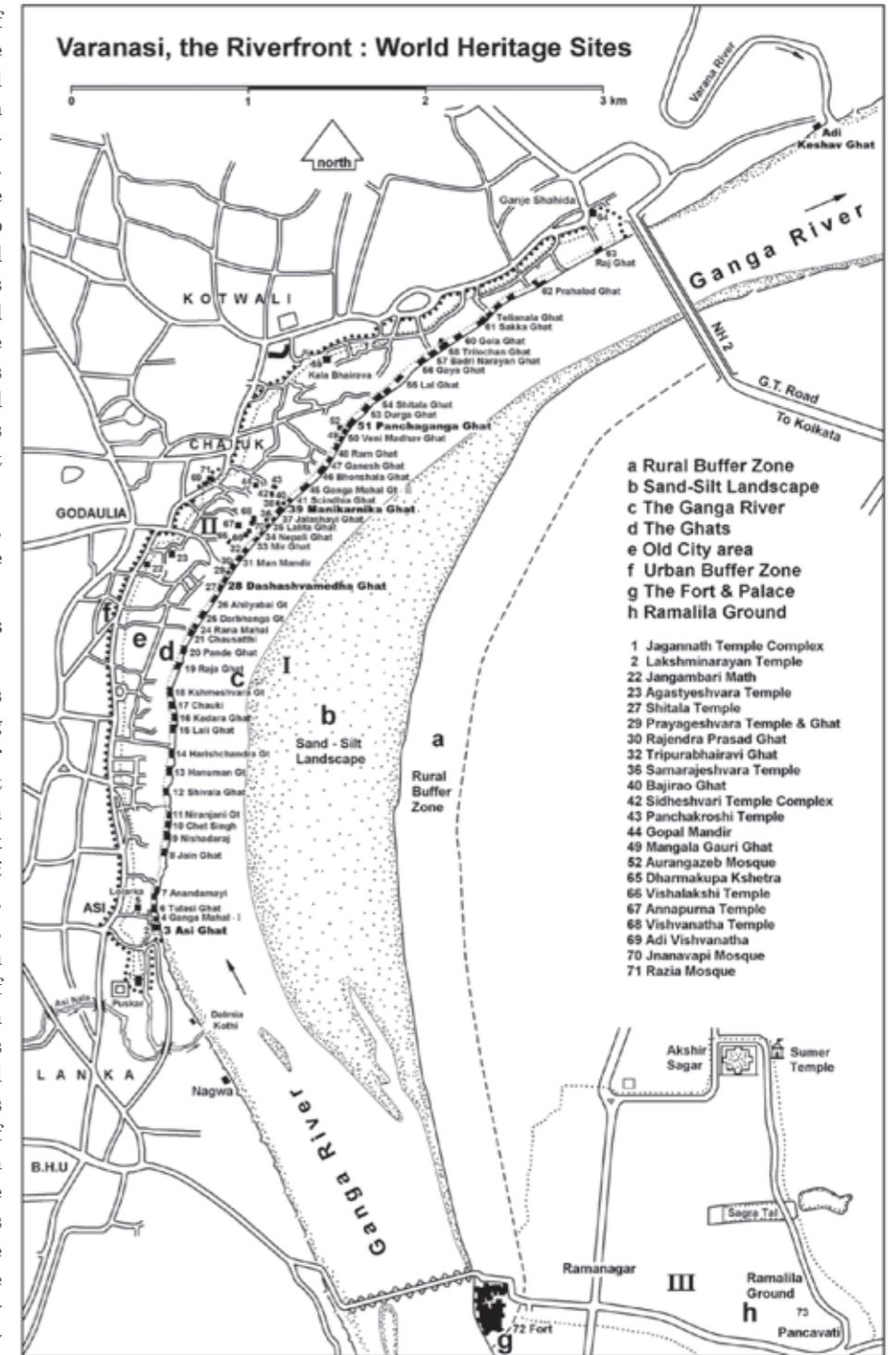

Fig. 3. Riverfront Varanasi, World Heritage Site.

Group), which is presently in the process of conversion into a heritage hotel that will consequently result into loss of heritage and promotion of environmental pollution. The *ghats* of Varanasi (cf. Fig. 4) represent one of the finest ensembles of monumental architecture linked with the everyday activities of the devout people, thus symbolising the heritage tradition of India.

Almost all visitors (tourists and pilgrims) take part in the on-site package scenic tour programmes (whether at a luxury or a basic level), of which the Ganga *ghats* are the most popular. The *ghats* are the nexus of the major rituals and festivals ('the intangible cultural heritage resources') in the holy city, from where all rituals start by taking a sacred bath and get concluded by giving a donation to the riverfront priests, like thanks giving.

Fig. 4. Riverfront Varanasi:
a scene of the Ahilyabai to Shitala Ghats.

In order to absorb the population growth in the old city centre, new buildings are being constructed either by demolishing old structures or by building on them. Since most of the heritage sites are in these densely inhabited narrow lane areas, two UP State Government orders (no. 320/9-A-3 2000-127, of 5 February 2000, and 840/9-A-3-2001, of 11 April 2001) state that, "in all the towns situated along the Ganga river, no development activities can take place 200 metres from the riverbank". It specifically prohibits new construction on the riverfront *ghats* unless these buildings are temples, *maths* and *ashrams* (monasteries) and only if these have approved construction plans or are only being renovated. The order goes on to say that all other old buildings that are within 200 metres from the *ghats* can only be renovated. Overall

these orders aim to protect the integrity, sacredness and the ancient glory of cities along the Ganga. The crescent-moon shaped riverbank is a landscape temple in the form of an amphitheatre, where the *ghats* form the platforms, the water the altar and the sun is God.

1.2. Durgakund-Sankatmochan Area

This area contains about twenty temples and shrines and the water pools of Durgakund and Kurukshetra *kundas*, which are two historic sacred tanks dating from the late 18th century (Singh 1994). Every Tuesday, and more frequently in the month of *Shravana* (July-August) and *Ashvina* (September-October), especially the nine nights (*Navaratri*) in the light fortnight, worshippers perform rituals in the Durga temple. This was built on the orthodox model of Hindu temples, but without an excessive display of minute carvings and sculptures. Towards the east near the Ganga river is the oldest sacred pond in Varanasi, viz. Lolarka Kund, which was referred to in the *Mahabharata* (2nd century BCE) and which still attracts a large mass of pilgrims, especially on its annual day of celebration falling on the *Bhadrapada* (August-September) 6th of the light fortnight. In this area also stand the temples of Tulasi Manas Mandir and Sankatmochan Hanuman Mandir.

1.3. Kamachcha-Bhelupura Area

This area records some of the old monasteries, ancient shrines and an ancient heritage site associated with the Jain Tirthankara Parshvanath, together with many monuments and buildings of the British period (18th-19th centuries). The historically notable temples and shrines in this zone are: Kamachcha Devi, Krodhan Bhairava, Angareshi Chandi, Vatuka Bhairava and Vaidyanath Shiva. The Dvarakadhisha (Krishna) temple and sacred pool of Shankhudhara are other heritage sites.

1.4. Kabir Math (Lahartara) Area

This site was the birthplace of Kabir, a great saint-poet and social reformer of the 16th century. There are several monasteries in this area related to the life of Kabir. The Kabir Temple Complex is coming up as a great modern heritage and centre of solace and learning; of course it is turning to be a 'White Elephant' less associated to the local society and culture. Under the heritage complex development programme by the UP Government, a development plan has been prepared and some works have already been going on.

1.5. Sarnath

This archaeological heritage site was famous for its sanctity, beauty and natural scenery (Fig. 5), qualities that attracted the Buddha to give his first sermon here in 528 BCE. Following Muslim invasions and the downfall of the Gahadavalas Kings, the site was left in ruins and only came to light in CE 1793.

The principal site in Sarnath includes a well-preserved commemorative *stupa* (a decorated masonry tumulus) which dominates the site, the foundations of a reliquary *stupa*, the ruins of the temple complex and ancient monasteries, and a myriad of small votive *stupas*. The *stupa* and its surroundings are already proposed in the tentative list of UNESCO World Heritage Sites in 1998. The on-going development plan is in accord with heritage conservation, environmental sensibility, public involvement and user feelings, as befitting a most important centre of heritage tourism. It is sad to record that there is lack of co-ordination between Japanese donors and the Indian institutions involved in planning.

1.6. Other Heritagescapes

There are many other sites, areas and monuments in Varanasi which urgently require restoration and preservation and inclusion in the sustainable heritage tourism programmes. These include the Hindu Observatory at Man Mandir Ghat, the Amethy temple at Manikarnika Ghat, the Sumer Devi temple at Ramanagar and adjoining tank, and many others. Varanasi is famous for its series and layers of sacred circuits, among which the Panchakroshi is the most popular. This pilgrimage circuit representing the cosmo-spatial *mandalic* territory (*kshetra*) of Kashi is a unique attribute of Varanasi. The total route covers 88.5km (25 *krosha*, i.e. 5 *krosha* x 5 parts) and is divided into five parts marked by overnight stops. At these five spots there are 44 *dharmashalas* (rest houses) for pilgrims. In every intercalary month,
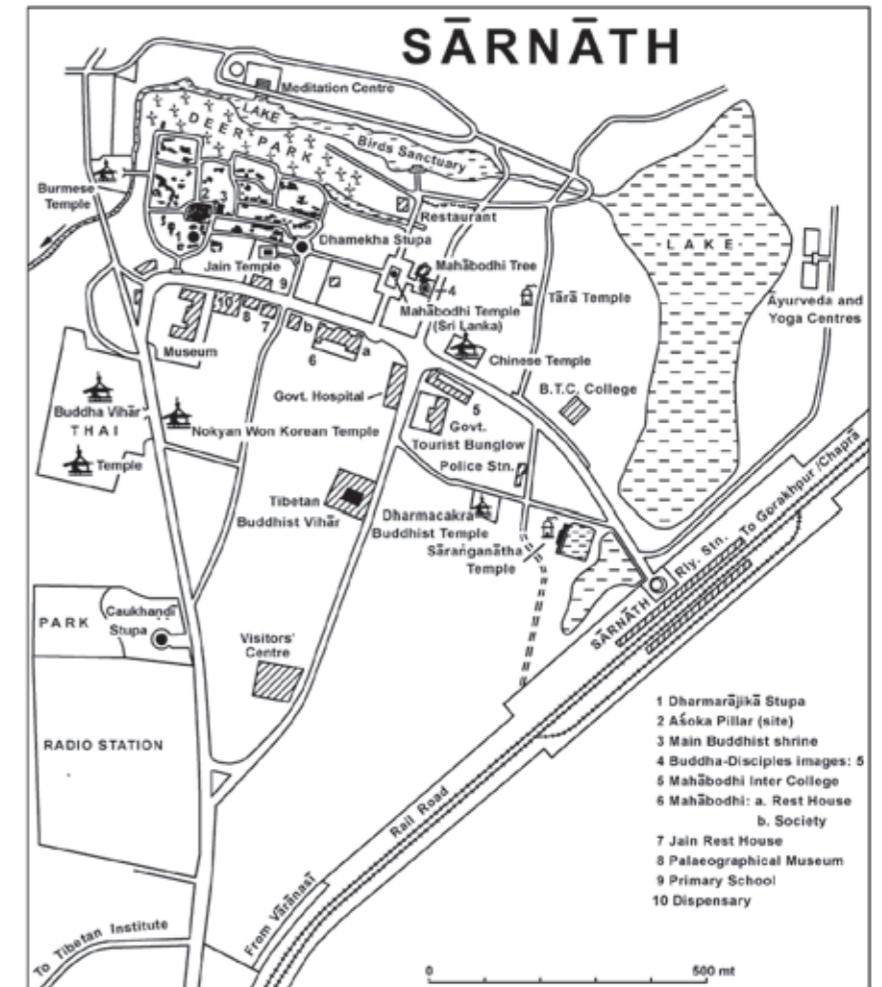
Fig. 5. Sarnath: Places of attraction.

malamasa (e.g. the last were from a period of 17 May to 15 June 2007, and 15 April to 14 May 2010, and the recent one from 18 August to 16 September 2014; falling every 3rd year), over 50,000 devotees perform this pilgrimage (cf. Singh, Rana 2002). Under the recently initiated heritage development project, a part of the Master Plan, partial works like improvement of roads, cleaning of the water pools and repairing of some of the roads are being completed. On the ground of pilgrimage-tourism this cosmic circuit should be given special emphasis, so also promote sustainable heritage tourism.

Among the above five sections, the Riverfront City is being in the process of getting enlisted in the UNESCO

Heritage List 'mixed cultural landscape' since 2001; however, due to the lack of the public awareness and active participation, the complex web of bureaucracy, rising corruptions, and the rise of both individualism and consumerism, there seems to be little hope for the proper implementation of the plans and maintenance of heritage properties in their original forms. Moreover, its nomination process has been marred with conflicts between Hindu and Muslim factions (Singh 2011b, p. 295). Ultimately there is an urgent need to re-vitalise the city with re-establishing the ecological order by promoting civic sense and active public awakening and participation (Singh 2011c, p. 351). The Ganga river is so polluted now that only the most faithful would venture to take bath in it. The Ganga River as an environmental milieu is not simply a water stream that flows across the land; this is what the Hindu culture knows to be true — and knows this in a certain way. It is not simply a question of how the river matters to society at present (in a strict sense), it is more important to see the meanings and cultural values which have been sustained for centuries. It is our moral obligation to revere this deeper attitude and maintain it in the context of the present needs, searching for a balanced relationship between man and nature within the microcosm of the Ganga river. This ideal brings together both Hindu culture and the vision of a sustainable society. The Ganga is declared as a 'National River' by the union government of India on 4 November 2008, as the first step for environmental and heritage preservation; however, even after passing more than two years rarely any recordable transformation made!

Having a prime objective to help replace the current piecemeal efforts to clean up the Ganga with an integrated approach that sees the river as an ecological entity and to address the problems and strategies for environmental cleanliness the National Ganga River Basin Authority (NGRBA) was founded on 20 February 2009 and opened by the prime minister of India. Let us hope that the vision and reflections of heritage (tangible and intangible) associated with the Ganga river and continued since the ancient past would also be considered in such programmes.

The impact of urban sprawl and neighbouring effect is constantly marked by the expansion and growth of two towns across the Ganga river, i.e. Ramanagar and Mughalsarai UA, lying only at 5 km and 18 km east of the main city, and recording population of 48,378 and 154,692

in 2011, respectively (cf. Singh 2009c, p. 335). During 1991-2001 they recorded a growth of 35% and 27%, which reached to 19% and 33% in 2001-11, respectively, mostly due to varying degrees and complexities of urban sprawl. It is further estimated that both towns will be directly linked as a continuous urban space by 2031. This tendency will further intensify the demographic and economic pressure on the city of Varanasi.

Unfortunately the *Master Plan 2001-11* as prepared by the VDA and passed by the UP Legislative Assembly has failed to implement most of the priority projects enlisted. Realising this now 'private investors' are encouraged to come forward and take care of the follow up in-process *Master Plan 2011-31* under the purview of withdrawal or non-implementation of the earlier strategies and projects. In the *Master Plan 2001-11*, a long list of roads was prepared to ensure its widening but the condition of roads could not improve despite the fact the traffic load continued to increase. The VDA could also failed its drive against high number of illegal constructions, misuse of basements sanctioned with parking provisions and developers of illegal residential colonies on the outskirts, and illegal destruction and encroachments of heritage properties. Projects like Kamdhenu Nagar were put on the backburner while the fate of Transport Nagar hung in balance due to delay in completion of the process of land acquisition. A few years back, the VDA had adopted strict attitude against the law breakers and violators of building laws, but its drives could also not continue for long — resulting back into the earlier condition. However, despite its failures in the past, the VDA now appears 'serious' for ensuring a planned development in future as would be proposed in the in-process *Master Plan 2011-31*.

It seems that some ready-made plans on the line of other similar cities would be superimposed; like in the past, and again rarely people's participation being given its rational place? Will the VDA put these plans in public domain and call for opinion of the civil society who is passionate about their heritage and contributing their bit towards its maintenance and preservation? Or will it want the people living in this sacred city to be as disconnected as they are today with their heritage and traditions, which are mostly used as resource for (outsider) tourists? Do we want citizens to continue to be disconnected from the campaign and continue to flush and forget its rich traditions? There is a need to involve the communities and reconnect them to the heritage and traditions in making in-process

Master Plan 2011-31 more sustainable and heritage-oriented. Let's not undermine the fact that success of the programme to bring the city's culture to better life will rest with the involvement of communities' right from planning to monitoring (cf. case of the Ganga river, Babu 2009).

2. Inscribing the Riverfront Ghats in UNESCO WHL: Story of fight and failure

The story of realising issue of inscribing the Riverfront Ghats in Unesco WHL goes back to 1989, when under the direction of Prof. M.S. Swaminathan (President, National Academy of Sciences, NAS; b. 7 Aug. 1925—), a Project Design Workshop on "Natural and Cultural Sites along the Ganga for inscription in the World Heritage List" was organised during 7-8 April 1989 under the auspices of the NAS with the collaboration of several departments of the Government of India like Planning Commission, Department of Arts, Ministry of Human Resource Development, Ministry of Environment and Forests, Prime Minister's Committee on Heritage and Cultural Resources, and also INTACH and the Ganga Project Directorate. This was undertaken as a part of Nehru Centenary Celebrations. This Workshop had turned to be only an academic exercise and bureaucratic propaganda, and rarely any comprehensive report came into black-and-white, even after passing three years! Surprisingly the case of Riverfront Varanasi was no way discussed at all.

Encouraged and inspired by the above initiative, the present author had contacted Hélène Legendre-De Koninck, a Canadian heritage expert and writer, through a letter dated 6 April 1992, to know about the criteria and procedures of inscription in the WHL. Her reply and advice (30 April 1992) helped to get in contact with ICOMOS, UNESCO World Heritage Committee, and concerned ministry of the Government of India. On these lines on 16 May 1992 a letter was sent to the President of ICOMOS by Singh, attaching the details, potential grounds and strong conditions fulfilled by the "*Riverfront Ghats and the Old City Heritage of Banaras*" for getting inscribed in the WHL. Also a follow up letter (18 May 1992, ref. NGJI/VSF/206) was sent to the Indian National Commission for cooperation with UNESCO (Ministry of Human Resource Development, Govt. of India). The

ICOMOS has considered the request sympathetically and through the head of communication IUCN (The World Conservation Union) sent the letter and documents to Sectional Officer, Department of Culture (Ministry of Human Resource Development, Govt. of India); the office took note for appropriate action (ref. No. F.17-19/ 92-UU, dated 1 June 1992), and sent copy to Singh. As a follow up Singh had further contacted the Secretariat of the IUCN, who forwarded his letter and all documents to several persons concerned with the issue. Time passed and things went in their own way, but nothing in support of the proposal resulted.

The above story has encouraged publication of a paper taking into consideration all the criteria and characteristics that rationally and most viably justified nomination of "*The Riverfront and Old City Heritage Zone of Varanasi*" for getting inscribed in the UNESCO WHL; the resultant essay was first of such reports (Singh 1993). Again the author had tried to disseminate this noble idea by sending his essay to several persons and institutions, including INTACH New Delhi and local Varanasi Chapter, but sorry to say that no positive result had been noticed except a few other publications of papers on the line of the same/similar idea repeatedly (Singh, Dar and Rana 2001; Michell and Singh 2005; Singh 2004, 2007, 2009a, 2009b). Those involved in heritage conservation movements have felt humiliated and disappointed from all sorts of potential steps for public awakening, shareholders' active participation, non-cooperation from the intellectuals and INTACH Varanasi Chapter, non-seriousness from bureaucrats and administrators, and their consequential situations and rarely now these issues are discussed.

With the initiative of Mr Jagmohan [Malhotra], then Govt. of India's Central Minister of Urban Development, and later of Tourism and Culture (2001-04), ca. four-month exercise of preparing 'Integrated and Integral Cultural Development Plan of Varanasi' was performed intensively, resulting into two-days National Seminar, organised by the U.P. State Department of Tourism: 11-12 August 2000, and thus recommendatory plans for preservation and development of cultural and monumental heritage and also intangible heritage (fairs, festivals, celebrations, folk culture, etc.) were proposed. This comprehensive project also included issues of development related to tourism, cleaning and repairing of the *riverfront ghats* and the ancient and heritage lanes,

maintenance and repairing of roads and interlinking paths, plan for developing Panchakroshi pilgrimage circuit, environmental cleanliness and pollution control, and energy conservation, etc. Soon the ministry had changed, resulting into change of priority and interest. In this project as usual INTACH Varanasi had no way involved itself for any sort of support.

After a gap of about seven years the Kautilya Society, an NGO working for cultural preservation, under the supervision of the present author hold a meeting on 4th of February 2001 and chalked out some plans for heritage documentation, preservation and conservation, while collaborating with Society of Heritage Planning and Environmental Health, SHPEH, a local NGO; this resulted like a strong mass movement and activities that promoted the cause of heritage awakening and preservation, at least during last ten-years.

As a follow up programme the Kautilya Society contacted the VDA (Varanasi Development Authority) and its senior authorities, including the then Commissioner and Chairman VDA) and the Vice-Chairman, who shown keen interest and under their patronage the project for "Nomination Proposal for Inscription in the UNESCO World Heritage List" had started its procedural preparation in November 2001. With common consensus a Working Group for Drafting UNESCO Proposal was formed consisting of thirteen representative members from administration, bureaucrats, Varanasi Development Authority, intellectuals and activists, department of tourism, department of culture, faculty members teaching heritage tourism (e.g. from Banaras Hindu University), museums (e.g. Bharat Kala Bhavan), legal experts, eminent citizens, SHPEH, and Kautilya Society; this WG worked under the guidance of three unanimously nominated persons as honorary officials. As in the past, the INTACH Varanasi Chapter was completely silent and in spite of several times calls and requests none of the associates attended any meeting and took part in any of the heritage programmes. Finally an agreement between VDA and Kautilya Society was made on 15 March 2002 for overlooking all the preparatory activities and final draft proposal.

On the above line of agreement the Kautilya Society has prepared three reports (March/April 2002) under "Nomination Proposal for Inscription in the UNESCO World Heritage List", where all the listed properties are described under historical importance, aesthetics, locational characterises, present state of condition and religious importance, also illustrated with GPS values, line drawings, cross-sections, site plans and photographs (cf. Singh 2009b, p. 363) within an year that deal with: (**a**) *Varanasi: Heritage Zones and Sites* (details of 53 sites and properties, covering the riverfront ghats, core heritage area surrounding Vishvanath temple, Sarnath, notable properties in the city, and Panchakroshi route), (**b**) *Varanasi: Heritage Zones and Sites* (details of 40 sites and properties, covering the same areas like first report 'a' with additional illustrations and drawings), and the final (**c**) *The Riverfront and Old City Heritage Zone of Varanasi* (details of 73 sites and properties, covering the riverfront ghats and old heritage zone area, and also other side of the river Ganga, i.e. Ramanagar fort and Ramalila space and affiliated built-up structure, also consisting of select bibliography, historical accounts, tourists statistics, critique and resume of other Chapters' heritage activities, history of heritage laws and Indian context, suggested amendment on Urban and Town & Country Planning Acts, and finally detailed schedule of Plan of action 2002-2011). The final report (op. cit., **c**) was on the line of the *Master Plan of Varanasi 2011*, which was approved and passed by the UP Government Assembly on 10th July 2001 (ref. 2915/9-Aa-3-2001-10Maha/99); in this Plan five Cultural Heritage Zones were identified and in the purview of tourism development strategies were proposed (see Fig. 2).

After passage of time by changing the government at state and ministerial changes into the central government, the local officials transferred to other places, the degree of peoples' involvement and interest, the whole intense exercise for inscribing the 'Riverfront and Old City Heritage Zone of Varanasi' gone into vein. However, with the initiation from the UNESCO Delhi branch and pressure of the Central government, again some attempts had been made on these lines, which started in March 2003. In continuation, to discuss the 3rd Report VDA had called official meeting on 15 October 2003 and asked for revision and modification of the Proposal, which Kautilya Society had complied and submitted on 21 October 2003 taking in view the recommendations made by ASI (Archaeological Survey of India) in its letter dated 28 July 2003, addressed to the Commissioner, Varanasi Division and suggestions made by the VDA. Some bureaucratic formalities and forwarding transmission were performed, but nothing consequential came out; and the officers get transferred from Varanasi that resulted to put whole exercise into waste bins as usual in such a system.

The latest initiative under JNNURM of a similar proposal of HDP (Heritage Development Plan) was started on 1 January 2009 under the auspices of INTACH New Delhi that without any direct collaboration from its local Chapter or and local organisation has already prepared several plans and pilot-projects. Ultimately, no (detailed) document on the line of UNESCO's Guidelines to prepare proposal for inclusion (dossier) in the WHL has been made. Moreover due to time lag, there is a little chance for such proposal and its acceptance even in the Tentative List, because already 22 such properties are enlisted in the Tentative List in 2014, thus the List now records 46 such properties from India. Also to be noted that already by February 2015 in total 32 properties are enlisted in the WHL, including the latest one the Great Himalayan National Park Conservation Area (2014) under Natural World Heritage. Considering these happenings, at the earliest the Riverfront and Old City Heritage of Varanasi may probably be put on the tentative list in 2016 (?) provided the project proposal is prepared strictly in accordance with the UNESCO WHC Guidelines, and to be reviewed, verified and submitted as soon as possible.

Thanks to the recent vision and guidelines of the hon'ble Prime Minister Narendra Modi, who is also an elected member from Varanasi city parliamentary constituency, that under the purview of Smart City development strategy through the process of lifonology, the interfacing programmes of HRIDAY and PRASAD seek to promote an integrated, inclusive and sustainable development of heritage sites (cities), focusing not just on maintenance of monuments but on advancement of the entire ecosystem including its citizens, tourists and local businesses. The scheme covers 12 heritage cities including Varanasi, Amritsar, Ajmer, Mathura, Gaya, Kanchipuram, Vellankanni, Puri, Dwaraka, Badami, Warangal, and Amravati. At the first phase already Rs 5,000 million has been allocated for the HRIDAY programme on 21 January 2015 by the Urban Development Ministry (cf. Singh, Binay 2015a). Of the twelve cities, Varanasi received major share, accounting to Rs 893.1 millions, which consists of implementation of project (800), information, education and awakening programmes (30), preparation of DPR (30), and skill development (20), infrastructure of the city (10.5), and administrative works and its functioning (2.7). On 26 November 2014, the UNESCO by an agreement with Ministry of Urban Development, GOI, has agreed in revitalising and conserving the rich cultural heritage of these cities, while taking care of the increasing pace of urbanisation. In this programme priority be given to conserve and preserve the heritages (natural, cultural: tangible and intangible), which may attract more tourists and pilgrims, and to improve civic amenities for betterment of life and landscapes. Under the purview of HRIDAY and PRASAD the plan to get included '*The Riverfront and Old City Heritage Zone of Varanasi*' has recently been further discussed (December 2014), and preparation started to prepare dossier for its inscription the UNESCO WHL. This is also to be kept in mind that the sacred spaces vis-à-vis public spaces are in way will serve as peace plaza and places of spiritual awakening having "the potential for healing communal strife and reviving urban art, (*cultural and*) folk practices. Heritage conservation can thus become an empowering tool for local communities and for the visitor an opportunity for spiritual growth" (Sinha 2014, p. 60), which is ultimately aim of the urban areas.

3. Varanasi on the criteria of UNESCO-WHC

i. *Representing a masterpiece of human creative genius*

There are several examples of architectural master pieces of attached with inherent meanings, archetypal representations and continuity of performances and rituals. The microcosmic temple of Panchakroshi that places 273 deities in three-dimensionality as replica of the originally existing images and shrines along the five sacred routes in the city is a unique example (Gutschow 2005, also Singh 2002). Built in 1936 Bharat Mata ('mother India') temple, of which the interior is dominated by a remarkable 90-square-metre map of India carved in a relief out of marble blocks set into the floor, is an example of perceiving the nation as a goddess, as eulogised in the ancient mythologies. Other distinct and unparallel examples include the temples of Gurudham, Kardameshvara, Vrisabhadhvajeshvara, Amethy, Mahamaya, Lolarka water pool, and some others too (cf. Michell and Singh 2005).

One of India's earliest, most picturesque and one of the finest Gothic Revival structures in Perpendicular style,

the building of Sampurnananda Sanskrit University, Varanasi, dates from 1848-52. Of course the Sanskrit University (earlier college) was founded in 1795, but later it shifted to the present building. This is the only institution in the whole world that is based on Sanskrit language and ancient Indian tradition. It has also the richest collection of ancient manuscripts, kept in the Sarasvati Vidya Library. Presently the building and the collections in the library are both facing the problem of destruction and loss.

ii. *Exhibiting interchange of human values in architecture and monuments*

Varanasi is the only city in India where textually described cosmogonic frame and geomantic outlines are existent in their full form and totality, thus the city becomes universally significant even today. The city is a mosaic of the various religious groups and their traditions. In the city alone, there are over 3300 Hindu shrines and temples, about 1388 Muslim shrines and mosques, 12 churches, 3 Jain temples, 9 Buddhist temples, 32 Sikh temples (*gurudvaras*) and several other sacred sites and places. Here Hinduism, Buddhism, Jainism, Sikhism, Christianity and even Islam have their distinct traditions, and on the other end they together conform the harmonious life and culture of the city called 'Banarasian'. The life style of Banaras is unique in nature, and is referred to as Banarasipan. It is an art of living, both passionate and carefree, what the Banaras dwellers call *masti* ('joie de vivre'), *mauj* ('delight, festivity') and *phakarpan* ('carefreeness'). Teaching and training of Sanskrit and Ayurveda (the traditional system of Indian Medicine) has been present here since at least the 5th century BCE, and is still in practice prominently.

iii. *Testimony to cultural tradition in history*

The city has two remnants of a holy past: the first one being Sarnath where Buddha gave his first sermon, 'Turning the wheel of law' in ca. 528 BCE. Later during the 3rd century BCE king Ashoka built a monastery township there which continued its existence till the 12th century CE and was later destroyed. The second one is the Rajghat Plateau, where the archaeological findings and the C^{14} dating of some of the wares excavated from the earliest level (upper part of IA layer, sample No. TF-293) refer the existence of urban settlements in the period during 1000-500 BCE. The archaeological investigation is further supported by Robert Eidt (1977) on the basis of scientific analysis of chronosequence of non-occluded/occluded phosphate ratios. This site has been the original centre of one of the oldest continuously occupied modern cities in the world. The site evidences indicate small farming and domestication of animals, a sign of pastoral economy. This is only the far past. After this, the whole history of Banaras is a 'testimony to cultural tradition in history', as it was one of the main centres of Hindu culture and civilisation.

iv. *Outstanding example of architectural ensemble and landscape*

The unique crescent-shaped arc of the Ganga river has attracted people from various parts of India to come, settled and make their own distinct imprint along the 7 km bank of the river as clearly visualised in the architectural grandeur and the cultural landscapes. The existence of 84 *ghats* along the Ganga river to archetypal connotations, e.g. 12 division of time x 7 *chakra* (sheaths), or layers in the atmosphere; likewise the number 84 refers to the 84 *lacs* (hundred thousands) of organic species as described in Hindu mythologies. This development records a sequential growth during the last two thousand years. Since sunrise to sunset, the cultural landscape along the Ganga river is dominated by ritual scenes and religious activities, a supportive system for other profane functions that are dependent on this. The view of the riverfront from the river is clearly an outstanding example of architectural ensemble and landscape scenario.

v. *Example of a traditional habitat, culture and interaction*

Since the past people from different cultures, religions and territories came and settled here while maintaining their own distinct traditions in their own community, and also developed a harmoniously integrated culture of traditions lost elsewhere, which is still visible on different festive occasions. Of course, occasionally there also happen religions conflicts, tensions and contestations; however, during natural calamities like flood, water logging, heavy rains, or human induced occurrences like bomb blasts and riots, people from such diverse ideologies, like Hindus and Muslims, work together to save the city and thus prove that this is a city of humanity and universality. There are fourteen tombs of Muslim Sufi saints which are regularly visited by Hindus and Muslim, who perform their own rituals side-by-side.

vi. *Example of the continuity of living traditions of life (intangible)*

Since ancient times the natural and cultural landscapes of the city, closely associated with the traditional way of life, have retained an active social role in contemporary society. The city is a place of pilgrimage and a holy site for sacred baths in the Ganga River, for having a good death, and getting relief from transmigration for learning and receiving spiritual merit, etc. In spite of several downfalls and upheavals, traditions are fully alive even today. The presence of 'dying homes', charitable homes and pilgrims' rest houses are some of the city's unique characteristics. Additionally, silk weaving and sari making, metal, wood and terracotta handicrafts, toy making, particular painting forms, etc., bear witness to the continuity of historico-cultural tradition. Banaras is considered to be a veritable jungle of fairs and festivals with respect to variety, distinction, time, sacred sites, performers, overseers and side-shows. "Every day is a great festival in Banaras" – so says the tradition. Recently some of the old festivals have been revived in it original style, despite some modern touches. This lifestyle has also manifested itself in a musical tradition known as the Banaras Gharana (style). Many great musicians and performing artists have been born here and still regularly return to visit and to perform their art for the public as tribute to the spirit of the soil. The names of Ravi Shankar, (late) Bismillah Khan, (late) Kishan Maharaj and many others make obvious the richness of the Banaras musical culture.

vii. *Beauty of natural phenomena & aesthetic importance*

The city represents a unique natural shape along the Ganga river which forms a crescent shape, flowing from south to north for about 7 km; the city has grown on the left bank in semi-circular form around it. The area along the right side is a flood plain, preserving the natural ecosystem. Thus, together the two sides represent the cultural and natural beauty where meet the human construct of architectural grandeur in the form of series of traditional buildings and other side perennial flow of the Ganga from south to north, which is unique in the whole course of the Ganga valley. This is described in ancient mythology and religious literature, which became part of the religious and ritual activities that are still the prominent scenes. The eastern edge of the city faces the rising sun, which makes the *ghats* of Banaras sacred and unique for all Hindu rituals. This aesthetic harmony between the river and the city is unique in its presentation.

viii. *Unique traditional performance: example of environmental theatre*

Of course originally proclaimed in 2005 by the government of India, UNESCO has incorporated the 'Rāmalilā — traditional performance of the Rāmāyana' in its representative list of 90 declared on 4 November 2008. This list also includes two more intangible heritages, i.e. 'Kutiyattam, Sanskrit Theatre', and the 'Tradition of Vedic Chanting'. The Rāmalilā is a dramatisation of the epic journey of Rāma, the 7th incarnation of the Hindu god Vishnu. The Rāmalilā, a theatrical form of story of the *Rāmacharitamānasa* (old *Rāmāyana)*, is performed in a series of scenes that include song, narration, recital and dialogue. It is performed across northern India during the festival of Dashahra, held each year according to the ritual calendar in autumn (September-October, Hindu month of Ashvina). Of course the most representative Rāmalilās are those of Ayodhya, Ramnagar and Banaras, Vrindavan, Almora, and Madhubani, the Rāmalilā of Ramanagar is unique in the whole world. In the city of Banaras Rāmalilā holds for different periods at different sites according to their tradition and historicity, ranging from the period of ten days to 31 days (cf. for details see Sax 1990/ 1993).

4. Old City Heritage and Riverfront Cultural Landscape

All the criteria, according to *Article 2* of the UNESCO World Heritage Convention of 2003 and 2005, which relate in the domain of intangible cultural heritage, are already part of age-long traditions in Varanasi. This includes oral traditions of ritual performances; folk music and songs; performance arts like traditional dance, music and theatrical performances on special festive occasions throughout the year; social practices in celebrating festivals and events; knowledge and practices concerning nature (like naturopathy, alternative medicine, yoga) and the universe (classical astronomy and astrology); and traditional craftsmanship like toy and pot making, silk embroidery, etc. Moreover, other characteristics as defined in the above Article also are a part of life in Varanasi, continued and maintained since the past, being

transmitted from generation to generation; being constantly recreated by communities and groups, in response to their environment, their interaction with nature, and their history; providing communities and groups with a sense of identity and continuity; promoting respect for cultural diversity and human creativity; being compatible with international human rights instruments; and complying with the requirements of mutual respect among communities, and of sustainable development.

Article 1 of the World Heritage Convention of 2003 clarifies its purpose for safeguarding the intangible cultural heritage by ensuring respect for the intangible cultural heritage of the communities, groups and individuals concerned, raising awareness at the local, national and international levels about the importance of intangible cultural heritage, and securing mutual appreciation thereof, and ultimately providing international cooperation and assistance. Nevertheless it is to be noted that all these plans have to pass through governmental and bureaucratic procedures. Thus many times they suffered delays, obstacles, as well as lack of priority — given to other choices for political or personal motives — in spite of the urgency of the matter and its universal importance.

The Ganga riverfront with its *ghats* fully fulfil the criteria of Cultural Landscapes as designated in *Article 1* of the Convention, and specifically that of cultural landscape "that retains an active social role in contemporary society closely associated with the traditional way of life, and in which the evolutionary process is still in progress", and associative cultural landscape "by virtue of powerful religious, artistic, cultural associations of the natural element". It is noted that 'the shift of the Ganga river and silting of banks has impacted the riverfront landscape causing alarm among conservationists who have been pressing since 2001 to have the riverfront and the old city nominated in the UNESCO World Heritage List (cf. Singh 2009a, pp. 139-142). Varanasi ghats fit the categories of 'an organically evolved landscape' as well as 'an associative cultural landscape' in the cultural landscape criteria. The ghats on the Ganga have evolved over centuries into the spiritual centre of Hinduism' (cf. Sinha 2014, p. 3).

The conservation of most heritage properties faces intense pressure. Even if these properties are presently in the same physical condition as in the last couple of decades

and their architectural characteristics are being maintained without many legal and administrative measures, their architectural integrity is now being threatened. In the name of development, old structures are modified or demolished, even where these structures are made of stone and are not weak. The ownership is often collective or remote (like *maths*, *ashrams*, *havelis*, palaces, etc.), and renovation work is expensive. Unless stringent measures are taken for protection, there is a high probability that new structures, using new building materials, will increasingly replace old architectural shapes and material. Recent construction work and events in the old city demonstrate that even when ownership is in a single proprietor's hands, he usually prefers rebuilding rather than renovating. Besides these risks, the buffer zones and the skyline of the old city, whose status quo is preserved at this moment, are also being threatened by encroachments and the rising heights of buildings.

According to the **Master Plan** (1991-2011), under the Clause 2.9.2 Use Zone S-2 (Core Area/Heritage Zone), all the heritage monuments will be protected by the laws and construction permits be issued as per the norm of 'the distance-regulation'. This plan is the first of its kind to be officially approved by the govt. of Uttar Pradesh (ref. No. 2915/9-Aa-3-2001-10Maha//99, dated 10 July 2001). For the first time, heritage protection issues have been discussed in this Plan and heritage zones and sites have been identified. In the follow up **Master Plan** (2011-2031), the earlier Plan has been revised in order to implement the policy of preservation of heritage sites and to channelize the development of the city.

In order to absorb population growth in the old city centre, new buildings are being constructed either by demolishing old structures or by building on them. Since most of the heritage sites are in these densely inhabited narrow lane areas, two state government orders (order number 320/9-A-32000-127, dated 5 February 2000, and order number 840/9-A-3-2001, dated 11 April 2001) state that, in all the towns situated along the Ganga river, no development activities can take place 200 metres from the riverbank. It specifically prohibits new construction on the riverfront *ghats* unless these buildings are temples, *maths* and *ashramas* (monasteries) and only if these have approved construction plans or are solely being renovated. The order goes on to say that all other old buildings, that are within 200 metres from the *ghats*,

can only be renovated. A recent example of renovation and conservation of the Manikarnika Ghat with the support of JICA (Japan International Cooperation Agency) is an example of work that was completed in 2006 (cf. Fig. 6); however in lack of continuity of maintenance and carelessness the scenario is again return back to its old phase in ugly way.

The increasing impact of pollution and the decreasing volume of water in the Ganga together have a multiplying effect in Varanasi. The appearance of huge sand islands from the end of April and the increasing lower water level

of the Ganga are proving a big threat to the very existence of the *ghats* and their purpose. About three decades ago the width of the river had been 225-250m, however it has recently reached to around 60-70 m. The main stream has lost the previous high speed of its current due to less volume and pressure of water, resulting in an increased pollution level. Close to the Asi Ghat, the first one, the river has already left the bank about 7-8m. The existence of *ghats* in Varanasi is in danger because the existence of the Ganga is in danger! This trend is constantly increasing, and already some *ghats* at the down stream are now facing the problem of sinking and fracturing.


Fig. 6. Manikarnika Ghat, Varanasi, the Heritage Planning sites.

5. Public Awakening (*chetna march*): Raising the Voice

As a public awakening march, an open dialogue and press conference was called upon on 10 August 2009 evening at Asi Ghat, attended by around hundred persons raising a public voice to "Save the Heritage city of Varanasi" taking in view of the discrepancies and major drawbacks of the City Development Plan, CDP (esp. transportation and morphology) prepared in hustle by Feedback Turnkey Engineers Pvt Ltd, New Delhi, FV, which was highlighted in a newspaper (cf. Dikshit, 28 July 2009, *TOI*). No where the DPRs (Detailed Project Reports) prepared by INTACH Delhi and submitted to VDA on 16 July 2009, are taken into consideration or even any sort of coordination maintained between these two plans (cf. Singh, Binay 2009, *TOI*). The Convener of the INTACH Varanasi has already sent (29 July 2009) an appeal to Hon'ble Prime Minister of India and other concerned authorities of the Govt. of India to see the issue and intervene in such superimposed plans (prepared by outside agency) that never fit to the spirit and culture and not viable; obviously they will turn to serious threat to the holy and cultural city of Varanasi.

The budget of CDP is planned to Rs 46,806.5 millions (equals to US$ 965 mill) and should be completed by the year 2030. In this plan the following six threatening issues are realised and petitions are moved by the public to media and government personnel, of course with a little success:

1. *Construction of Permanent Jetties along the ghats for the boats* will destroy the very purpose of the riverfront historical and cultural sceneries serving as the most attractive landscape.

2. *Construction sites of the five Flyovers in the main heritage zones* would destroy the functional character and heritage monuments.

3. *Construction of the Ring Road* outside the city territory without considering the sacred territorial pilgrimage path of "Panchakroshi" that developed in medieval period and still so frequently used by pilgrims, will destroy the archetypal and cosmic symbolism of the city.

4. *The construction of a new area for Dyeing and Polishing of fabrics* outside the city will serve as 'outside' pressure that will loss the traditional craftsmanship of the city.

5. *Introducing Mass Public transport system* in the main city will create a chaos and disaster to the heritagescapes; let the traditional system may be improved in renovated way.

6. *The Lighting of the heritage sites* will promote stress on the heritage component and further deteriorate the heritage environment. Modernity should be avoided if heritage is in danger.

In continuing of several such this marches, on 9 February 2009, with the initiatives of INTACH (Delhi) and the Ministry of Foreign Affairs and Cooperation (MFAC) of Spain a Memorandum of Understanding (MoU) was signed to conserve, protect and preserve the heritage monuments and promote cultural heritage in the temple city of Varanasi and develop world-class infrastructure in the area, which will pave the path in inscribing Varanasi as 'World Heritage City'. According to this MoU experts from Spain will intensively work in Varanasi for documentation, inventory and status reporting of the heritage properties and heritagescapes; but no progress is made yet, and also the role of local chapter of INTACH has been negligible in coordination, mostly due to lack of vision, insights and plans that undemocratically handled for the personal interest. Such programmes are mostly based on outsiders' creation — that are superimposed here, keeping away the assessment of local requirement, understanding and without hearing the local voices, however through media they propagate the rationality and suitability of the plans and designs they have crafted out!

During 2010-2012 with technical support and cooperation of German Technical Cooperation (GTZ), CEPT (Centre for Environmental Planning and Technology, Ahmadabad), and Advisory Services in Environmental Management (ASEM), a venture of the Indian Ministry of Environment and Forests, the Municipal Corporation of Varanasi had worked out for the sanitation plan enhancing environmental cleanliness and hygienic urban habitat that will result to conserve, preserve and maintain the aesthetic values of heritage. Of course, the action through functioning "City Task Force" had started, however at some stage it was stopped.

In spite of all such tragic situations, people are still hopeful for some good changes that would be befitting in maintaining the glorious culture and heritage of this heritage city. Let us hope for new light that may help to keep, continue and envision its image as "the City of Light" through the vision and plans under HRIDAY and PRASAD, recently dreamed and structured by the Hon'ble Prime Minister Narendra Modi, who is the Member of Parliament from the city itself.

6. Framing HRIDAY and PRASAD

Framing tourism and cultural development in holistic frame for national and international resource within the purview of the ancient roots of heritage properties and traditions of spirituality, sacrality and pilgrimages that have a long tradition and continuity in India, Ministry of Tourism and Culture, and Ministry of Urban Development, Government of India, have recently conceptualised two innovative and appropriate national programmes of interfacing and counter-depending missions of (i) *Heritage city Development and Augmentation Yojana* (**HRIDAY**), and (ii) *Pilgrimage Rejuvenation And Spiritual Augmentation Drive* (**PRASAD**). In both of these programmes the ministries of Culture and Tourism and Urban Development will collaborate to strengthen and promote the heritage sites and centres of pilgrimage-tourism in making the environment green and sustainable while befitting into the roots of culture, traditions and society and also image of the site. The three major sites selected at priority level, include Varanasi, Mathura, and Ajmer.

(i) National mission of HRIDAY

The National mission on the "Heritage city Development and Augmentation Yojana" (**HRIDAY**), aims conserving and preserving the distinct and unique characters of the *heritage cities*, those maintained the continuity of their traditions of heritage (tangible, intangible, and cultural landscapes, including written, oral, and performed ones), and they would be used as a resource for sustainable development and ecological restoration. That is how, heritage development means not only the beautification of the city and conservation of the heritage site but also the preservation and sustainable development of the entire city with respect to its cleanliness, planning, livelihood of the local people and economy.

In Indian tradition, heritage is called '*dharohara*', which is a combination of two words, i.e. *dharā*- ('the mother earth/ Lord Vishnu who holds'), and *-ihara* ('endeavour of identity through time'). The word also carries the meaning of 'bearing' and 'preserving' the surface of the earth. That is how it should be explained in terms of the 'root' ('*shrota*') and 'identity' ('*asmitā*') — a framework of continuity of interconnectedness and a personality of culture, thus in terms of space it combines the microspace, site (*sthān*), the extended space, habitat (*paryāvāsa*) and the regional projection, territory (*parikshetra*), and ultimately linking to terrestrial, cosmos (*brahmāṇḍa*). Additionally, it also connotes the tangible, intangible and visual attributes. Altogether the Indian word '*dharohara*' should be better translated as '*heritagescapes*' and to be explained in the purview of 'heritage ecology' in corroboration with 'deep geography'. It possesses the spirit of spirituality and interconnectedness that have roots in the past, existence in present and vision in future ('*sanātana*'), and altogether this works in unified totality for psychological well-being or soul healing.

Cultural heritage sites are the true representative of the divine order and human's deep faith involvement, that is how it may be accepted as religious 'resource', but it has scientific, recreational, aesthetic, economic and sacramental values too. Thus the metaphorical meaning of "HRIDAY" (literally '*heart*') is the core concern for the 'inclusive-sustainable development of heritage-and-pilgrimage cities' in India. This frame would be taken as core concern under the HRIDAY Programme.

The protection, augmentation, management, authenticity and integrity of properties (both tangible and intangible) are also important considerations, together with the above specific characteristics. In the above context three basic meanings, in historical context, to the understanding of heritage sites are:

▪ a *political* meaning – to assure responsibility for the decisions;

▪ a *cultural* meaning – to save culture rootedness and sense of continuity; and

▪ a *didactic* meaning – to promote citizen's participation.

These meanings are associated with deconstructing the value of cultural heritage into its component parts identifying the following six *value elements*:

▪ *aesthetic value*: the visual beauty of the building, site, and so on;

▪ *spiritual value*: the significance of the asset in providing understanding or enlightenment or in representing a particular religion or religious tradition;

- *social value*: the role of the site in forming cultural identity or a sense of connection with others;
- *historical value:* connections with the past;
- *symbolic value:* objects or sites as repositories or conveyors of meaning, and
- *authenticity value:* the uniqueness of visiting 'the real thing'.

(ii) National mission of PRASAD

With a view to beautify and improve the amenities and infrastructure at pilgrimage centres of all faiths, a National mission on 'Pilgrimage Rejuvenation And Spiritual Augmentation' (**PRASAD**) has been announced in the Union Budget 2014-2015 and an amount of Rs. 1000 million has been proposed for this initiative. Under PRASAD the old historical-cultural pilgrimage routes and associated sites would also be developed.

The interconnectivity and reciprocity between pilgrimage and tourism are integral part of human travel. That is how 'pilgrimage-tourism' is conceived as an alternative for the solution; of course this is more inclined to metaphysical issue and life philosophy: meeting sacred-and-profane. Pilgrimage-tourism is considered now as strategy for heritage awakening, deeper experiences and transferring the religiosity into global humanism and spirituality. The sustainable frame of pilgrimage-tourism and heritage should be promoted in three ways: philosophical, organisational, and managerial. The eco-healing approach to pilgrimage-tourism is considered as a post-modernist way to consider pilgrimage as a bridge between recreation and spirituality; this way pilgrimage-

tourism will provide a rational alternative for cultural consciousness and strategy for poverty alleviation.
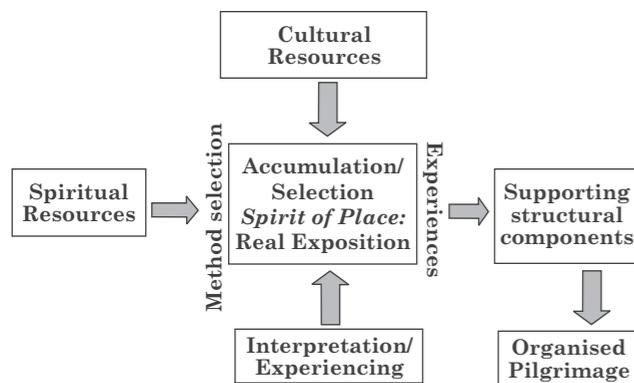
The deeper sense of attachment is pre-requisite for awakening (of awareness). Once one can develop deep feeling (of love) to a place that would help caring for it — a path that helps one to have realization leading to revelation. As the 'caring for the place (the *Earth*)' is inherent in the pilgrimage-tourism, it provides opportunity to intimately sense and deep feelings for the place and the people — their behaviour, their heritage, and the present in which they live, act, and keep the glorious tradition alive.

The approach to study tourism so for has been the study of economic activity almost always. It limits the scope and answer to many questions posed as consequence. On the line of 'commodification approach' proposed by Ashworth (1991, p. 111), the 'eco-healing package' (cf. Fig. 7) may be explained here which extends the horizon of potential resources in pilgrimage-tourism as an alternative tourism, expected that it will fulfil the objectives of PRASAD.

The purpose, of developing 'eco-healing approach' within the frame of PRASAD, evidently is to highlight the strong rationality of developing pilgrimage-tourism on the pathways of ecofriendly and ecospiritual ways. The components of this package may be briefly explained as the following:

(a) The Resource(s)

This package identifies cultural and spiritual heritage as resources. In one hand, the goddess shrines and associated territories form the cultural heritage resources; and, the rituals, awe, deep feelings and faith, belief, and the system of *vratas* and fasting, etc. together make the spiritual resources on the other hand. The live traditions of continuing maintenance of these resources reflect their inner strength. Their qualitative and quantitative richness may be taken as the indicator of their potentialities for serving as the basis of an alternative tourism. Additionally, the involvement of spiritual resources will effectively check the consumer (tourists) behaviour and thus ensure healing of the mother earth.

(b) The Assemblage

The process of assembly begins with selection of the way. Apart from it, this process, also involves interpretation.

Fig. 7. Components of Pilgrimage-Tourism (cf. Singh, Pratibha 2004, p. 213).

With reference to goddesses, the assemblage of archetypal symbolism represented by the goddess's form and geographical setting, the *spiritualscape*, and the cultural context make the spirit of place meaningful and confirm its potentiality for pilgrimage based tourism. While interpreting, the importance of deep feelings and intimate sensing to be projected in clear and simple terms. Making simultaneous reference to enshrouding value system is also equally significant.

(c) The Operational Aspect

Experience(s) and the capacity to experience are two most vital issues at the interface between the product and consumer, i.e. spirit of place and (pilgrim) tourist. Here, the greater emphasis is on the (pilgrim) tourist who has to undergo the process of experiencing, which depends upon certain pre-requisites, e.g. reverence and respect, belief and faith, and more importantly deep insight to understand the revelation and a developed sensitiveness to feel the spiritual bliss.

For the successful operation of this kind of alternative tourism, it needs to be well organized. This stage involves many supporting agencies to provide infrastructural facilities. Ashworth (1991, pp. 118-119) talks of certain 'necessary preconditions', like organizational integration, motivational integration, financial integration, functional integration, and spatial integration — for the efficient functioning of his model. All of these seem to be equally essential in the case of pilgrimage based alternative tourism that remains oriented more towards the health of heritage (and mother Earth) than commercial profits (for appraisal in India see, Neuß 2012).

7. *Indo-Suitogaku* vis-à-vis *Kashi-Kyoto Interface*: framing the Water-front Cities

I saw the light along the riverfront Ganga; I suddenly realized that was my home, where the earth spirit meets the divine – the revelation of life. Alas! Now the feeling of attachment is superseded by consumerism together with individualism and materialism. Attachment to a place is a prerequisite for developing a sense of the spirit of place, and would also be an inherent force behind framing HRIDAY and PRASAD. This sense of attachment provides emotional and spiritual sustainability to both

individuals and the community, and ultimately the landscapes. Attachment is an existential and phenomenological experience, as illustrated in Kyoto. The key to the future is in the commitment of human inhabitants living there who maintain this sense of attachment and perform their activities in a quest of awakening (*svachetana*). Within the broad vision of eco-spirituality preserving the spirit of sustainability keeping the spirit of place at its nexus is generally taken as the main philosophy behind "*Suitogaku*": towards framing the Water-front Cities, as proposed and elaborated by Japanese landscape architect Hidenobu Jinnai (2013). The ethics of "sustainable development," to which almost everyone subscribes today, requires this generation to use the world's environmental resources in ways that do not jeopardize the ability of future generations to meet their own needs. To be successful, this principle requires another dimension — *reverence* and *revelation* (ecospirituality) [cf. Fig. 8]. Development should preserve, not destroy, those assets of the natural and spiritual power of our own cultural heritage, which future generations would also wish to enjoy and cherish.
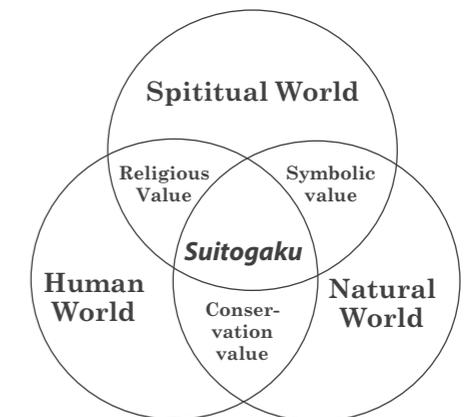
Fig. 8. Main constituent values of *Suitogaku* (in the frame of Sacred Natural Sites, after Verschuuren 2007, p. 308).

Reverence — the deeper vision of the sanctity of life; *responsibility* — the connecting link between ethics and rationality; *frugality* — grace without waste; and *ecojustice* — all form the minimal core of intrinsic values for right conservation and preservation of the spirit of sustainability (Skolimowski 1990, pp. 100-102). In fact, in

corroboration with reverential development *Suitogaku* should be conceived as an unitary in the broadest and deepest sense, which combine reverence and sanctity of life with contemporary economic, social, moral, cultural, and traditional premises to bring peace and harmony with nature (cf. Skolimowski 1990, p. 103), i.e. a rational integration and righteous counter-balance between *dharma* (moral code of conduct) and *karma* (right action). The expansion and rejuvenation of the Japanese idea of *Suitogaku* may also have its Indian form, let me call it *Indo-Suitogaku* that may take consideration of the five gross-elements (*mahabhutas*) of nature.

The *Mahabharata* (12.198.14–19) states that the Supreme God created primordial man, who first made *sky*; from sky, *water* was made and from sea of water, *fire* and *air* — these latter two together made the *earth*; these together are called as *mahabhutas*. Hence, in a metaphysical sense, these elements are not separated from earth other. These elements are related to one another by means of their intrinsic nature leading to a bond among creatures (cf. Singh, Rana 2009c, p. 131). In the Puranic theory of creation, the Svayambhu God Brahmā (self-born creator), being desirous of progeny, created water first. The *Bhagavata Purana* (1.3.2–5) says that primordial man was lying down in the waters of the universe, therefore in any habitat planning and preservation water to be given prime importance. At riverfront Banaras the traditional and salvation activities are performed along the bank, ranging from initiative and birth rituals to death and post-deal rituals and in between several others which include even amusement (e.g. tourism, entertainment and various plays) and awes too (e.g. mystical and unique varieties of rituals, which one can easily visualise while passing on the boat or having walk along the riverfront *ghats*.

Considering the above perspective, the *Indo-Suitogaku* should to be studied and projected in the frames of interdisciplinarity and unitary links among various subjects. The *Indo-Suitogaku* should I hope avoid to 'think of *space* as "something" to be perceived, but it should be visualised, experienced and revealed as an "in born organising principle" of mind that used to construct the perception of the world from the data received through the senses' (Deveroux 1996, p. 175). Waterfront to be developed as repository of contact-point among water, land and human habitat "where the symbols of the past stand in contact with lively present" (Lynch in Banerjee

and Southworth 1991, p. 670). The fact that they may be difficult to implement in practice, in no way negates their importance and desirability (for a comprehensive illustration see Jinnai 2013). It may further be used as healing channel between human mind and the divine nature (cf. Deveroux 1996, pp. 136-137), of course it is a challenge in case of Banaras where the age-old traditional holiness has constantly been resisting modern and planned developments.

As a followed up programme after hon'ble PM Narendra Modi's visit to Kyoto and sign of an agreement on 31 August 2014 between Varanasi and Kyoto, the Kashi-Kyoto MoU and pact between India and Japan has been finalised in a Steering Committee meeting on 13 January 2015 at New Delhi, taking into consideration the similarities between Kyoto and Varanasi and the possibilities of sharing the experiences of Kyoto's emergence as the top ranked city in the world in the domain of cultural tourism with inclusive-heritage development strategies centred around conserving its rich culture heritage. The three concerned areas highlighted in respect of Kyoto's initiatives were: conservation of cultural heritages (tangible and intangible), radical changes and modernisation in town planning is a sustainable way, drastic reduction in garbage generation and enhancing the appeal of city's cultural visibility in the purview of public awakening through measures like banning outdoor advertisements, riverfront encroachment and unauthorised development, etc. (cf. Singh, Binay 2015b).

8. Envisioning Future & Liveable City

There is no perfect optimal plan for making city complete and ecologically liveable. Although modern design, technology and resource transformation are important ingredients, cities will flourish by creating opportunity through their own narratives while working with their history, tradition, cultures, resources, location and population potentials to improve liveability (cf. Stanley 2010). Liveable city is a concept on the minds of urban planners, developers green builders and stakeholders concerned for good and happy places around the world. Liveable cities enhance the lives and well-being of its citizens, encouraging community and public participation through designing urban infrastructure that brings people together (cf. Murry 2011). Additionally, liveable cities embody sustainability — ecologically, economically,

culturally, socially and humanistically (cf. Pal 2015, p. 278).

The following five general principles should guide the development of Liveable City on the line of ecological sustainability; these should be given more care in the *Varanasi Master Plan 2031*:

- Be better places to live, for everyone;
- Underpin growth and jobs;
- Leave a sound legacy for future generations;
- Offer better linkages to regions and other major cities;
- Integrate within and between transport and land use, urban form and new technologies.

The following principles that are more specific should guide mobility within accessible city:

1. Take a 'systems' approach to the whole network.

2. Limit the need for travel and, if this is not possible, limit the distance to be travelled. For example, by providing work opportunities close to home and making teleconferencing and augmented reality facilities available within local precincts.

3. Relieve people of the need to 'drive' vehicles, thus freeing their travel time for more personal or productive tasks; for example, using non-crowded 'public' transport and intelligent transport systems to permit automatic operation of road vehicles.

4. Separate major flows of freight and passengers via separate networks.

While many city governments face unprecedented challenges, a number of steps can make cities more liveable and protect the environment. These include better urban planning, more public transportation, better sanitation and rational water use policies, energy conservation, urban farming, and waste recycling. In addition, slower population growth would ease pressures on cities and buy time to find solutions. Of course, sustainable urban development is a recent, yet controversial concept. Wheeler, in his 1998 article, defines sustainable urban development as "development that improves the long-term social and ecological health of cities and towns." He sketches a 'sustainable' city's features: compact, efficient land use; less automobile use, yet better access; efficient resource use; less pollution and waste; the restoration of natural systems; good housing

and living environments; a healthy social ecology; a sustainable economy; community participation and involvement; and preservation of local culture and wisdom.

After passing twelve years now the concept of sustainable urban development and liveable city planning are popularly conceived as philosophical vision for city planning, especially for old cities; as also this would be befitting to Varanasi. Because of political and governance structures in most jurisdictions, sustainable planning measures must be widely supported before they can affect institutions and regions. Actual implementation is often a complex compromise among several stakeholders and policy makers, and in bridging machineries, which in our cases quite complex and corrupt. Nevertheless, sustainability requires governments to stay engaged, public-private partnership to be appropriately designed and regulated to benefit the community (Yuen and Ooi 2010, p. 8); it may be difficult, but not impossible. A conflict between the preservation of the character of existing historic towns and "change" has formed the central argument for conservation and sustainable planning. Presently, heritage has superseded conservation, where marketing of heritage as a product according to the demands of the consumer, mainly tourists, has resulted in the commercialisation of heritage over conservation values that also turn into contestation. Today, the symbiosis of both tourism and heritage places has become a major objective in the management and planning of historic cities like Varanasi (cf. Nasser 2003).

As regional capital the City is serving as nexus for the economic development and its transactions, and also trying to maintain its status as popular place of pilgrimage and tourism. But think of the period after two decades when population will be double, the requirements will be different and intense, the transportation would require complex network, maintenance of city's role as bridge between rural and urban culture, and also coping with India's urban share that would be half by 2031, how the city will take lead in these situations and transformations! Presently the City is unprepared and ill-equipped to tackle the challenges it faces to create new and better landscape and life (cf. Singh, Rana 2015b).

Land acquisition is one of the biggest, most politically fraught obstacles to industrial growth and expansion of

the City. Farmers have fought bitter battles against their land being taken for urban expansion, development of residential colonies, and stalling some projects for years. There is lack of coordination among the three development institutions responsible for making plan and implementing them, viz. Varanasi Development Authority, Varanasi Municipal Corporation, District Urban Development Authority, and their affiliates.

The way *Master plan 2031* manages its urban transformation will determine the course of its development and economic ascent. Unfortunately, rarely public participation is taken care for making this *Master Plan*, which is mostly conceived as an extension of the old one and additionally chalked out as manifestation of earlier model plans those have no way concerned with the similar situation. There is another big gap between 'inside' (residents) and 'outside' (administration) approaches. Theoretically tourism and heritage are also given consideration in preparing development plan, but no way rationales, threshold and land use plans based on 'pilot projects' and case studies are yet prepared. The INTACH (Indian National Trust for Art, Culture and Heritage), New Delhi, has been entrusted to work on the issues of heritage development plans, which completely avoided to take any sort of collaboration with the local expert and resources. The situation is turning as unwillingly the residents have to accept all such plans conceived by outsiders and theoreticians those no way have experience or deeper interaction with the local society and culture. Let the authorities realise these and such studies to be taken for making planning strategies (cf. Pal 2015, p. 281).

9. Concluding Remarks

Heritage is the mirror of mankind's growth, progress and prospects; it is very important that it should be preserved. One has to remember that modern way of life and science, and ancient wisdom and its messages can work together to help in searching a harmonious and peaceful path of mankind's integration with nature. In order that this heritage become a resource for development, it needs to be first documented, then protected, maintained and finally utilized according to specific heritage guidelines and legislations. Only then, combined with an increased citizens' awareness and participation, will policy efforts and interventions become sustainable – environmentally, socially and culturally (cf. Singh 2011a, p. 251).

It is notable that the initiative made by local NGOs, experts and eminent citizens of the city, to propose the nomination of the old city centre of Varanasi for inclusion in the UNESCO World Heritage List has activated the sensitive and positive response in the city administration to think of preservation of cultural heritage. A mass movement of awakening (*chetna march*) is required for reverential development. But it should not turn into fundamentalism, nor should it cause any damage to secular life.

In order that heritage becomes a sustainable resource for development, it is essential that: (i) Heritage be protected and maintained; (ii) Heritage protection be continuously monitored, assessed and strategies be changed fitting according to appropriateness, priority and in need of the time; (iii) Impact of heritage protection should be constantly evaluated am improved upon; (iv) Heritage protection activities should be supported by the residents and stakeholders; (v) City development plans follow specific heritage guidelines support system and the by-laws; (vi) Heritage to be promoted so as to bring sustainable economic benefits to the local population; and (vii) Information and cultural programmes on heritage issues to be disseminated for awareness building among citizens.

In our temporal frame we have to give respect to the past, search solutions in the present, and make directions for the future. This should apply to the issue of urban sprawl beyond the corporation boundary and interlinks with the surrounding areas (peri-urban), which were not considered in preparing the CDP or DPR. Remember, a thing is right when it tends to preserve the integrity, stability and beauty of the site as a living organism. In order that this heritage becomes a resource for development, it needs to be first documented, then protected, maintained and finally utilised according to specific heritage guidelines and legislations. Only then, combined with an increased stakeholder awareness and participation, will policy efforts and interventions become sustainable – environmentally, socially and culturally. We may separate ourselves from the web of our heritage in the pursuit of modernity and secularism, but it would always be at the cost of our hearts and souls.

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Varanasi: An Exploration of Mythology about Its Origin

Vijay Nath Giri
Head, Department of Humanities and Social Sciences, IIT Kharagpur

Abstract

Varanasi, one of the oldest living cities of the world, has a long history which is full of mystery. Known by its various names like Benares, Kashi, Avimuktka, Varnavati, Anandavana, Rudravasa, etc., it is situated on the west bank of river Ganges, bounded by its two tributaries Varuna and Assi in Uttar Pradesh. Various mythological sources are found about the origin of Varanasi. In Hindu epics, the description of Kashi was first found in Rigveda, where Divodasa is mentioned as king of Kashi. The time period of Rigveda is considered about 1500BC- 800BC. According to Jain epics (Kalpa Sutra, Bhagwati Sutra), Thirthankar Parshvanathji (born in 850BC) was the son of Vamadevi and Ashvasen, king of Kashi. According to Buddhist epics (Anguttara Nikaya and Digha Nikaya), Buddha gave his first sermon in 'Sarnath', near Varanasi in 528BC. These epics define about a cultured civilization in this area with 16 Mahajanpads theory which is also in Vedas and Jain epics which proves the theory and time period of origin of Kashi. Other Sources as Mahabharata, Ramayana and Jataka Tales are also important sources to know about Varanasi. Thus, the present paper attempts to explore the various mythological sources related to the origin of Varanasi.

Keywords: *Kashi, Rigveda, Sarnath, Mahabharata ,Jataka Tales.*

Fig.1. Ancient Varanasi (Source: www.wikimedia.org)

Introduction

Varanasi, known by several names like Benares, Kashi, Avimuktka, Varnavati, Anandavana, Rudravasa, etc. is situated on the west bank of the river Ganges, bounded by its two tributaries Varuna and Assi in Uttar Pradesh. It is also called '*Cultural Capital of India*'. According to the 'Vamana Purana', the Varuna and the Assi rivers originated from the body of the Primordial Person at the beginning of time itself. The tract of land lying between them is believed to be 'Varanasi', the holiest of all pilgrimages. According to one of the myth, the two rivers Varana and Asi are respectively originated from the right and left legs of Vishnu lying at Prayaga (Allahabad). A myth from 15th century establish that the two rivers were created by the gods and placed in position to guard against the entrance of evil. The northern one was named "The Averter" (*Varana*) and the southern river was named "The Sword" (*Asi*). According to early *Puranas* the Varana river is called Varanavati or Varanasi, and the old city would have then got its name as it was settled along the river The another famous name of Varanasi is '*Kashi*' which is derived from Kasha that means brightness. It is also called '*Avimuktaka*' because Avi means 'Sin' in hindi, so the area which is 'Mukt' or free from Avi,

and never forsaken by the Lord Shiva is called Avimuktaka. Varanasi is worldwide famous for its unique cultural heritage. Mark Twain (1898: 480), the famous American litterateur, once said about Benares or Varanasi,

"Benares is older than history, older than tradition, older even than legend, and looks twice as old as all of them put together.

Mythological Evidences

In Hindu epics, the description of Kashi is found in Rigveda, other Vedas, and 14 Puranas (*Skanda, Brahmvatatrya, Brahma, Vayu, Matsya, Kurmu, Padma, Vamana, Linga, Narad, Shiva, Bhagwat, Agni, Markandeya*), etc. Thesehelp us to decide that this area was populated before or about 1000BC. The time period of Rigveda is considered about 1500BC- 800BC (where Indian scholars consider it around 12000BC-4000BC).

The first reference of the Vedic battle between Pratardana and Videha (ref. *Rig Veda*, RgV 10.179.2) is an example of two regional cultures. Pratardana was the son ofDivodasa. According to Hindu stories, Manu is the primordial man described in the Brahminical creation theory and Dhanvantari was the 7th in his lineage. Dhanvantari, father of Indian medicine, was one of the earliest kings of this city (cf. VyP 92.33.28; and BdP 3.63 and 119-141). The story tells that Dhanvantari's grandson Divodasa was once exiled from the city and thus made another capital city at the confluence of the river Ganga and the Gomati, which was described as Markandeya Tirtha in the *Mahabharata* (Aranyaka 82.68-70), identified today with Kaithi (Kitagiri), 28 km away from Varanasi city. In 10thMandal of Rigveda, Divodasa is mentioned as the king of Kashi. The later version of the Divodasa story refers to the battle between the patron deity Shiva and the king Divodasa (cf. *Brahmanda Purana*, 2.3.67-68; also *Vayu Purana*, 92; both dated ca 9th-10th centuries). Divodasa is described as a man of unusual purity and of strict integrity who resisted the encroachments of Brahminism on its first approach to Banaras, but eventually was obliged to succumb to it, and to surrender his crown to the Brahminic followers (worshippers of Lord Shiva). According to another interpretation, Divodasa might have been a Tantric, follower of indigenous belief systems.

The story further continues that due to catastrophic drought and epidemic in mid 17th century BCE, the Aryans migrated from the west to the Ganga Valley and succeeded in superimposing their culture at the place of indigenous culture (cf. Fig.2). For the first time in history, a Great War spread by the Yadu clan of Haihaiyas spread from Gandhara (Afghanistan) to Saptasindhu (northwest part of India). This was the first dark spot on human migration when all the codes of human values lost their hold and one brother killed the other one (cf. VS: 194).

There is no common agreement as to when the Aryan came and settled in the central Ganga valley. Most likely the heavy pressure of population encouraged the Aryans to migrate from their major areas of concentration in northwest India, the Indus valley, mostly along the Sarasvatiriver (that vanished around 1750 BCE). The core was the township of Harayupiya (Harappa) in the Sarasvati basin, referred as Brahmavarta (Fig.2). The *Mahabharata* (3.83.4 and 205) mentions this land as Kurukshetra. Chaudhuri (1966: 49) mentions: "The Vedic Aryan settled down in the Punjab, but they could not remain satisfied with it, nor confined to it. For one thing, they were a restless warrior folk with wanderlust. Next, they had come into India, not simply as an aristocracy, but as a complete society". They initially spread in masses up to the coast of the Gulf of Kutch (Gujarat). Around 1000 BCE another stream of Aryan migrant went to Bhrigukachha and from there to Mahishmati ('source of the Narmada river'). And, the other one went to Pratishthan (Allahabad), Ayodhya and Kashi (Singh 2004: 43).

According to another view (based on remote sensing data) a catastrophic drought and epidemic in ca. 1750 BCE (VS: 8) were the main factors resulting in the drying of the course of the Sarasvati river. The settlers were bound to search for an alternative land for survival and subsistence. The drought was so intense and widespread that people even ate the meat of dead animals. One of the sages said (cf. RgV, 4.18.13) that "leaving aside the religious codes, I have eaten the boiled intestine of a dead dog; I have seen how my wife took her last breath because of the lack of food. Even in this crucial time the gods did not help us. Finally, O Shyena ('Rays of Light'), you offered the rains to us". The *Shatapatha Brahmana* (1.4.1.15-17), a ca 8th century BCE text, narrates the story of Aryan expansion. It says that from the dried bed of the Sarasvati river a noble Aryan group marched towards the east under the leadership of Videgha Mathava and in the course of time reached the bank of the
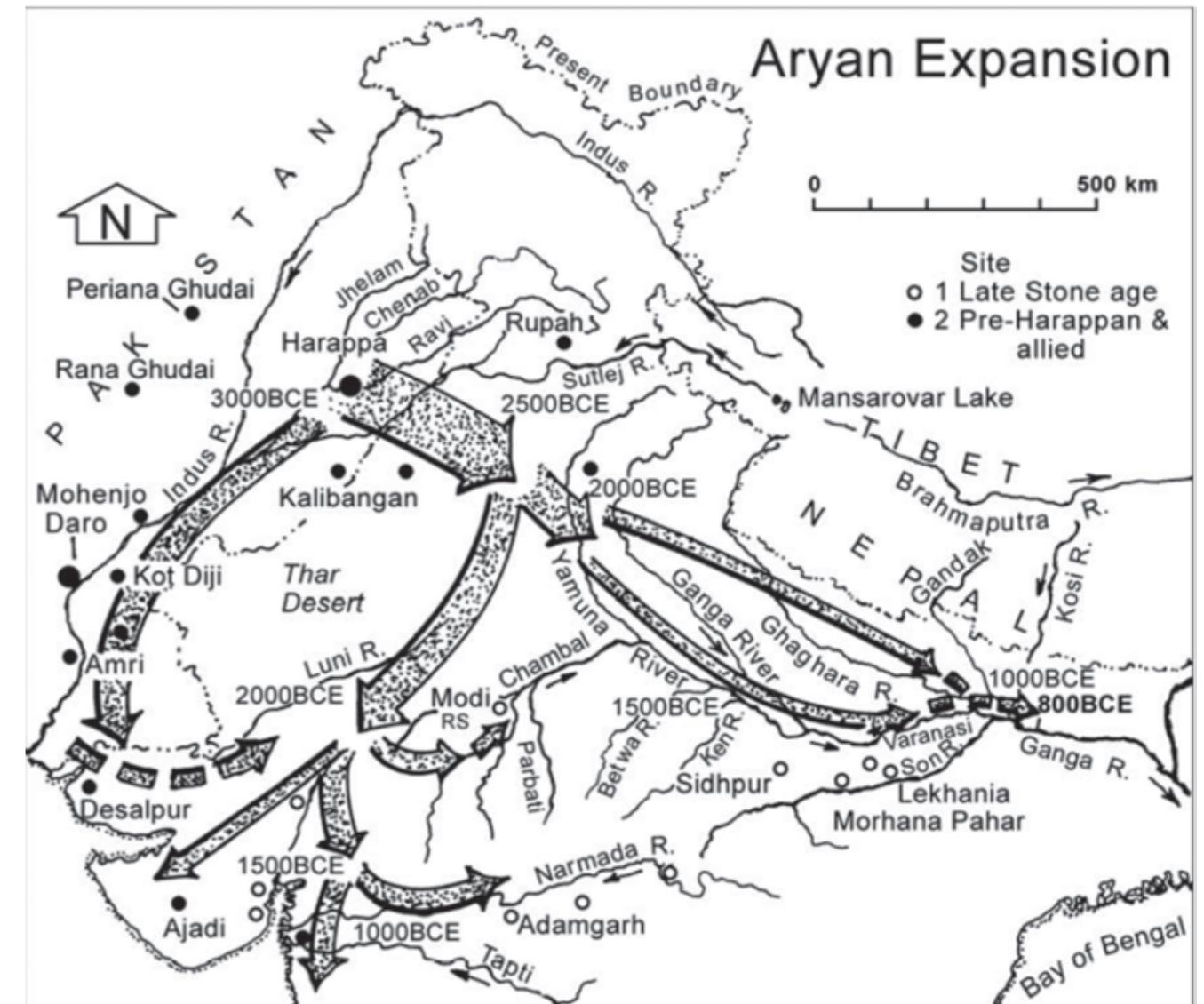
Fig.2. Aryan expansion, from Harappa and Mohenjo-Daro to Kashi region (Source: Banaras, Making of India's Heritage City)

Sadanira (Gandaki) river. They established the kingdom of Koshala. Another branch, named Kashya, at the same time established its separate kingdom, which was called Kashi.

The epic *Mahabharta and Satpatha Brahmana*also tell about Varanasi or Kashi. Where *Mahabharata* has a passing reference to the city, but on the other hand the *Jataka Tales*, written after the *Mahabharata*, record vivid descriptions of the city. The literary description given in the *Shatpath Brahmin,* dated ca. 9th century BCE, also supports these Jataka stories (around 100 stories)and mentions the rich pastoral life and habitation in the Rajghat area. The *Jataka Tales*, 6th to 3rd century BCE, refer to Banaras as the site of birth cycle of previous Buddhas, the last one is considered as Gautam Buddha (563-483BCE)

The *Ramayana* also described Kashi as a kingdom and an important city. Before 1000BC Kashi region was well

Fig.3. Picture of Various Jataka Tales
(Source: www.wikimedia.org)

settled under the sovereignty of king Kashya clan who named the city according to his name, Kashi (Motichandra, 1985:26). In the *Mahabharata,* Divodasa is described as a king who had fortified the city of Varanasi and also taken away the sacrificial fire of his enemies. The Pandavas also visited the city in search of Shiva to atone for their sins of fratricide and Brāhmanahatya that they had committed during the climactic Kurukshetra war. In latest studies, time of Kurukshetra waris found about 3067BC (Raghvan & Iyengar, 2009). Kashi is also mentioned in SkandaPurana where Lord Shiva says, *"Thethree worlds from one city of mine and Kashi is my royal place"*. It is also mentioned in so many ancient and modern epics as 'holiest in seven sacred cities (*Sapta Puri- Ayodhya, Mathura, Kashi, Gaya, Kanchi, Avantika, Dwarawati)* in Hinduism, Jainism and Ravidassia religion.

According to Jain epics, Bhagavati Sutra and *Kalpa Sutra,* in their chain of twenty four

Tirthankaras;7[th]Tirthankara *'Suparsvnathji'*, 8th Tirthankara *'Chandraprabhuji',* 11[th]Tirthankara *'Shreyanshnathji'* and 23rd Tirthankara *'Parshvanathji'* were born in Varanasi. Parshvanathji (born in 850 BC), son of Vamadevi and Ashvasen, king of Kashi (Motichandra 1985: 39), was born near a mythical tank in Varanasi (Parshvanatha Jain temple, Bhelupura). 24th Tirthankara Mahaviraji (599-527 BCE), the last Tirthankara, also visited the city many times and made big cultural imprint on the city. The birthplace of Suparshvanatha, the 7th Tirthankara, is also described in the Jain literature, though its location and identification have still not been confirmed. Traditionally, the temple of Suparshvanatha in Bhadaini commemorates that incident. The present Jain temple in Sarnath, near the Dhamekha Stupa, is believed as the birthplace of Shreyamshanathaji, the 11th Tirthankara. Chandravati, an ancient village lying on the Varanasi-Ghazipur road, is considered to be the birthplace of the 8th Tirthankara Chandraprabhu.

According to Buddhist epics *Anguttara Nikayaand Digha Nikaya*, Buddha gave his first sermon in 'Sarnath', near Varanasi, in 528 BC. Sarnath is the place where the Buddhist Sangha first came into existence. These epics define about a cultured civilization in this area with 16 Mahajanpada's theory which is also in Vedas and Jain epics, and which proves the theory and time period of Kashi's origin in Hinduism. Banaras was also mentioned as a famous halting station on the ancient northerly route, *Uttarapatha*, which had connected Rajagriha in the southeast and the sea coast to as far as Taxila (now in Pakistan) in the northwest (cf. *Vinayapitaka* 1.262; *Dhammapada* 1.126; Motichandra 1985: 48).

Conclusion

Based on various research findings, it can be said that Varanasi indeed is one of the oldest cities of the world. From various mythological evidences, the origin of Varanasi seems to be during the time period from very before to 1000 BC. Further, its descriptions in various mythological sources and also the archaeological evidences reveal that Varanasi is one of the world's oldest continually inhabited cities. A number of contemporary scholars, researchers, historians and travelers have experienced the city and have no hesitation to say that Varanasi is a unique city and many more are yet to be known about this mysterious city.

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Contributor to the paper: Sri Saurabh Sharma, HSS, IIT Kharagpur

Creative Economy:
Revivals and Resurgence

Santiniketan Built Environment and Rabindranath Tagore

Arunendu Banerjee

Director, STS Systems, Kolkata and Advisor, Viswabharati and Rabindra Bharati University

Deep ecological ethics

The Santiniketan Ashram School (popularly known as forest school-Tapovana)was started by Rabindranath during the latter part of 1901. The foundation work of the ashram, a spiritual retreat, was established by MaharshiDebendranath Tagore, the philosopher-father of Rabindranath during 1862-63. He was responsible for the pioneering work of making the barren spread into green. Santiniketan, the guest house building, Upasana Temple and the surrounding architecture and open environmental art were designed and built from 1862. The School was fundamentally based on the spirit of the ancient Indian ashram. Rabindranath's dream of an Open University (Visva-Bharati) for the synthesis and unification of a universal learning centre, was conceptualized during 1918. In his lecture of "The Centre of Indian Culture" Tagore had mentioned – '… In an age of great mental vitality, when men were there whose minds overflowed with thoughts and learning, the culture centers of Nalanda and Taxila were naturally formed in India. …'.

Invocation

Om!

Where the mind is without fear and the head is held high

Where knowledge is free….

Where the world has not been broken up into fragments

By narrow domestic walls

Where words come out from the depth of truth

Where tireless striving stretches its arms towards perfection

Where the clear stream of reason has not lost its way

Into the dreary desert sand of dead habit -

Om!

Santiniketan, where Rabindranath Tagore's dream of Open University for the cultural synthesis and unification of universal learning came into reality, was initially based on the Indian traditional spirit of Ashram-the seat of learning, during 1901.Perhaps poet had his own vision and respect for eastern mind-culture and intended to form an ecological creative community which can work together into a common strength of truth, sharing our common heritage in the contemporary world.

From the barren land of Khoai, the final University environment was created through the effortful landscaping and tree plantation matching with the art-architectural elements developing rare cultural vitality of space. Visva-Bharati, Santiniketan were built in various stages through couple of decades fully utilizing the natural surroundings, complimentary to Rabindranath's dream of the eternal involvement of nature in all architectural achievements.

The School – an Ecological Laboratory

The Santiniketan Ashram School (popularly known as forest school-Tapovana)was started by Rabindranath during the latter part of 1901. The foundation work of the ashram, a spiritual retreat, was established by MaharshiDebendranath Tagore, the philosopher-father of Rabindranath during 1862-63. He was responsible for the pioneering work of making the barren spread into green. Santiniketan, the guest house building, Upasana

Figure 1: The Green laboratory of Ecologic-Habitat and its array of shapes and precincts

Temple and the surrounding architecture and open environmental art were designed and built from 1862. The School was fundamentally based on the spirit of the ancient Indian ashram. Rabindranath's dream of an Open University (Visva-Bharati) for the synthesis and unification of a universal learning centre, was conceptualized during 1918. In his lecture of "The Centre of Indian Culture" Tagore had mentioned – '… In an age of great mental vitality, when men were there whose minds overflowed with thoughts and learning, the culture centers of Nalanda and Taxila were naturally formed in India. …'.

Santiniketan reflected the special flavor of building traditions, open air sculpture, murals, fresco, installation- art also revival of Indian and oriental art – architectural heritage to contemporary culture. An attempt was made to incorporate neo-built forms, which are environmentally sound, economical and locally available yet strong and simple in aesthetic expression. Such architectural elements of poetic fusion, complimentary to the environment formed the fabrics of the ashram's life forces. Tagore's personal experience of nature and the building expression inspired the development of designs of built and unbuilt spaces. The art of built form and its sense of proportion and the visual interpretation of dimensions, volumes and space are evident throughout the campus (see Figure 1).

Such unique built environment at Visva-Bharati University (mostly during 1919 through 1950) had been conceived by Rabindranath and his colleagues, mainly the planners like SurendranathKar, Rathindranath Tagore (his designer son); and outstanding artists Nandalal Bose and Sculptor Ram Kinkar, Binodbehari, TejeshchandraSen in a conscious attempt to create harmony in totality.

The Green Movement

Sir Patrick Geddes, one of the close friend of Rabindranath, was the pioneer in Architecture, Town and Country planning. He was associated with EdinburghUniversity, came to Calcutta, in 1915, bringing the unique "Town and City Planning Exhibition".

He later, worked in India for various Town and University planning projects as well as in the initial period of Visva-Bharati Campus planning at Santiniketan.

Tagore was deeply interested in Patrick Geddes' concept of Triad : Place-Work-Folk, as well as in their common concept of development into the theory of leaning, through the generations. Sir Patrick Geddes, as a planner and architect did realize Tagore's vision of learning and the Indian living design - arts. The philosophies of Geddes and Rabindranath, matched and the creative direction started at Santiniketan. During this period, conscious attempt was made to live in tune with nature and the environment, and to shed unnecessary expenses and discard wasteful construction.

To show gratitude towards Santiniketan, Geddes had sent his son (1921-22) Arthur Geddes and then an able young Indian Architect VamanRao to work there. Arthur Geddes, inspired by Rabindranath had made a detailed study and survey of rural Bengal and related field study for water level, water table, soil settlement, weather study, wind movement and habitat study in relation to land, people and environment. Geddes had studied the philosophy of art and architecture in India and had the rare opportunity to understand the inner philosophical and creative strength of India through the two geniuses, Vivekananda and Rabindranath. Arthur Geddes was touched by the learning atmosphere of Santiniketan, and he wrote "The olive grove under which Socrates spoke with Plato, Aristotle and their fellow disciples, was as it were, re-planted at Santiniketan with tall and robust Sal trees and flowering evergreen Amlakai".

The play of forms and the ecology of shapes

There are natural built forms in the Campus whether they are the class-rooms, teachers' quarters, Rabindranath's own houses and even the lesser important built forms like 'Chaitya', the notice and display space, arches on the water walls, open air sitting arcade, wherein the synthesis of three art forms including architecture, sculpture and painting are naturally presented (see Figure 2). Buildings, the surroundings with the landscaping and gardening, in totality, were the creations of Rabindranath's own expression of informal

Figure 2: The 'Chaitya' shape
(the incoming ray-arch of the sentient Sun) in Uttarayan

living style and habitat with the nature. These building experimentations even today show us the direction, in finding out the new functional language with regard to the character and harmony of the built and non-built forms, which are bio - centric inspirations for modern green architecture.

Tagore had built for himself in the initial period at Santiniketan. Three room world of thatched roof cottages "Natun Bari", during 1902, which were in great contrast with the formal dignified mansions of Jorasanko Tagore family, in Calcutta and different parts of Bengal. Tagore had an intense urge for the search of living place, small simple but full of light and space. Santiniketan period of his life was the time when his personal living style started manifesting the influence of nature even more firmly. Even Tagore's creation of Visva-Bharati Campus is a great architectural departure, as compared to 'Santiniketan Building' and it's environment – in the colonial style (the first building at Santiniketan) built by his father between 1862 – 1863. UpasanaMandir – the prayer hall is unique glass architecture – the prefabricated iron - glass structure with colored glass cladding, built in 1891; which were brought from Calcutta in prefab forms and then completed to theme architecture style within one year. We need to remember, Santiniketan Green Architecture was created by Jorasanko Tagore family – the center stage of renaissance. Santiniketan – Sriniketan built environment are one of the best Bengal renaissance-initiative of built environment, when the country suffered from illness of deforestation largely due to construction of Railways, commerce - centric timber exports, ruthlessly ruining Indian forest timbers, with no care of afforestation.

The dance of the 'Sun' – Udichi and 'Udayana'

Tagore's own experience of nature and the building expression, inspired the development of designs, including non-built spaces. Art of built form and the blending with signs of proportion and visual interpretation of dimensions, volumes and spaces is spread throughout the campus by the creation of several centres and the sub-centres. Examples like the sitting arcade 'Mrinmoyee' (The creative work station), are also extended through sub-centres by creating smaller, low height functional concrete sitting encircled and shaded by

Figure 3:Udayana (part of Uttarayana)

the palm trees at Uttarayana. The raised verandahs as sitting and performing arcades at 'Udayana' building and then formed into similar sub-centres at 'Udichi' building and also at 'Shyamali' in the Uttarayana Complex, built during 1919 through 1939.

In Santiniketan, there are interesting examples of simple integration of buildings with nature, painting and open air sculpture. The buildings during Tagore's time, represent the style of Indian content with the sincerity of humanization of land, built spaces and nature. This new kind of harmonization, had been evolved in the neo-traditional architecture and living style, which is fully conversant with climatic conditions, soil character and tree plantation techniques; and reflect his respect for his own 'Sadhana' : the realization of life.

In harmony with nature – contemplation as a way of life

Rabindranath's deep love for the natural living style, using the basics of the body, soul and mind generated the aesthetical parameters of building re-layout. Simple but efficient creation of different buildings reflect the design, full of sense of proportion and purpose, with visual pleasure and assembly of traditional elements of system of forms, mass and volumes, light and shade, alongwith the variety of experimentations of building materials and construction techniques. Last forty years of Rabindranath's creative life and campus development can also be noted for the unique art- architectural, civil engineering, built environmental and landscaping - gardening experimentations with ideal harmonization of buildings with existing skyline and surrounding nature.

Stylized buildings, open-air settings, class areas, performing stages, water well in the surroundings of open air sculptures, murals, paintings and relief sculptures, being the unique synthesis of the three arts : architecture, sculpture and painting. These are presented in a natural style which brings out a new expression of art and aesthetical in total form. Possibly, such natural design activities are reflection of great revival of art as essential part of the Bengal renaissance of modern art-architecture blending to learning centre. This approach of interactive art is now increasingly relevant in the modern world of green - design habitat. Positive functionalist approach is seen in the land use, sizes of rooms and spaces, management of scarce building materials and ecology; experimentations with Mud Architecture, Open-air classrooms, open-air theatre, informal sitting and meeting places (see Figure 3).

Uttarayana – the north bound movement of the sun

'Uttarayana' Complex, the five buildings and the raised sitting arcade 'Mrinmoyee', shows the harmonization of open-ended built forms amongst the dissimilar houses, with the connecting threads of landscape designing and greening.

Single storied, split-leveled 'Konark' building (from 1919 to 1922) was constructed in phases at the extreme northern laterite fields of the ashram. It is noted for its first-of-its-kind split level planning attempt which gives a clear view of the horizon from some predefined area.Its large room placed at a higher plinth level was used as performing stage for Rabindrnath's dance-drama

Figure 4: As the sun turns and re-rises – 'Udichi and 'Punascha'

'NatirPuja' .Natir Puja was based on life and culture of Buddhism which was written by Rabindranath and staged at Uttarayana under the Simul tree (Konarka). Open air sculpture, public architecture, visual art were distributed with art architectural, aesthetical harmony as part of ashram daily living. It may be recalled that at the zone of Kala Bhavana and SangeetBhavana, open air sculptural environmental relation were also created through the sculpture – installation of Sujata moving towards Gautam Buddha, reminding us our own cultural civilization. This was the creation of Ram Kinkar and RudrapaHanj (see Figures 3 and 4).

The twin –SandHI of the Ecologic and the Economic: Creative Economy

Santiniketan and Sriniketan – the twin campus, imparted well balanced educational courses in Science, Art, Visual Art, Music, Literature, Philosophy, Spiritualism, Applied Art and Design, School of languages, Oriental Studies, Environmental Studies, as well as Rural Reconstruction and Agri-Horticultural Studies with local level participation from adjoining villages and ruralscape. This was the poet's vision of Visva-Bharati – the universal learning centre in the nest of natural surroundings.

'Udayana', the east-facing house was built over the years in phases from 1923 to 1938. In the design of 'Udayana', the textural synthesis of Chinese, Balinese, traditional Indian elements, Oriental doorways, and window facades, Buddhist pillars, European construction techniques and Oriental interiors have brought the spirit of creative architectural – cultural unity. The most striking features in the building are the successful management of the

fenestration, ventilation aspects, through the building orientation arrangements. The sitting hall in ground floor, wonderfully designed with oriental interior design-art flavour have bronze sculpture of meditating Buddha, placed at dignified space centroid. The Meeting hall of Udayana, is also multi-functional space of performing art, stylised wood crafted Buddhist interior pillarscapes are the distinct design space feature. Chief designer was Rathindranath Tagore – the creative mind of modern Indian Designs.

KintaraKasahara, the Japanese craftsman and landscape designer had collaborated with outstanding designer Rathindranath in creating the breath-taking Japanese garden with lake and the garden-house 'Chitrabhanu' and Pompa Lake. They had also constructed the Japanese tree house over the Pakur tree for Rabindranath. His lyrical poetry 'Purabi' streamed from this loving 'Poet's Nest'.

"I long to build this mud house beautifully. The vanity of stone and brick will have to be put to shame", Rabindranath, the creative optimist always hoped. On his 75th birthday, his dream(1935) came true in the form of 'Shyamali', a mud architecture which represents the mood of majestic infinity. The experimentation took place in the pattern of building walls and roofs. The building wall have high relief work and murals treated with coal tar, which were created by artist Nandalal Bose and the students of Kala Bhavana. Design inspiration was Ajanta Chaitya. Main door way and the eastern corner were decorated with mud relief work of Santhal couple, excellently rendered by Artist Ramkinkar. Tribal artists from Santiniketan's own Pearsonpally village and adjoining rural folks also had joined in making of Shyamali.

As an annexure block to 'Shyamali', 'Punascha' (1936) was born. Its stepped terrace, with built-in garden and concrete sittings was the place for Rabindranath's early morning meditation and his work. Apart from his writings, many of his paintings too, were created here. This three dimensional living space-form, at the backdrop of green trees, stands out as one of the best examples of creative fusion of purpose, economy and beauty.

'Udichi',(built during 1938-39) the last north-facing house of Rabindranath, is an effectively functional, aesthetically meaningful building, having a distinct identity. The building I surrounded by well-designed

gardens and Mughal-styled rose beds. This duplex type of building planning, in collaboration with nature has enriched the building heritage of the campus.

The raised sitting area and the covered canopy, amidst trees and greenery demonstrates the range of architectural visions 'Mrinmoyee' (1936) its body soul and mind. There are such elegant sitting-corners, where poet used to write and meet people are the refreshing structural-architectural oasis, proportioned into garden landscape.

Indian traditional knowledge of human space habitation, in relation with the cosmic forces (man, land, water, air, sun, rain, flora and fauna) and the organic architecture, was known to us for several centuries, but such experience started declining . This campus re-established variety of such examples of habitation and experimentation based on the philosophy of culture of co-existence. The Indian art-architectural ethos were integral part of the living style in Santiniketan. This creative fusion had the latent strength of future in the sighting of oriental culture for universal language with respect to land, people and environment.

Design opportunity associated with pedestrian access, mixed use communities, diversified housing, community hygiene, safety and intangibles of the "Sense of Place" were experimented and presented for overall facets of community life. Several aspects of campus building and landscape planning, including environmental, conservation and aesthetic considerations, were integrated with the campus set-up.

Santiniketan and Sriniketan were according to Rabindranath, the ideal combination – life and living. They incorporated the facilities, potentials and strength of problem solving directions as regard aspects of human habitation with dignity in life. Active architectural space with the need for aesthetics, also transformed the utilitarian built form into a work of applied art in architecture, very similar to our own cultural civilization in continuity.

Spontaneous encouragement for the development of creative learning centres to protect and better the environment evolved permanent identity in the campus. During the golden era of Santiniketan, the harmony between the art and architectural movement can be earmarked as the milestone of the then modern Indian Environmental Architecture. The kind of neo-traditional

architecture and living style took into account of climatic conditions, local soil character, public health and tree plantation techniques; SinghaSadana, PathaBhavana, Hostel Buildings, Hindi Bhavana, China Bhavana, Kala Bhavana Studio and the surroundings with a variety of sculptures, murals and frescos are examples of such elements of expressive joy and ecological cultures. These green living design examples will be the futuristic creative force of neo-order of architecture of humanity.

Renewal of free expression at the campus also led to the creative expression of visual arts which provided the stimulus to the surrounding architecture.(Living education with mother nature). Similar building examples with balance of structures and nature are interwoven throughout the campus. The finest examples of earth architecture at the campus are mud built Buddhist styled structure 'Chaitya', (1934) hostel building of Kala Bhavana as 'Kalo Bari'(1936) . 'TalodhajKutir' (1925) which encourages the ever-lasting relationships with the land, people and environment. Indian traditional design ethos so also tribal and folk architecture were the design inspiration of living style and eco-habitat of Santiniketan. Such ecological, built environmental culture, once created with poetic vision of scientific, spiritual, and humanistic unity, will be the symbol of futuristic green- inspiration. The ancient Indian tradition of live-in university of Nalanda, and Taxila-were almost revived in defined scale with contemporary context in Visva-Bharati, with unique creativity as cultural continuity.

Reverting crisis and a return to the heart of Civilization

In his last public message(1941), addressed from the Buddhist architectural design space pedestal – Udayana , the "Crisis of Civilization", Rabindranath, once again had expressed his hope for the revival and continuity of the human heritage. "A day will come when the unvanquished man will retrace his path of conquest, despite all barriers, to win back his lost human heritage".

Om!
Where the mind is led forward by thee
Into ever-widening thought and action
Into that heaven of freedom, my Father, let my country
awake.
Om!

Prospects of Business Tourism with respect to Heritage Potentials

Kunal Sen
Executive Director, Peerless Hotels, Ltd., Kolkata

Integral tourism

Tourism is a social, cultural and economic phenomenon which entails the movement of people to countries or places outside their usual environment for personal or business/professional purposes. Tourism has emerged from the movement of people to and stay in various destinations. In short Tourism means the business of providing information, transportation, accommodation and other services to travellers. Tourism could be classified into several distinct categories & this would include Holiday Travel, Visiting Friends and Relatives, Business Travel, Health Treatment, Shopping, Conference, Incentive Travel, Official Mission, Education, Sport & Other Travels. Tourism marketing is an integrated effort to satisfy tourists by making available to them the best possible services. It is a device to transform the potential tourists into actual tourists and in the safest way to generate demand and expand market.

Introduction

Visiting Historical & Archaeological sites is a popular tourist activity in the world. Historical Sites are attractive destinations for visits in almost every country. For this reason the importance of Historical Tourism is increasing day to day. Historical Tourism can be defined as "visiting Historical & Archeological Sites for the purpose of acquiring knowledge or entertainment". Many developed and developing countries have successfully used marketing concepts and tools to attract Historical Tourists in their countries.

Tourism is a social, cultural and economic phenomenon which entails the movement of people to countries or places outside their usual environment for personal or business/professional purposes. Tourism has emerged from the movement of people to and stay in various destinations. In short Tourism means the business of providing information, transportation, accommodation and other services to travellers. Tourism could be classified into several distinct categories & this would include Holiday Travel, Visiting Friends and Relatives, Business Travel, Health Treatment, Shopping, Conference, Incentive Travel, Official Mission, Education, Sport & Other Travels. Tourism marketing is an integrated effort to satisfy tourists by making available to them the best possible services. It is a device to transform the potential tourists into actual tourists and in the safest way to generate demand and expand market.

Heritage places are those which help understanding of the past, enrich the present and which will be of value to the future generations. For the place of archeological and architectural values, it is the people and the activities that form the cultural heritage. Heritage tourism is defined by the National Trust for Historic Preservation (NTHP) as "travelling to experience the places, artifacts and activities that authentically represent the stories and people of the past and present. It includes cultural, historic & natural resources." Heritage tourism uses assets like historic, cultural & natural resources that already exists. Rather than creating and building attractions, destinations, look to the past for a sustainable future. Indeed these assets need preservation and often restoration or interpretation but the foundation for creating a dynamic travel experience lives on the stories and structures of the past. Heritage / Cultural tourism has also been defined by Economic Planning Group of Canada as "visits by persons from outside the host community

motivated wholly or in part by interest in the historical, artistic & scientific or lifestyle / heritage offerings of the community, region, group or institution."

Heritage tourism is a highly competitive and market oriented business and many heritage sites around the world place greatly emphasizes on attracting and maintaining a viable market share. The importance of marketing heritage tourism is attached to understanding the nature of demand for heritage so that product development and promotional strategies may be devised in accordance with the needs and expectations of visitors.

To draw a SWOT Analysis of Heritage Tourism Sites, it would be as follows:

1) Strengths
a) Unique history & culture.
b) Significant architectural historical & religious tourism products
c) Cheap labor
d) Presence of International & Domestic Airport connectivity

2) Weaknesses
a) Heritage tourism marketing is at times not fully utilized
b) There could be lack of adequate political support
c) There could be lack of sufficient funding
d) There could be lack of tourism marketing skills and experts
e) Lack of investment in tourism marketing
f) Lack of information & academic work about heritage tourism industry
g) Lack of safety, security & hygiene in heritage sites
h) Lack of infrastructural development

3) Opportunities
a) Provides International recognition of the heritage sites
b) Emerging increase of Foreign Tourists in heritage tourism.
c) Unlocking economic potential of heritage tourism
d) Diversification of tourism product portfolio

4) Threats
a) Fears competition in Heritage tourism industry specially with neighboring countries
b) Lack of synergy among stakeholders.
c) Lack of conservation effort of heritage sites.

d) Political instability in the country
e) Image crisis of the country
f) At times improper implementation of tourism policy
g) Lack of awareness among stakeholders about the potential of heritage tourism

Having discussed about Strength, Weakness, Opportunities & Threats every Country possessing heritage assets are concentrating for generating new source of revenue and to restore cultural legacy. Cultural tourism accounts for 37% of Global Tourism and forecast that it would grow @ 15% per year. Port Louis again has conserved many historic and colonial buildings through the years. One of them is a fortification named Fort Adelaide or La Citadelle built by the British in 1835. For there one can observe most of the cities architecture.

Heritage/Cultural Tourism in European countries

1) In Scotland, heritage is marketed as an integrated part of tourism development rather than as a separate tourism product and is used to promote stakeholder collaboration and sustainable growth. In Scotland heritage, culture, history, traditions, myths & symbols feature in the majority of promotional publications and strategies.

2) Culture tourism in Europe is a big time business. The cultural heritage of Europe is one of the oldest and most important generators of tourism and it retains its central role in the European Tourism Industry to this day. During the last decades, city tourism and specially city based culture tourism have become of increasing importance for National and City Tourism Organizations and Cultural Institutions in Europe.

3) In Mauritius recent cultural heritage development is fostered to be one of the tourism marketing strategies of the policy makers since two cultural heritage sites have been inscribed in United Nations Educational Scientific & Cultural Organisation (UNESCO's) World Heritage list.

Heritage/Cultural Tourism in India

The Tourism of India is economically important and is growing rapidly. The World Travel & Tourism Council calculated that Tourism generated Rs.6.4 trillion or 6.6% of the nations GDP in 2012. It supported 30.5 million jobs.

Mahabodhi Temple – an UNESCO Heritage Site

Taj Mahal – an UNESCO Heritage Site

Fatehpur Sikri – an UNESCO Heritage Site

The same sector is predicted to grow at an average annual rate of 7.9% from 2013 to 2023. India possesses plethora of Historic Monuments, Nature Tourism (Wild Life, Hill Stations, Lakes, Beaches, Adventure Tourism) & World Heritage Sites. There are 32 World Heritage Sites in India that are recognized by UNESCO as of 2014. These are place of importance of Cultural or Heritage. It can be interesting to note that India's first two sites inscribed on the last at the Seventh Session of the World Heritage held in 1983 were the Agra Fort and the Ajanta Caves. Over the years, 30 more sites have been inscribed the latest being the Great Himalayan National Park in 2014. Of the 32 sites 25 are cultural sites and other 7 sites are natural sites. India's rich history and its cultural and geographical diversity makes its International Tourism appeal large and diverse and presents Historical and Cultural Tourism along with business, medical and sports tourism.

Heritage/Cultural Tourism in West Bengal

Kolkata the capital of West Bengal has been nicknamed as the Cultural Capital of India, City of Palaces, City of Joy etc. This comes from the numerous palatial mansions built all over the city. The layout of much of the Architectural variety in Kolkata owes its origin to European styles and tastes imported by the British as it was the capital of British India from 1772 – 1911 and to a much lesser extent the Portuguese and French. Historical Sites in West Bengal are of 2 kinds. One category includes the built heritage like the Architectural Splendors of Kolkata, the Nawabi Complex in Murshidabad, the Temple Complex in Bishnupur, the Sultani Heritage of Medieval Bengal in Malda (Gaur, Pandua etc), etc. The other category includes palaces and natural beauty like North Bengal & Purulia (Chhau Dance), the Sunderbans, Shantiniketan (Tagoriana) etc. Murshidabad which not only provides a rich ray of Historical Sites but also has the added advantage of being currently promoted proactively by the Murshidabad Historical Development Society which has important business links in Kolkata. The key Historical Theme that may be promoted here is 'Bengal before Europe'. Murshidabad/Berhampur may also be used as a base for offering conducted tours to Malda/Gaur/Pandua & Shantiniketan. The other option may be around Kalimpong or somewhere around Dooars themed on 'Tea' or 'Summer Capital of the Raj' or a combination of the two.

Darjeeling Himalayan Railway – an UNESCO Heritage site

Royal Bengal Tiger at Sunderbans National Park – an UNESCO Heritage Site

Resorts themed on 'Raj Nostalgia' and offering High Quality Food & Beverage like British style afternoon tea & curated tours of tea garden, verdant hills and Raj different architecture should be a very popular destination for various segments of the market.

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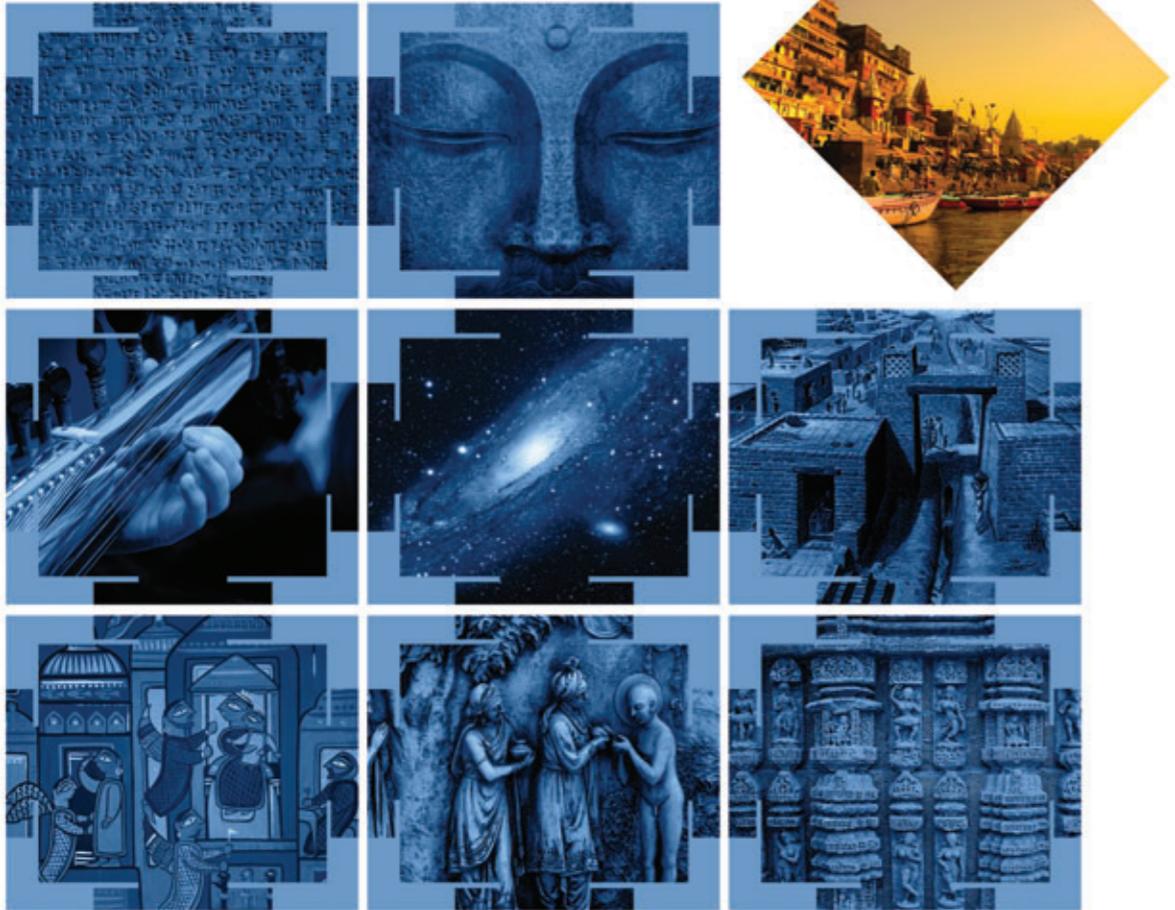
About the Authors

Partha Pratim Chakrabarti is an Indian computer scientist. He is currently (2013 onwards) the director of IIT Kharagpur. He completed his B.Tech in 1985 and PhD in 1988 from the Dept of Computer Science & Engg, Indian Institute of Technology Kharagpur. He joined the same department as a faculty member in 1988 and is currently a Professor. Partha was the Professor-in-Charge of the state of the art VLSI Design Laboratory which he helped set up and has been the Dean of Sponsored Research and Industrial Consultancy at IIT Kharagpur and Head of the Advanced Technology Development Centre. He was also the co-Director of the strategic General Motors-IIT Kharagpur Collaborative Research Laboratory on Electronics, Controls and Software.

He pioneered the development of the Incubation Programme at IIT Kharagpur. His areas of interest include Artificial Intelligence (AI), Formal Methods, CAD for VLSI & Embedded Systems, Fault Tolerance and Algorithm Design. Dr Chakrabarti received the President of India Gold Medal (1985), the INSA Young Scientist Award (1991), Anil K Bose Award (1995), INAE Young Engineer's Award (1997) and the Swarnajayanti Fellowship (1997–98), Shanti Swarup Bhatnagar Prize (2000), INAE Visweswarya Chair Professorship (2007-9), J. C. Bose National Fellowship (2013) and many other awards. He has been elected a Fellow of the Indian National Science Academy, New Delhi and the Indian Academy of Science, Bangalore, Indian National Academy of Engineering and the West Bengal Academy of Science & Technology.

Partha is currently the Principal Advisor to SANDHI: A Science and Heritage initiative (2014 – 17), sponsored by the Ministry of Human Resources Development, Government of India at IIT Kharagpur.

Amita Sharma, former Secretary in the Government of India, has been appointed Senior Consultant in Educational Consultants India Limited (EDCIL) under the Ministry of HRD. She is retired 1981 batch IAS officer of Madhya Pradesh cadre. She is a living continuity and the daughter of Late Professor Govind Chandra Pande who was a well-known Indian historian of the Vedic and the Buddhist periods; and was once professor of ancient history and vice-chancellor at Jaipur and Allahabad universities. For details kindly refer: http://en.wikipedia.org/wiki/Govind_Chandra_Pande

She was instrumental in formulating the Madhya Pradesh Education Guarantee Scheme, (MPEGS) a rights -based scheme for universalizing basic education that won the Common Wealth Gold Award for best Global Innovation in Public Service in 1998. Her work on literacy in the state won the President of India's Award for female literacy, 2001. She was awarded the India Today award for 'Woman in Public Affairs, 2010' for implementing the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), a Rights based National Law for guaranteeing employment in rural areas. Her use of ICT for creating public accountability and transparency for MGNREGA won the best web-site award by the Government of India in 2010.

Amita Sharma has been the key driving force behind the 'SandHI' movement across IIT-SPA system of connections and convergences and her heart-felt thoughts are additionally accessible at:

http://www.newindianexpress.com/columns/Designing-Integrated-Knowledge-Systems/2014/03/04/article2088788.ece

Koumudi Patil is Assistant Professor in the Department of Humanities and Social sciences in Indian Institute of Technology Kanpur. Koumudi has completed a brilliant work (PhD dissertation) on 'Surviving modernism- 'Investigating modernity in local craft narratives' with Prof U. A. Athavankar of IDC, IIT Bombay. She is a versatile academic background of having a MFA, from Tagore's Vishwabharati University, Shantiniketan, 2004; and a BFA, Sir J.J. School of Fine Arts, 2002. The two important research interests embedded in her works are:

- Communication Design
- Creative Visualization

Her Specialization is in Craft Thinking, Installation Art and her key Research Interest is also in Craft Thinking, Design for Frugal Innovation, Communication Design, Video Installations, and Art History.

She has been involved with several public art projects and group shows. Her support and guidance for the aesthetic led us to achieve an eye pleasing and user friendly design. She is a mentor-participator in several innovation organizations like Innosium Technologies and now she plays a lead role in steering the SandHI movement in IIT Kanpur.

Pallab Dasgupta is Associate Dean, Sponsored Research and Consultancy Cell (SRIC), IIT Kharagpur; Professor, Dept. of Computer Science & Engineering, IIT Kharagpur and Professor-In-Charge, Synopsys CAD Lab. Pallab's current research focus is on automated formal and semi-formal techniques for verification, mainly targetted towards design verification in VLSI CAD; as he works with several companies on related areas. Pallab's other interests include combinatorial optimization, logic, deduction and distributed algorithms. Pallabhas been awarded till date, to name a few only are:

- IBM Faculty Award (2007).
- Indian National Academy of Engineering (INAE) Young Engineer Medal (2002).
- Indian National Science Academy (INSA) Young Scientist Medal (1999).
- Associateship of the Indian Academy of Sciences (1998).

Pallab has been playing an Indian stringed instrument called 'sitar' for several years now and he is currently the Principal Investigator of SandHI 'Music' project 1.

Priyadarshi Patnaikis Professor-in-charge, SandHI, Documentation, Dissemination and Communication-Outreach, IIT Kharagpur ; Professor, Department of Humanities and Social Sciences, IIT Kharagpur; and Principal Investigator of SandHI (Music) project2.

Priyadasrhi is Secretary, Nehru Museum of Science & Technology, IIT Kharagpur and Professor-Rectors' Nominee (Cultural), Technology Students Gymkhana, IIT Kharagpur. His key interests are Indian aesthetics; Visual Culture and Communication; Cultural Translation theory and practice; Media and Multimedia Studies; and Emotions and nonverbal communication. Priyadarshi edits several e-Journals and has authored several books of national and international repute, of which to mention the two latest are:

1. Communication Skills in English by Sanghita Sen, Alankrita Mahindra and Priyadarshi Patnaik (Cambridge University Press, India, 2013)
2. Communication and Language Skills by Sanghita Sen, Alankrita Mahendra and Priyadarshi Patnaik (Cambridge University Press, India, 2014)

Michel Danino is currently Guest professor, IIT Gandhinagar but his experience and wisdom surmounts normal precedence. Michel is an Indian author, originally from France. He participated in the translation and publication of the works of Sri Aurobindo and of The Mother. Danino also edited India's Rebirth and India the Mother (a selection from the Mother's works about India). In 2001, he convened the International Forum for India's Heritage (IFIH) with the mission of promoting the essential values of India's heritage in every field of life. One of the greatest contribution to Indic studies based on deep scientific evidences are his books like The Lost River: On The Trail of the Sarasvati, published in 2010. His other books continue to inspire a whole new generation of scholars of which some are:

- Sri Aurobindo and Indian Civilization (1999)
- The Invasion that Never Was (2000)
- The Indian Mind Then and Now (2000)
- Indian Culture and India's Future (DK Printworld, 2011)

In the book entitled 'The Invasion that Never Was' (2000), he criticized the "Aryan invasion theory" and its proponents, instead opting for the notion of "Indigenous Aryans". Danino asserts that Aryans are indigenous to India. Danino is now a guest professor at IIT Gandhinagar, where he is assisting the setting up of an Archaeological Sciences Centre. Most important of all, his works continue to inspire the SandHI movement and its scholars-researchers.

Michel is a long-time student of Indian protohistory and the author of The Lost River: On the Trail of the Sarasvati (Penguin Books India, 2010); he is currently guest professor at IIT Gandhinagar, where he is assisting the setting up of an Archaeological Sciences Centre.

Amitabha Ghosh, born on 3rd December 1941, received his Bachelor of Engineering and Master of Engineering degrees from Bengal Engineering College, Shibpur, (Calcutta University) in 1962 and 1964, respectively. He joined the Mechanical Engineering Department of this college as a Lecturer in 1965 May and continued his doctoral research receiving the Doctor of Philosophy degree from Calcutta University in 1969. He joined IIT Kanpur in January 1971 as an Assistant Professor of Mechanical Engineering and became Professor in 1975 June. From 1977 to 1978 he was at the Technical University Aachen with Alexander von Humboldt Foundation fellowship. From 1997 to 2002 he served IIT Kharagpur as the Director and subsequently returned to Kanpur where he continued till 2006 till his retirement. From 2006 to 2011 he served as a Senior Scientist of the Indian National Science Academy New Delhi and as Honorary Distinguished Professor of IIT Kanpur and Bengal Engineering & Science University Shibpur. Currently he is a Platinum Jubilee Senior Scientist of the National Academy Of Sciences India and an Honorary Distinguished Professor of Bengal Engineering & Science University Shibpur. At IIT Kanpur he guided a large number of Masters' and PhD students. He, along with his students was the first to discover the phenomenon of chaos in mechanical systems and conducted the first experiments on mechanical chaos in 1978. He proposed a new theory of inertial induction leading to a number of profound cosmological and astrophysical consequences. Besides developing some new manufacturing processes utilizing the electrochemical discharge phenomenon and some new stationary and mobile robotic systems for the DAE, Ghosh also developed an innovative regenerative brake mechanism and stable drive system for cycle rickshaws. He also invented a number of new drive systems and mechanisms. He has published over 120 research papers and written five books; the text books

by him have made a lasting impression on the way the subjects are taught in India and abroad. Prof. Ghosh has been conferred with Doctor of Science (Honoris Causa) by Bengal Engineering and Science University, Shibpur. He is a Fellow of the Institution of Engineers (India), Indian National Academy of Engineering New Delhi, Indian Academy of Sciences Bangalore, Indian National Science Academy New Delhi and the National Academy of Sciences India Allahabad.

Sudipto Das is the author of the novel *The Ekkos Clan*, released in July 2013 by Niyogi Books and the coffee table book Myths & Truths behind the Ekkos Clan, released in April 2014. Within a fortnight of its release The Ekkos Clan came to 3rd position in the best seller list in Flipkart in the Literature and Fiction section. Sudipto, an alumnus of IIT Kharagpur and a musician too, is currently the VP Engineering of Mirafra Technologies. He is also a secretary at the Sarathi Socio Cultural Trustfor many years, looking after their cultural initiatives in Bangalore.

The Ekkos Clan is a contemporary mystery novel set against the backdrop of ancient Indian history; dealing extensively with linguistic palaeontology, Astronomy, Archaeology, History, Music and Poetry. It has demystified Rig Veda to a great extent, delving deep into the behind the scene stories of Rig Veda, the oldest book of the mankind. For details please see: http://en.wikipedia.org/wiki/The_Ekkos_Clan

Sudipto is an external expert, and a well-wisher to the SandHI project of IIT Kharagpur, mainly the 2 Language projects.
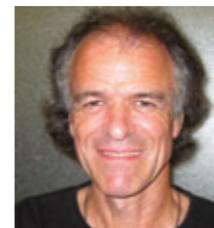
Ian Whicher is Head of the Department of Religion and Cultural Studies, University of Manitoba, Canada. In his recent works on 'Yoga and Freedom: A Reconsideration of Patanjali's Classical Yoga', Ian Whicher has sought to counter a dualistic and isolationist interpretation of Yoga he believes is presented by many scholars. His recent pioneering works or Books are:

The Integrity of the Yoga Darsana: A Reconsideration of Classical Yoga (SUNY Series in Religious Studies, 1998)

- Patanjali's metaphysical schematic: Purusa and prakrti in the Yogasutra (Adyar Library pamphleft series, 2001)
- Cognitive Samadhi in the Yoga-sutra-s (Adyar Library pamphlet series, 1997) .

His key interests are: Religious and Philosophical Thought of India, Hinduism, the Yoga Tradition Interests: Approaches to Spiritual Liberation in India. He had been the Deputy-Director of the Dharam Hinduja Institute of Indic Research at the University of Cambridge. An important book by him is 'The Integrity of The Yoga Darsana,' where the philosophy of Sri Aurobindo and movements from great Institutes like the Esalen in Big Sur, California (formed by Arnold Toynbee, Alan Watts and Abraham Malsow and others) secures a major convergence. Ian wishes to start an Ecologic-Spiritual laboratory based on the foundations of Sage-mind (Rishi pragna) and looks forward to collaborate with SandHI.

Subhash Kak is an Indian American computer scientist and Alumnus, IIT Delhi. He is Regents Professor and a previous Head of Computer Science Department at Oklahoma State University in Stillwater who has made contributions to cryptography, neural networks, and quantum information. He is also notable for his Indic publications onhistory, the philosophy of science, ancient astronomy, and the history of mathematics. Subhashkak has made pioneering contributions to Indic studies by writing a rich array of non-fictional books namely:

- The Nature of Physical Reality, Peter Lang Pub Inc, 1986
- Patanjali and Cognitive Science (1987) Second edition, OSU
- India at Century's End, South Asia Books / Voice of India, (1994)
- Georg Feuerstein, Subhash Kak, David Frawley (winner of Padmabhusan 2015) In Search of the Cradle of Civilization, III: Quest Books, (1995, 2001)
- The Astronomical Code of the Rigveda; Munshiram Manoharlal Publishers Pvt. Ltd (2000), Third edition, OSU
- Computing Science in Ancient India; MunshiramManoharlal Publishers Pvt. Ltd (2001)
- The Wishing Tree: The Presence and Promise of India, MunshiramManoharlal Publishers Pvt. Ltd (2001)
- The Gods Within: Mind, Consciousness and the Vedic Tradition, Munshiram Manoharlal Publishers Pvt. Ltd (2002)
- The Asvamedha: The Rite and Its Logic, Motilal Banarsidass Publishers, (2002)
- "The Prajna Sutra: Aphorisms of Intuition", 2003; DK Printworld, 2007.
- The Architecture of Knowledge: Quantum Mechanics, Neuroscience, Computers and Consciousness, Manohar Pubns, 2004
- "Recursionism and Reality: Representing and Understanding the World", 2005.
- Consciousness and the universe: quantum physics, evolution, brain & mind, Cosmology Science Publishers, 2011. (with Roger Penrose and Stuart Hameroff)

K. Ramasubramanian is Professor in the Department of Humanities and Social Sciences, IIT Powai. K. Ramasubramanian, son of R. Krishnamurthy Sastri, former Principal of Sanskrit College, Chennai (who was honoured with the President's award last year) was in the city recently on the occasion of the 900th birth anniversary celebration of the great Indian mathematician of 12th century, Bhaskaracharya. Currently employed in IIT, Mumbai, Prof. Ramasubramanian, a Masters in Physics, delivered a lecture on the 'Lila of Leelavati'. Ramasubramanian clarified that he is part of the Cell for Indian Science and Technology in Sanskrit and has been helping to bring the science-related materials to the fore.His job was not only teaching, but also included research and publication work, besides SandHI.

He spends a large portion of his earnings for the poor in and around his campus. He is frugal in his eating habits. He spends more time in his office than at home. He goes on global tours for lectures. Kanchi Paramacharya once said that he was on the fast lane to GnanaMarga.He is also a member of the Europe-based International Union of History and Philosophy of Science, which holds conferences every four years, attended by thousands of scholars and researchers from all over the world.He currently holds the council membership of Indian National Science Academy. He was awarded the Maharshi Badrayan Vyas Samman for scholars below 40, in 2008. K. Ramasubramanian, popularly known as 'Ramji' in the SandHI movement, is the lead inspiring figure behind the idea of recovering the depths of Indian scientific epistemology.

Sambit Datta is Professor of Architecture, School of Built Environment, Curtin University, Australia.

Sambit's career has centred on enhancing the design quality of the built environment at the intersection of architecture, urbanism, engineering and construction. Sambit Datta's research focus is on investigating the role of geometry in design, particularly new computational representations, and their consequent impact on architecture and urbanism in traditional and contemporary architecture in South and South east Asia. At Curtin, he currently lead saresearch group in advanced computational technologies and digital architecture, Codelab, at the Hub for Immersive Visualisation and eResearch (HIVE), a new facility for interdisciplinary research.

Arecipient of the Michael Ventris Memorial Award fromthe Institute of Classical Studies, Cambridge, he was A Michael Ventris Memorial Scholar at the Architectural Association, London. He has acted as a researcher, consultant and adviser to national and international research, government and Professional organisations, including Wood head International, Multiplicity, Williams Boag Architects, Buro Architecture, Surfcoast Shire, Wyndham City Council, Indian National Trust for Architectural and Cultural Heritage (INTACH), HMR Environmental Consultants, Aedas Singapore, Cape Oman, BBA, New Delhiand UVO Architecture, London.

Rajeev Sangal is presently Director, IIT (BHU), Varanasi and also Vice Chancellor, BHU is a key figure behind Project Varanasi. Rajeev Sangal has been working on processing of human languages in Computational Paninian Grammar (CPG) framework, particularly applied to Indian languages. His team is building machine translation systems among Indian languages and from English to Indian languages. He also works on knowledge representation, information extraction, search engines; and thereby authored 3 books, and a number of research papers in NLP and AI. He had been fortunate to be able to play a major role in shaping a new research university, namely IIIT Hyderabad. He fore-runs a human values course a regular part of the academic curriculum at IIIT-H, where it is playing a major role in shaping the atmosphere, and relating to larger human and societal concerns. He is the Fellow, Indian National Academy of Engineers (Awarded Oct. 2009) and Fellow, Computer Society of India (Awarded Dec. 2012).

Rana P. B. Singh is Professor, Cultural Geography and Heritage Studies, and Head, Dept. of Geography, Banaras Hindu University, Varanasi. His key areas of specialization are: (i) Modern Geographical Thought & scientific vision; (ii) Cultural Landscape studies: India, Japan, Italy, Sweden, Korea; (iii) Cultural Astronomy and Heritage scapes; (iv) Sacred Geometry; (v) Pilgrimage Studies; (vi) Indian culture, and Banaras as Mesocosm and Cultural Whole. He was F.J.F., Japan Foundation Scientist Fellow, Okayama National University, Okayama, Japan 1980; Visiting Professor, Geography & Environmental Systems, Virginia Tech (PI & SU), USA 1981. Linnaus-Palme Visiting Professor, Karlstad University, Sweden: May 2002 and May-June 2005; Indo-Japanese Exchange Professor at Gifu Women's University, Gifu, Japan, December 2004; F.A.A.I., Academic Fellow: Accademia Ambrosiana (Milano, Italy), since January 2009; presented in a ceremonial seminar on 31 October 2009; Indo-Japanese Exchange Professor at Toyo University, Tokyo, Japan, December 2010;(x) Executive Member, A.A. Istituzione del Comitato Scientifico (Milano, Italy), 2010-12, II-term 2013-2015; Vice-President ACLA- Asian Cultural Landscape Association, SNU Seoul, Korea,

2012-2016; and elected as F.A.C.L.A. in October 2013. He has been Member, IGU Steering Committee for the 'UNO Year of Global Understanding', 2012-2014; and Member: IGU Commission on Cultural Approach in Geography, 2012-2016. He has authored more than 20 books of which, "Varanasi, the Heritage City of India: Growth of urban fabrics, visions and strategies for future development. Asian Profile, Asia's International Journal (ARS, Burnaby, Canada" is a seminal one.

Vijai N. Giri is Professor and Head in the Department of Humanities & Social Sciences, IIT Kharagpur. He has been teaching subjects related to Communication Studies. He has received many awards including DAAD-Fellowship, Germany. He has published a book, number of book chapters, and more than forty research papers in referred journals. He has supervised eight students for Ph.D. degree. He was on the editorial board of 'Communication Theory" published by International Communication Association, USA and member editorial board "Encyclopaedia of Communication Theory" published by Sage, USA. His current research interests include organizational, interpersonal and intercultural communication, communication styles, and conflict management. He is the PI and one of key forces behind PROJECT Varanasi, a major mega-exploratory dimension of SandHI, IIT Kharagpur.

Arunendu Banerjee is Practicing Consulting Engineer, Environmental – Designer specialized in Ecologic Architecture, Built Environment and Heritage conservation work. He writes on Environment, Built Heritage, Art and Culture and also on Rabindranath Tagore, Swami Vivekananda, Abanindranath , Patrick Geddes and Rachel Carson. Associated Engineering Advisor – Consultant to Rabindra Bharati University, Indian Statistical Institute, Visva-Bharati , Eastern Zonal Cultural Centre (Ministry of Culture, Govt. of India), The Asiatic Society, Oil India Ltd, Indian Oil Corporation, Numaligarh Refinery Ltd., (BPCL), Indian Museum, West Bengal Heritage Commission, West Bengal Tourism Development Corporation Ltd., Peerless Hotels , Department of Environment, Govt. of West Bengal and many other reputed institutes and industries in the country. Earlier, was the General Manager, Nagarjuna Coated Tubes Ltd. – Indo – US Joint venture company, IFC Washington in the board. Created large space frame structure for Salt lake stadium, Kolkata, JN Indoor stadium Orissa , Sonar Taree Housing Complex, Santiniketan, for Bengal Peerless Housing Devolopement Ltd., VIP Guest House (Rathindra Athiti Griha), Visva-Bharati, Santiniketan etc.

Arunendu Banerjee has worked with the tribal society in the Santhal villages within Visva-Bharati, for local level participatory environmental reconstruction, creativity and development work, also supported by Department of Environment, Govt. of West Bengal; West Bengal Pollution Control Board. Design-created Art and Craft Village with the participation of folk and tribal artists of Santiniketan – Sriniketan for Srijani - Shilpagram, and Bharatiyam Cultural Centre, EZCC, Ministry of Culture, Govt. of India.

He has delivered academic lectures (with paper publications) in various Universities and Institutes like Calcutta University, Visva - Bharati University, Jadavpur University , IIT Kharagpur, Asiatic Society, Rabindra Bharati University and various National and International centres of learning. He

- Member, Board of Studies , Shilpa Sadana , Visva Bharati University
- Visiting Expert, Indian Institute of Technology, Kharagpur

- Member, Advisory Council, Ranbir and Chitra Gupta School of Infrastructure Design and Management, Indian Institute of Technology, Kharagpur

A great number of his books and articles have been published at National and International levels on Environment, Built Heritage, Culture and Tagore Studies in Bengali, English and translated into French language. His Paintings and Design work have been shown in important exhibition centers in India and abroad.

Kunal Sen is an Executive Director of Peerless Hotels Ltd., Wholly owned Subsidiary of The Peerless General Finance & Investment Company Limited, one of the oldest & most distinguished Business Houses in India being in continuous business for over 80 years. His immediate previous assignment was as the CFO & Member of the Executive Committee of a Software Company RS Software where he was associated with for nearly 15 years. Mr. Sen has over 32 years of work experience. He started his career with Chartered Accounting Firm M/s. Lodha & Co. and thereafter as Management Consultant in B.M. Chatrath& Co., and worked in industries such as Kanoria Chemicals, Arm Group Enterprises, Pashupati Seohung, thereafter RS Software and then Peerless Hotels. In recognition of outstanding professional achievements and expertise in his field of work KunalSen has received three Awards in form of citation & plaque from affiliated bodies of the Central Government.

Kunal Sen born & brought up in Kolkata, completed his education from St. Xavier's School & College and thereafter he acquired professional degrees and became Chartered Accountant, Company Secretary, Law Graduate & MBA from the Kings College, Cambridge University, UK. Kunal Sen has travelled extensively across the globe. He likes to spend his leisure hours playing Tennis, Golf, Swimming, reading Books & socialising. Mr. Sen has represented his College & Clubs in Tennis Tournaments. He is a Member of Bengal Club since 1991 & currently in the Executive Sub-Committee, a Member of Tollygunge Club since 1993. He is in the Committee of the Institute of Company Secretaries of India, Eastern Region. He is also in the Committee of Indian Chamber of Commerce (ICC) & BNCCI. He is also associated with other Bodies & Social Organisation and currently, Member, Advisory Council, Ranbir and Chitra Gupta School of Infrastructure Design and Management, Indian Institute of Technology, Kharagpur.

Forthcoming Issue:
Focus on 5 branches, SandHI Episteme, IIT Kharagpur

Bhasa (Language): to develop a scientific rationale of Indo-European Language Systems based on:
1. Evidences surface (temporal and personified) and deep (universal) structures
2. Morphological evolution through Tantricvarnamala

In charge: Pawan Goel; Sudeshna Sarkar; V. N. Giri; Joy Sen; Arun Chakraborty; Anirban Dasgupta

Sangeet (Music): Decoding and exploring ancient classification of Indian music through a) Machine learning and b) Audience response (ITA)
1. To explore and apply techniques from music information retrieval (MIR) and machine learning
2. To explore through "audience response" the various dimensions of Hindustani classical music

In charge: Pallab Dasgupta; Priyadarshi Patnaik; Damodar Suar; K. S. Rao; Sourangshu Bhattacharya

Itihas (Mythology and 4 Geo-Quest projects) - Varanasi; Chandraketugarh; Lalitagiri; and Coastal Odisha
In charge: Abhijit Mukherjee; Arindam Basu; Probal Sengupta; Willam K Mohanty; V. N. Giri; Joy Sen; N. C. Nayak; Priyadarshi Patnaik; Bhargab Maitra

Dana (Generosity) and *Moksha* (End-of-Life care) Community planning / Innovation and CSR based projects
In charge: Narayan C. Nayak; Suhita Chopra Chatterjee; Jitendra Mahakud; C. S. Mishra; A. K. Pradhan; Haimanti Banerjee; Priyadarshi Patnaik; Joy Sen

Dhyana (Meditation) project analyzing effect of meditation techniques on quality of life and well being, resilience, adjustment to the environment, social cognition, and contemporary social engineering features
In charge: Aurobindo Routray; Rajlakshmi Guha; Priyadarshi Patnaik

End Note for Contributors

Where can you contribute ?

SandHI Journal will assimilate an inspiring and sparkling coverage of papers highlighting the spirit of India's science and technology and its relationship with Indian heritage against that of the ancient and contemporary world. Authors are requested to focus mainly in the areas of:

- General history of Indian scientific researches down the ages – ancient, medieval and modern structured on a 'Timeline' best commensurate with the heritage of the country
- Specific history, facts and figures of a particular area of Indian scientific research and its application to technology – for instance, from ancient Indian mathematics to modern computation logic; from ancient Indian chemistry and health sciences to the contemporary world of herbal, therapeutic, and natural nutritional medicines; from techniques of ancient built-environment and infrastructure design systems to current green practices and their ecological relevance
- Exclusive fact and figure (even in the form of old documents; photo gallery; relics and others) to bring to light an area or an event (or both) which has remained dormant or neglected in the field of India's science and technology
- Pioneering biographic researches and documentations on personalities – in various fields – for instance, Physics and Cosmology; Geology and Natural sciences; Humanities and Social Sciences; Electrical Sciences and Communication Technology; Statistics, Coding, Cryptology and Operational Research; Sociology and Management Sciences; Urban and Regional Planning Systems; Structural Engineering and Mechanical Engineering innovations, Robotics, Advanced Digital Image Processing and MEMS; Agro-harvesting, Integrated Regional Watershed management and Disaster Management Innovations; Ocean Engineering and Offshore innovations; Bio-technology and Medical Informatics innovations and many more.
- Relevant areas of India's science and technology well related to national regeneration, positive social and economic change, and collective self-reliance at diverse community and regional levels of India.

On the whole, **SandHI Journal** will bring forth an interrelated array of facts and a search for 'social, economic and cultural relationship between these facts' of diverse scientific and technical pursuits of India down the ages and build an episteme of living research and research-driven philosophy of living and sharing in collective good.

For India, the arrays will just not be a material coverage of mundane facts and documentations, but also aggregate social, ecological and all-embracing spiritual significances of such advents, attempts and progresses.

SandHI Journal hopes to raise the spirit of our motherland to our very own ears, hearts and actions to make us humble and patient, on the one hand and yet is confident, proud and proactive, on the other hand.

Over time, **SandHI Journal** will perhaps make the Indian and global community aware of India's forerunning position as the mother of culture and civilizations.

SandHI Journal is intended as a medium of interaction and communication to reach the spirit of India's scientific and technological youth-mind. One day, SandHI Journal will shape India's future scientific mind and be ever dedicated to her greater future re-generation and recognition on the world stage.

What will be the Content ?

All papers received will be peer reviewed to meet the twin goal – a) the basic standards of academic research and b) the spirit of an inspiring message to elevate the youth-mind of India. The Journal will have the following sections:

1. **Invited papers** – Thematic papers from eminent persona from the History of India's science and Technology and its interface with Indian heritage and traditional knowledge systems

2. **General papers** – Research works and documentations from noted academicians, practitioners and media experts in the con-joint field of India's science and Technology and Indian heritage. Special emphasis will be given to notable coverage of allied field like – Scientific anthropology, Scientific Ecology, associations with art and social history, technology and social change reciprocities, technology and socio-political changes targeting self-reliance and entrepreneurships and so on.

3. **Book Reviews** – Review of works of Grand masters and current researchers will be duly included

4. **Featured Case Studies** – Contemporary works of Historians of sciences and Technology will be covered in relationship to traditional knowledge systems recovery

5. **Notes / features on Research, Development and Application** – A Photo Gallery: Exclusive works from the world of contemporary media and communication will be assimilated.

Creative contributors

This journal will comprise articles and features contributed by people of various facets related to science and technology:

- Scientists and Technocrats
- Heritage and Cultural Anthropology
- Deep Ecology and Transpersonal Psychology w.r.t Indian systems of psychic sciences and neuro-physiology
- Historians of Science and Technology and Heritage systems
- Senior Researchers of various Scientific and Technological organizations
- School teachers and primary science educators
- Allied Art Historians in the related field

The purpose to represent all these groups and to focus on the extent and efficacy of science and technology and not just confined to some high end researchers - how the thoughts and ideas mature from the child's mind to great researchers and thereby impacting the society as a whole and gradually enter the pages of history which goes on inspiring the future torch-bearers.

What are the Editorial requirements?

Contributors have to kindly follow:

- All manuscripts have to be submitted in hard and soft copies.
- The paper should have a short abstract not exceeding 200 words.
- All figures, drawings and photographs should be mailed as 'image files' with suitable print resolutions.
- References should be numbered in superscript, serially in order.
- Text Format:
  • Heading: Arial 14 bold
  • Section headings: Arial 12 bold
  • Body of Text: Arial 11 at single line spacing
- Only Footnotes, no endnotes are permissible.
- Referencing format: Name of Author (surname first), Year, Title, Publisher, page no.
- All articles/ researched papers are to be supported with references and bibliography.
- Contributors have to send a short bio-data and a passport size picture.

Contact:

Prof. Joy Sen
joysen@arp.iitkgp.ernet.in

Prof. Priyadarshi Patnaik
bapi@hss.iitkgp.ernet.in

भारतीय प्रौद्योगिकी संस्थान खड़गपुर

INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR

www.iitkgpsandhi.org